DOE/EIA-0555(96)/2

Energy Consumption Series

Residential Lighting: Use and Potential Savings

September 1996

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Residential Lighting: Use and Potential Savings

September 1996

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

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Acknowledgment

Dr. Wendel L. Thompson made a significant contribution to this report. Alas, Wendel retired on March 29, 1996. During his career, his knowledge and unfailing effort were invaluable in making the RECS the high-quality survey that it is. We will miss his expertise, dedication, good humor, and kindness. So long Mr. RECS; good luck in your retirement.

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Contents

Figures

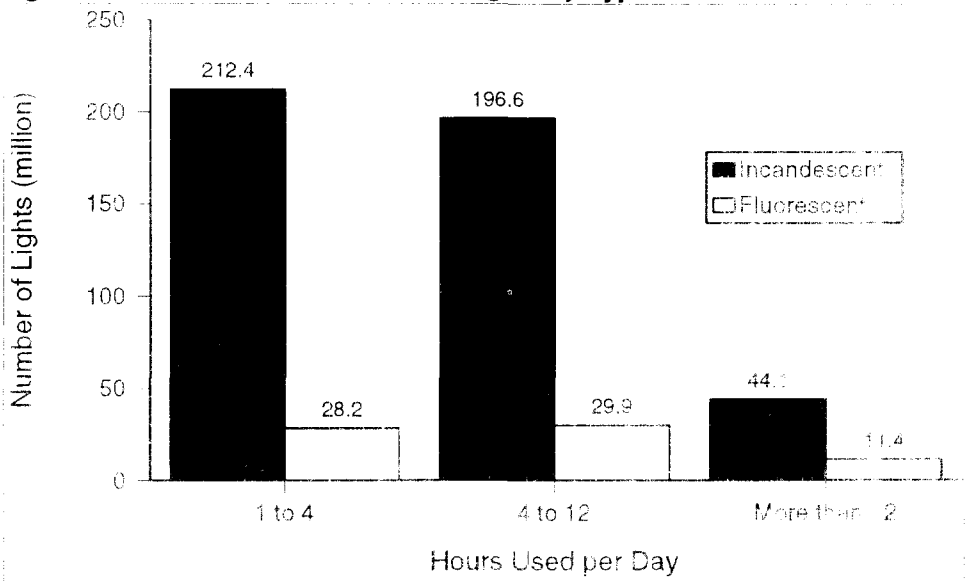
Tables

Executive Summary

Potential Savings

The overwhelming majority of lights in residential households are incandescent--the least energy efficient of all light types (Figure ES1.). If households replaced the most intensively used bulbs with compact fluorescent bulbs, they would see a sizable savings in their electric bills. The total U.S. household energy that would be saved by replacing all incandescent bulbs used 4 or more hours per day would be 31.7 billion kilowatthours (kWh) annually, or 35 percent of all electricity used for residential lighting.

Figure ES1. Total Number of Indoor Lights by Type and Hours Used



Source: Energy Information Administration, 1993 Residential Energy Consumption Survey: *Housing Characteristics 1993*, Table 3.22.

The amount of time it takes for households to see a simple payback from compact fluorescent bulbs depends on the price of electricity. Assuming a 26-watt compact fluorescent bulb that costs 22 dollars, an average sized 75-watt incandescent bulb that costs 75 cents, and that the lights are used 6.7[1] hours per day, households see a savings in 2.5 years, if the electric rates are five cents per kilowatthour (Figure ES2). Households see a savings in 1.1 years if the rate is 15 cents per kilowatthour. At the national level, the average cost of electricity is 8.4 cents per kilowatthour.[2] At this rate, compact fluorescent bulbs pay for themselves in 1.7 years.

The life-cycle cost of a light bulb includes the cost of the bulb itself, as well as the cost of the electricity required to power the bulb. Electricity costs are a large percent of the life-cycle cost of incandescent lights. Depending on the electric rates, electricity costs account for 78 to 91 percent of the life-cycle cost of incandescent lights, but only 37 to 63 percent of the life-cycle cost of compact fluorescent bulbs (Figure ES3).

Compact fluorescent bulbs need about one-third of the power required by incandescent bulbs to emit the same amount of light.[3] If one wanted to replace a 75-watt incandescent bulb, a 26-watt compact fluorescent would be an appropriate choice. Therefore, regardless of electricity costs, compact fluorescent bulbs offer a three-fold increase in efficiency.

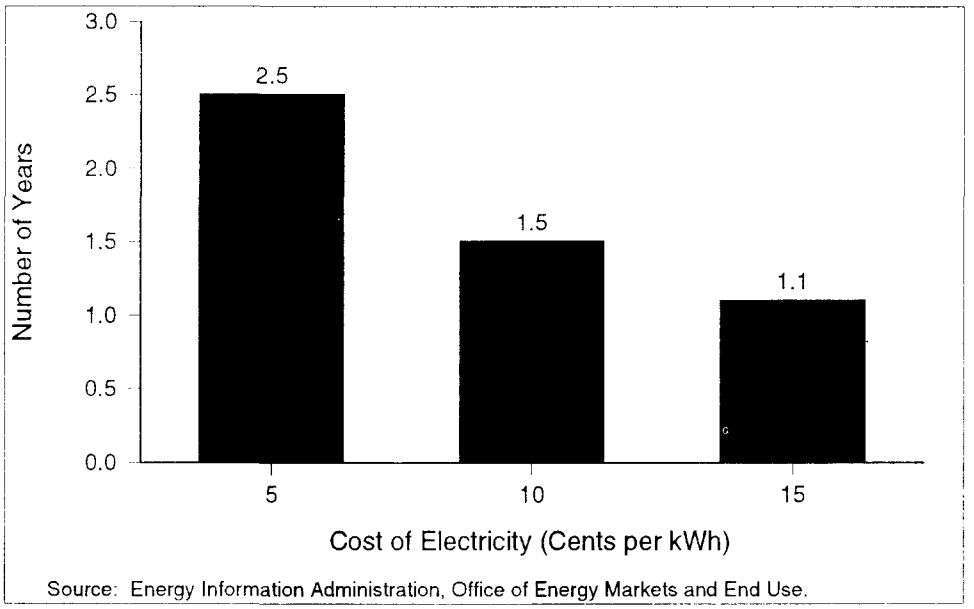
[1]Among light bulbs used 4 or more hours per day, the average length of use is 6.7 hours.

[2]Table 5.4 of Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, DOE/EIA-0321(93). (Washington, DC, October 1995), p. 46.

[3] This is according to *The Lighting Pattern Book for Homes, 1993,* Lighting Research Center, Rensselaer Polytechnic Institute. There is some uncertainty about this point. The lighting industry states that compact fluorescent bulbs need only one-fourth the wattage of incandescent bulbs. EIA compared the savings of both 26-watt, 22-dollar compact fluorescent bulbs and 20-watt, 20-dollar compact fluorescent bulbs. There is very little difference in overall savings between these two types of bulbs. The biggest difference in savings is between the compact fluorescent and incandescent. Estimates of potential savings in this report are based on a 22-dollar, 26-watt compact fluorescent.

If compact fluorescent bulbs, by virtue of their high cost, do not produce large dollar savings to individual households, they still result in large savings of electricity and the fuels required to produce electricity.

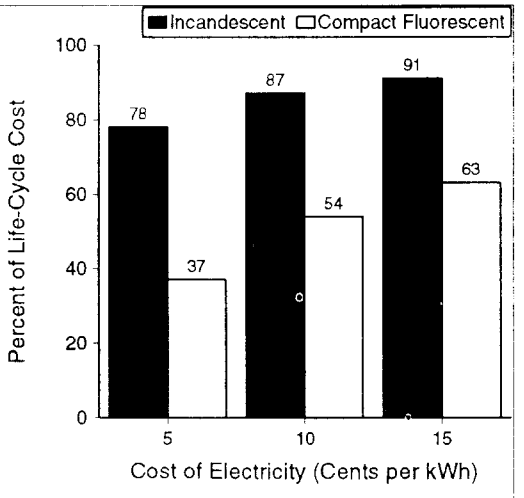
Figure ES2. Number of Years Before Life-Cycle Cost of Incandescent Bulb Exceeds Life-Cycle Cost of Compact Fluorescent Bulb (Simple Payback, Lights on 6.7 Hours per Day)



Source: Energy Information Administration, Office of Energy Markets and End Use.

Figure ES3. Electricity Cost as a Percent of Life-Cycle Cost of Incandescent and Compact Fluorescent Bulbs

- At a usage rate of 6.7 hours per day, an average compact fluorescent bulb lasts 4.1 years; an incandescent bulb lasts 3.5 months.
- The figure on the right shows the cost of electricity as a percent of the life-cycle cost of incandescent bulbs and compact fluorescent bulbs, calculated over a period of 4.1 years.
- The life-cycle cost of a light bulb includes the cost of the bulb itself, as well as the cost of the electricity that powers the bulb.
- Electricity costs are a large percent of the life-cycle cost of incandescent bulbs.
- As the cost per kilowatthour increases, electricity costs account for a higher percent of the life-cycle cost of both bulbs.



Source: Energy Information Administration, Office of Energy Markets and End Use.

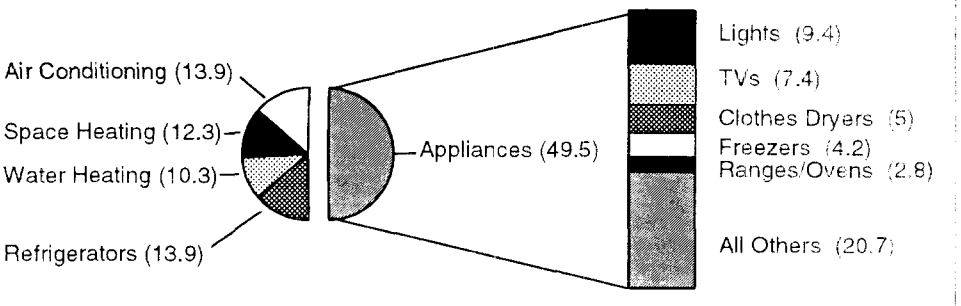
Residential Lighting Profile

According to the 1993 Residential Energy Consumption Survey, U.S. households have, on average, 5.4 indoor lights that are on one or more hours per day, and 8.9 lights that are on 15 minutes or more per day.[4] They use 940 kWh of electricity for lighting each year, and spend 83 dollars on electricity for lighting. Their expenditures on electricity for lighting are about 10 percent of their total electric bill.

Nearly every household uses lights and all households with lights use electricity to power them. However, electricity consumption for lighting is only 9.4 percent of all electricity consumption in the residential sector. Space heating, water heating, air conditioning and other appliances each accounts for more electricity use than lighting (Figure ES4).

The bedroom is the room that contains the most household lights. However, the lights in the living room and kitchen are used the greatest number of hours (Figure ES5). Although 27 percent of all lights are in bedrooms, they use only 19 percent of the total light-hours.[5] On the other hand, the living room has only 17 percent of all lights, but accounts for 22 percent of all light-hours. One reason bedrooms have the highest number of lights is that the average home has 2.6 bedrooms.

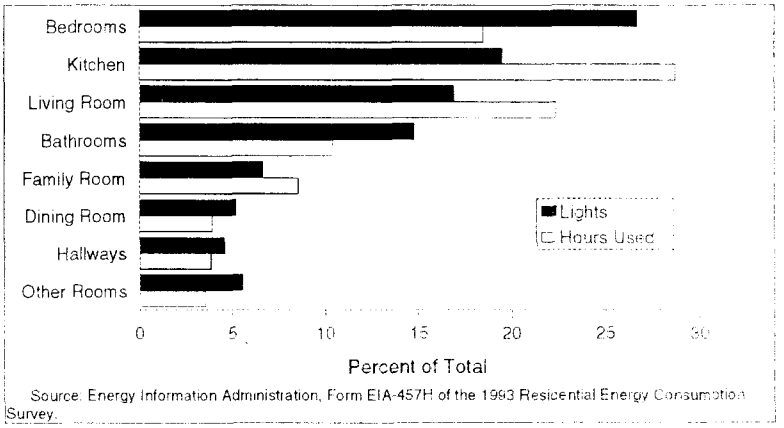
Figure ES4. Total Electricity Consumption by End Use (Percent)



Source: Energy Information Administration, 1993 Residential EnergyConsumption Survey. *Household Energy Consumption and Expenditures 1993*, Table 3.1.

The cost of electricity varies by Census region, from 7.7 cents per kilowatthour in the South to 11.4 cents per kilowatthour in the Northeast. The Midwest and West have similar rates--8.1 and 8.3 cents respectively. As the cost of electricity increases, households use less of it for lighting. However, with increasing electricity prices, the amount of electricity used for lighting accounts for a greater percentage of the total electric bill (Figures ES6 and ES7). This occurs because when electricity prices are higher, households choose fuels other than electricity for the more intensive uses, such as space heating, water heating, and cooking.

Figure ES5. Lights and Hours Used by Room (Percent)

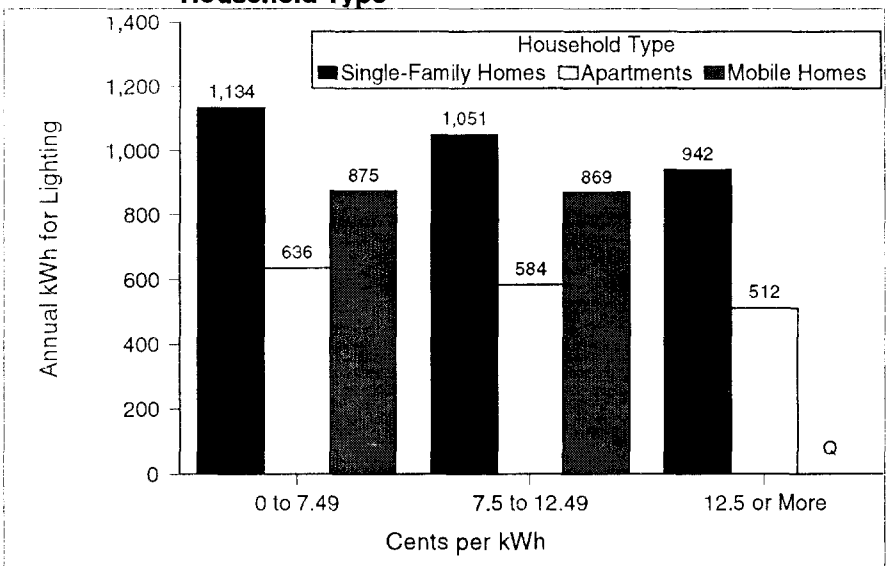


Source: Energy Information Administration, Form EIA-457H of the 1993 Residential Energy Consumption Survey.

[4]From these two estimates, one cannot conclude that 3.5 lights are used between 15 minutes and one hour per day because the estimates of lights used 15 minutes or more are from the Lighting Supplement Questionnaire, while the estimates of lights used one hour or more are from the RECS Household Questionnaire (see Chapter One for more details about these questionnaires).

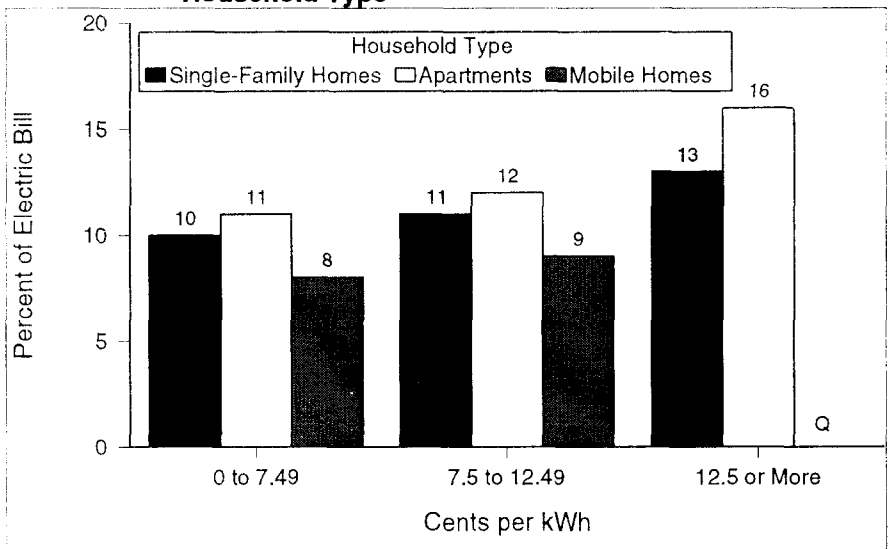
[5]Light-hours are the total number of hours that all lights in the household are used. For example, if a household has 7 lights, and they are all used, on average, 2 hours a day, then there are 14 light-hours per day in that household.

Figure ES6. Regression Allocation Estimates of Electricity Consumption for Lighting, by Cost of Electricity and Household Type



Q=Fewer than 10 cases were sampled.
Source: Energy Information Administration, Forms EIA-457A-C and E of the 1993 Residential Energy Consumption Survey.

Figure ES7. Regression Allocation Estimates of Lighting as a Percent of Total Electric Bill, by Cost of Electricity and Household Type



Q=Fewer than 10 cases were sampled.
Source: Energy Information Administration, Forms EIA-457A-C and E of the 1993 Residential Energy Consumption Survey.

Data Sources

The 1993 Residential Energy Consumption Survey collected information about lighting from two sources--the Household Questionnaire, answered by 7,111 households, and a Lighting Supplement, administered to a subset of 474 households.

General descriptions of the basic types of lights discussed in this report are presented in Figure ES8.

Figure ES8. Common Residential Light Bulbs and Their Characteristics

Light Bulb Basics

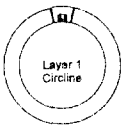
Light-bulb electrical use is rated in watts; light ouput in lumens. In the same way that miles per gallon (MPG) allows you to compare the fuel efficiency of different cars, lumens per watt is the common denominator that allows you to compare the light output of different types of bulbs.

Here is a quick look at the most common household light bulbs.

Incandescent

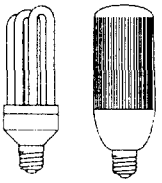
- Produces 14 to 18 lumens per watt
- Lasts 750 to 1,000 + hours, depending on wattage
- Widest variety of sizes, shapes, and specialty bulbs
- Standard one-piece with screw base (Edison sockets)
- Produces different effects with variety of coatings
- Dimmable with standard equipment

Fluorescent Tube



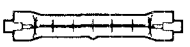
- Produces up to 105 lumens per watt
- Lasts 6,000 to 20,000 hours
- Variety of lengths and diameters
- One-piece with twist-pin socket
- Produces "warm" to "cool" gradations of light
- Not dimmable without special ballasts and wiring

Compact Fluorescent



- Produces up to 105 lumens per watt
- Lasts 10,000 hours
- Limited shapes and some size mismatches with fixtures
- One-piece, or modular with replaceable bulb unit
- Produces murkier light, but approaches standard bulbs
- Not dimmable without special ballasts and wiring

Halogen



- Produces 15 to 22 lumens per watt
- Lasts 2,500 to 3,500 hours
- Standard one-piece with screw base (Edison socket) or special tube-like bulb
- Produces clean light 25 percent brighter than standard incandescent bulbs
- Dimmable with standard equipment

Note: All figures are approximate because efficiency and durability are subject to a great number of variables--some in manufacturing and many in everyday installation and use.

Source: Energy Information Administration, Office of Energy Markets and End Use.

1. Introduction

The 1993 Residential Energy Consumption Survey (RECS) was the first to permit the estimation of annual kilowatthours (kWh) used for lighting. The survey contained more detailed questions about the number of indoor lights used for specific amounts of time and more detailed questions about the use of outdoor lights than did previous surveys. In addition to these basic questions on the Household Questionnaire, the 1993 RECS also included a supplementary questionnaire, administered to a subset of households, that contained more detailed information about the types of lights used in the household, the rooms in which they were located, and the amount of time they were used.

The Residential Energy Consumption Survey

The 1993 RECS is the ninth survey in a series of nationwide household energy consumption surveys conducted since 1978 by the Energy Information Administration (EIA) of the U.S. Department of Energy. The survey consists of three parts:

- EIA interviews households for information about fuels used, how fuels are used, energy-using appliances, structure features, energy-efficiency measures taken, and demographic characteristics of the household. Most of the interviews are personal interviews that take place in the respondents' homes. In households where personal interviews are not completed, EIA attempts telephone interviews. In households where neither the personal interview nor the telephone interview is successful, a shortened version of the questionnaire is mailed to the household.

- EIA interviews the rental agents for those households whose rent includes some portion of their utility bills. This information is used to augment information from those households that may not be knowledgeable about the fuels used for space heating or water heating.

- After obtaining permission from respondents, EIA mails questionnaires to their energy suppliers to collect the actual billing data on energy consumption and expenditures.

In the 1993 survey, more than 7,000 households were surveyed, using complex sampling methods. These methods allowed EIA to collect information from a small number of the 97 million households in the nation, yet use that information to make inferences about the total population.[6] The information collected represents the 97 million households nationwide. The data collected from the 1993 RECS are presented in two statistical reports: *Housing Characteristics 1993* and *Household Energy Consumption and Expenditures, 1993*.

Figure 1.1. Definition of Light

For the purposes of both the RECS Household Questionnaire and the Lighting Supplement Questionnaire, EIA defines a light as every light bulb turned on by a single switch. If a light has only one switch, it is counted as one light, even if it has more than one bulb. A fixture or lamp with two switches controlling different bulbs is counted as two lights. If two switches control the same light (for example, switches at both ends of the hallway control a hall light), that is one light. In the Lighting Supplement Questionnaire, the wattage of lights containing more than one bulb is determined by adding the wattage of each bulb. Outdoor lights are counted on the RECS Household Questionnaire only if the light is controlled by the respondent.

[6]For further information about the RECS sample design, see Energy Information Administration, Appendix A of *Housing Characteristics, 1993* DOE/EIA-314 (93) (Washington, DC, June 1995) p. 207 or Energy Information Administration, *Sample Design for the Residential Energy Consumption Survey*, DOE/EIA-0555 (94)/1 (Washington, DC, August 1994).

Lighting Data from the RECS Household Questionnaire

The RECS Household Questionnaire (Form EIA-457A) asked only a few questions about lighting in the household (see Appendix A). The survey asked respondents to consider a typical November weekday and report how many indoor lights were on 1 to 4 hours a day, 4 to 12 hours a day, and more than 12 hours per day, and how many of those lights were fluorescent. Respondents were also asked to describe their outdoor light usage, by giving information about the types of outdoor lights, the length of time they were used, and the total wattage of all outdoor lights.

The RECS Lighting Supplement

The RECS Lighting Supplement (Form EIA-457H) was a short questionnaire completed by 474 of the 7,111 households that responded to the RECS Household questionnaire. The 474 households are a proportional sample of all households in the United States. The oversampling that occurred in the 1993 RECS was not retained in the Lighting Supplement, so all households selected in the Lighting Supplement have equal sampling weights and represent the same number of households nationwide. The data collected from the Lighting Supplement were checked for logic and consistency and were edited when necessary. However, there were no imputations for missing data. See Table 1.1 for a comparison of the RECS sample and the Lighting Supplement subsample.

The primary purpose of the Lighting Supplement was to collect data to develop a model to predict electricity consumption for lighting. The Supplement provides information on the number of lights used 15 minutes or more, the hours used, the room where each light is located, the type of light, and the approximate wattage of each light. Although the Supplement provides more detail than the main questionnaire, it is limited to indoor lights. See Appendix A for a copy of the Lighting Supplement.

The Detailed Tables in this report contain data from both the Household Questionnaire and the Lighting Supplement Questionnaire. The RECS sample was designed to represent the entire U.S. population of residential households. Consequently, tables that are compiled from the Household Questionnaire include weighted data. On the other hand, the main purpose behind the Lighting Supplement Questionnaire was to gather enough representative data to develop a household-level model of lighting consumption. Therefore, data from the Lighting Supplement are not weighted and represent only the households that participated in the Lighting Supplement.[7] However, as Table 1.1 shows, the households that participated in the Lighting Supplement have similar energy-related characteristics as those households that participated in the RECS Household Questionnaire.

For the sake of simplicity, the remainder of the report will refer to the RECS Household Questionnaire as the RECS Survey. The Lighting Supplement Questionnaire will be referred to as the Lighting Supplement.

Estimating Kilowatthours (kWh)

For each light used 15 minutes or more per day, the Lighting Supplement asked respondents what types of lights they had in each room in the house and the approximate wattage of each. The possible responses for bulb type and wattage are listed in Table 1.2.

The Supplement also asked respondents how long each light was used in a day.

Based on the bulb type and approximate wattage, a specific wattage was assigned to each light type. The bulb type and the hours of use were used to calculate an estimate of annual kWh for each household in the supplement. Appendix B gives the details of this calculation.

[7]See the notes at the end of each table for information about the source of the table.

Computation of End-Use Estimates

All of the RECS end-use estimates data are determined by a nonlinear regression that allocates some portion of the total consumption of each fuel to the specific end uses that consume that fuel. In previous surveys, end-use consumption for space heating, air conditioning, water heating, refrigeration, and appliances was calculated. Because of the data collected in the Lighting Supplement, it was possible to model lighting consumption of electricity by using the Supplement and then applying the model to the total sample to estimate the amount of electricity consumed by lighting in U.S. households. Appendix B contains a complete description of the end-use estimation methodology.

Table 1.1 Comparison of Total RECS Sample and Lighting Supplement Subsample

Household Characteristic	Percent of Households with Characteristic	
	Total Sample (n=7,111)	Lighting Supplement (n=474)
Census Region		
Northeast	20.2	18.5
Midwest	24.1	24.9
South	34.7	36.9
West	21.1	19.6
Type of Home		
Single Family Detached	61.5	61.1
Single Family Attached	7.6	7.2
Apartment in Building with 2-4 Units	8.3	7.8
Apartment in Building with 5 or More Units	16.8	16.5
Mobile Home	5.8	7.4
Income		
Less than $20,000	36.6	38.4
$20,000 to $49,999	41.7	41.8
$50,000 to $74,999	13.1	13.7
$75,000 or More	8.6	6.1
Average per Household		
Floorspace (square feet)	1875.0	1855.0
Electricity Rate (dollars per 1,000 kWh)	89.2	86.1
Number of Household Members	2.6	2.6
Number of Rooms	5.5	6.1

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E, and H of the Residential Energy Consumption Survey.

Table 1.2. Light Bulb Types in the RECS Lighting Supplement Questionnaire

Incandescent	Fluorescent	Halogen
Low (10 to 40 watts)	Short (less than 24 inches)	One type only
Medium (41 to 149 watts)	Long (24 inches or more)	
High (150 watts or more)	Compact	

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457H of the 1993 Residential Energy Consumption Survey.

2. Residential Lighting Profile

This section contains a basic profile of lighting use in residential households. It includes brief discussions about the characteristics and location of lights used in residential households, as well as descriptions of the amount of electricity used for lighting and variations in households' consumption of electricity for lighting.

Types of Lights

Dominance of Incandescent Lights

The majority of light bulbs in residential households are incandescent. According to the RECS Survey, 453 million lights out of a total of 523 million used one or more hours per day are incandescent (87 percent).[8] The Lighting Supplement also estimates that 87 percent of residential lights used 15 minutes or more per day are incandescent.

Fluorescent Lights of All Types

Thirteen percent, or 69.5 million lights used one or more hours per day are fluorescent. Fluorescent lights tend to be used more hours per day than incandescent lights. Twenty-one percent of the lights used more than 12 hours per day are fluorescent lights (see Table 2.1).[9]

Table 2.1 Fluorescent Lights as a Percent of Total Lights

Hours Used per Day	Fluorescent as a Percent of All Lights
1 to 4	11.7
4 to 12	13.2
More than 12	20.5

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 A of the 1993 Residential Energy Consumption Survey.

Compact Fluorescent Lights

According to the RECS Survey, compact fluorescent lights are used in 8.9 percent of residential households, although 49 percent of the homes reported knowing about them.[10] The percentage of households using compact fluorescent lights varies slightly by Census region, with households in the Northeast being somewhat more likely to use them, presumably due to higher electricity prices. The Lighting Supplement data show that less than one percent of all lights used 15 minutes or more per day are compact fluorescent.

Halogen Lights

A halogen light is a type of incandescent light that is slightly more efficient than the common incandescent light. A 100-watt common incandescent produces 17.5 lumens per watt compared with a 100-watt halogen, which produces 18.8 lumens per watt. These differences are much smaller than the comparison with the compact fluorescent, but the typical cost of a halogen light is 4 dollars versus 20-22 dollars for a compact fluorescent. Halogen lights are more widely known

[8]Derived from Table 3.22, Energy Information Administration, *Housing Characteristics 1993*, p. 128.
[9]Ibid.
[10]See Figure 2.1 of Energy Information Administration, *Housing Characteristics 1993*, p. 7.

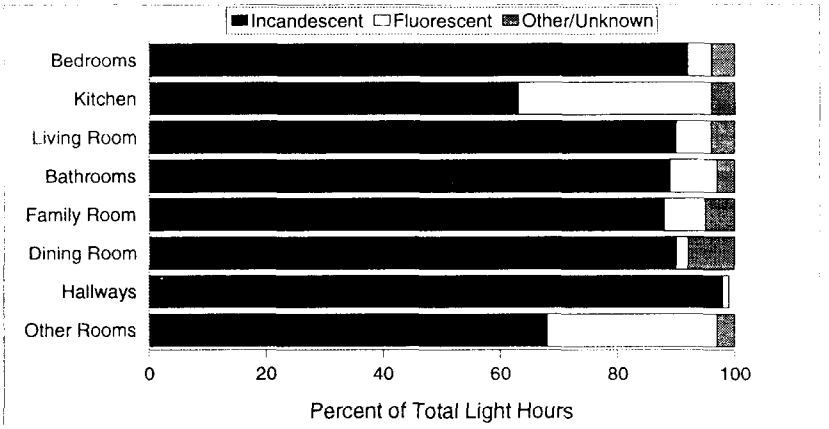
than the compact fluorescent (66 percent of households have heard of them), but they are used in only 12 percent of homes. Again, the RECS Survey shows this varies by Census Region, with households in the Northeast and West being somewhat more likely to use halogen lights.

Location of Lights

Rooms

Incandescent lights predominate in all rooms in the household, both in number and in hours used (Figure 2.1). In all rooms, except for the kitchen and "other" (which includes laundry rooms), incandescent lights account for at least 90 percent of the hours used. Although the kitchen and "other rooms" contain the most fluorescent lights, fluorescent lights in these rooms still account for only 30 to 33 percent of the hours used.

Figure 2.1. Type of Light by Room



Source: Energy Information Administration, Form EIA-457H of the 1993 Residential Energy Consumption Survey.

Rooms that contain the most lights do not necessarily consume the most electricity for lighting. For example, bedrooms have the most lights, followed by the kitchen and the living room. However, the lights in the kitchen are used the most hours, followed by the living room and bedrooms (Figure ES5).

For lights used at least 15 minutes per day, the average use per light in kitchens is about 3.8 hours, followed by living rooms (3.4 hours per light), and family rooms (3.3 hours per light). Rooms where lights are used less intensively are bedrooms (1.6 hours per light) and bathrooms (1.8 hours per light).

Outdoor Lights

About two-thirds of U.S. homes use outdoor lighting. The percentage is much lower for apartments in buildings containing 5 or more units. In these structures, only 28 percent of the households reported using an outdoor light.[11] The percentage using outdoor lights in other types of structures is 76 percent for single-family homes, 69 percent for mobile homes, and 59 percent for small apartment buildings (2 to 4 units).

In approximately half of the households that use outdoor lights, the wattage of all outdoor lights combined for each household is below 150 watts. We may assume it is over 150 watts for the other half.[12] Lights are turned on for the evening in 41 percent of the homes, while other homes using outdoor lights leave them turned on all night or have them controlled in some way. Only three percent of homes use a high-intensity discharge light outdoors (see the Glossary for definitions of different types of lights).

[11]This percentage refers only to outdoor lights controlled by the household, not those maintained by the property managers.
[12]Of all the households that use outdoor lights, less than 1 percent did not answer the question about total wattage.

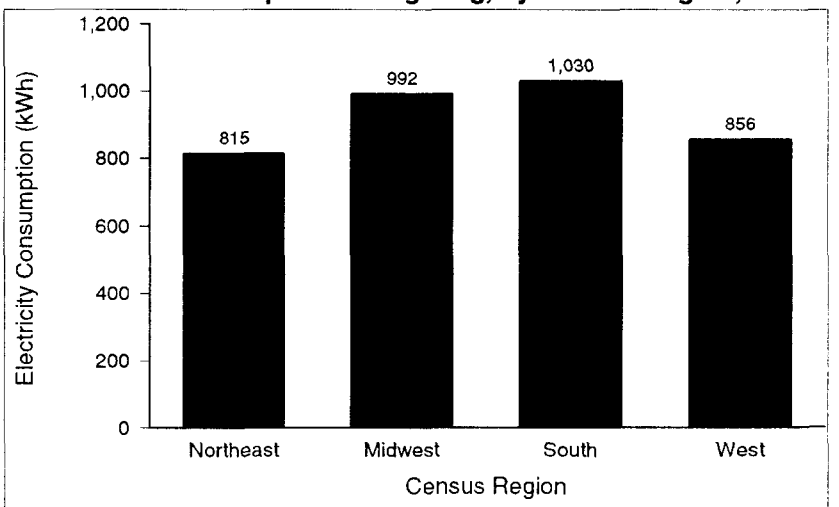
Lighting Usage and Costs

Usage

In 1993, the average household consumed 940.5 kWh of electricity for lighting. Electricity consumption for lighting increases with increasing income, number of household members, and number of rooms in the housing unit (see Tables 4.9, 4.10, and 4.11 of the Detailed Tables). Consumption also varies with Census region. Households in the South and Midwest consume the most electricity for lighting (Figure 2.2). Perhaps this is because electricity costs less in those Census regions.

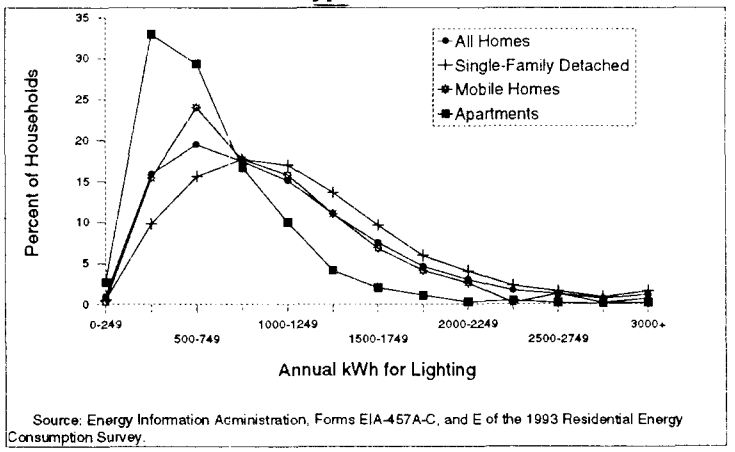
An alternative way of displaying electricity consumption for lighting is to show the percent of households in consumption categories. For example, Figure 2.3 shows a distribution of households, for each household type, by the amount of electricity for lighting, in 250 kWh increments. The largest number of apartments (32.9 percent) consume between 250 and 499 kWh. The largest number of mobile homes (24.0 percent) consume between 500 and 749 kWh. Among single-family homes, the consumption is higher, with 17.4 percent using between 750 and 999 kWh.

Figure 2.2. Regression Allocation Estimates of Electricity Consumption for Lighting, by Census Region, 1993



Source: Energy Information Administration, Forms EIA-457A-C and E of the 1993 Residential Energy Consumption Survey.

Figure 2.3. Electricity Consumption for Lighting, by Household Type



Source: Energy Information Administration, Forms EIA-457A-C, and E of the 1993 Residential Energy Consumption Survey.

Costs

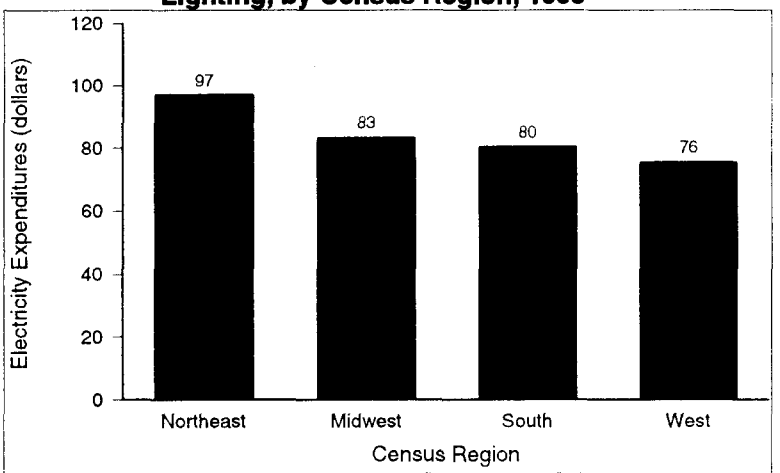
The RECS survey shows that the average annual cost of electricity for lighting is approximately 83 dollars per household (1993 dollars), which is about 10 percent of the average expenditures on electricity in 1993 ($840). The 25th and 75th percentiles show that 25 percent of the households paid less than 43 dollars and 25 percent paid more than 109 dollars. One-half paid between 43 dollars and 109 dollars. Although households in the South and Midwest consumed more electricity for lighting, households in the Northeast paid the most for electricity for lighting because they had the highest average electricity prices (Figure 2.4).

Variation in Lighting Consumption Among Households

The annual electricity consumption for lighting in 1993 was 940 kWh per household--9 percent of the total consumption. This figure includes both indoor and outdoor lights. Figure 2.5 shows the cumulative percent of households by annual

electricity consumption for lighting. The median consumption for all households is 818 kWh. Households in single-family homes use the most electricity for lighting, while households in apartment buildings use the least (median of 953 and 484 kWh, respectively).

Figure 2.4. Annual Electricity Expenditures for Residential Lighting, by Census Region, 1993

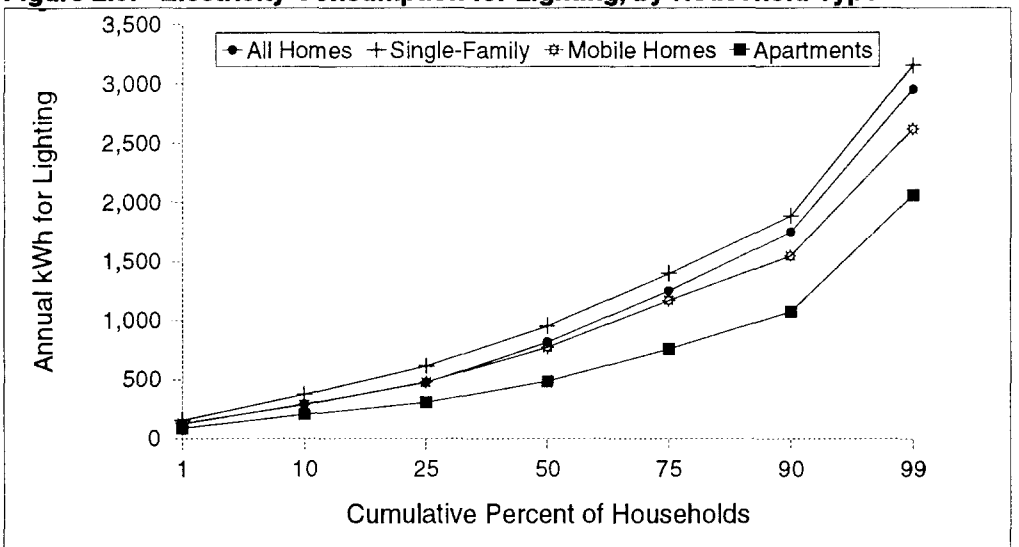


Source: Energy Information Administration, Forms EIA-457A-C, and E of the 1993 Residential Energy Consumption Survey.

Just as total energy use varies considerably from one household to another, so does the percentage of electricity used for lighting. This percentage varies because of the different uses that are made of electricity. Some households use electricity for some heavy work--heating the home, water heating, and air-conditioning, so their bills will be large and the lighting component a small part of the bill. Other households not using electricity for these heavy loads will show a higher percentage of their electricity used for lighting.

The variation in the percentage of electricity used for lighting depends on the cost of electricity, what it is used for, and the climate where the household is located. Unlike space heating and water heating, where nonelectric energy sources are chosen when the cost of electricity gets too high, alternative sources for lighting are not much used today. Consequently, in areas where the cost of electricity is high, one sees a small decrease in the amount of electricity used for lighting (Table 2.2), although these smaller amounts represent a larger share of the total electricity bill.

Figure 2.5. Electricity Consumption for Lighting, by Household Type



Source: Energy Information Administration, Forms EIA-457A-C, and E of the 1993 Residential Energy Consumption Survey.

Table 2.2 Regression Allocation Estimates of Kilowatthours Used for Lighting by the Cost of Electricity, 1993

Cost of Electricity (cents per kWh)	Annual kWh for Lighting		
	Single-Family Home	Apartment	Mobile Home
0 to 7.49	1,134	636	875
7.5 to 12.49	1,051	584	869
12.5 or More	942	512	Q

Q=Data withheld because fewer than 10 households were sampled.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A, B, E, and H of the 1993 Residential Energy Consumption Survey and EIA-861 of the 1993 Annual Electric Utility Report.

Lighting Consumption Compared to Other End Uses

Lighting accounted for 9.4 percent of all electricity consumption in U.S. households in 1993, less than air conditioning, water heating, space heating, or refrigeration (Figure ES4).[13] Residential lighting thus represents three percent of total U.S. sales of electricity to all sectors.[14] Because the end-use estimates do not distinguish between indoor and outdoor lighting, this estimate of lighting consumption includes both.

Virtually 100 percent of households use electricity for lighting, while less than 70 percent use it for air conditioning and less than 40 percent use it for space heating and water heating. However, because space conditioning and water heating are more intensive users of electricity than lighting, they account for a greater amount of the total electricity consumption in the residential sector. In 1993, air conditioning consumed 13.9 percent, water heating 10.2 percent and space heating 12.3 percent. Lighting consumed 9.4 percent.

Estimating the Number of Indoor Lights

The number of indoor lights used 1 hour or more per day can be predicted with some accuracy from knowing one fact about people (the number of persons in the household) and one fact about the housing structure (the number of rooms). The number of indoor lights can be predicted from the following equation:

$$\text{Number of Indoor Lights} = 0.6 + 0.4*(\text{number of household members}) + 0.7*(\text{number of rooms})$$

For this calculation, rooms are defined as kitchens, dining rooms, living rooms, family rooms, and bedrooms. Rooms do not include bathrooms, basements, or utility rooms. For example, one person living in a four-room housing unit would be expected to use about four lights for one hour or more per day. Other factors, such as the age of the occupants, would be expected to affect this estimate for any particular household.

[13]For a more complete list of end-use consumption for electricity, see Table 3.1 in Energy Information Administration, *Household Energy Consumption and Expenditures 1993*, p. 10.

[14]This is 91 billion kWh out of a total sales of 2,861 billion kWh. For total kWh sales of electricity for 1993, see Table 1, *Electric Sales and Revenue 1993*, DOE/EIA-0540(93). (Washington, DC, January 1995), p. 5.

3. Potential for Savings

Household-Level Savings

Households in the U. S. contain a total of 523 million lights that are on 1 or more hours a day--282 million of these are on 4 or more hours a day. The majority of these lights are incandescent--88 percent of those on 1 to 4 hours and 85 percent of those on 4 or more hours. Given the greater efficiency of compact fluorescent lights, how much would households save if they replaced their incandescent lights with compact fluorescents? Replacing incandescent lights that are on for a short period of time with compact fluorescents is not very cost effective, because compact fluorescents cost so much more than incandescents (about 22 dollars compared to 75 cents). However, at longer periods of use, compact fluorescents do become cost effective, in spite of their high initial cost. Figures 3.1 through 3.3 compare the total cost of an incandescent light with a compact fluorescent light, using the assumptions listed in Table 3.1.

Table 3.1 Assumptions Used in the Comparison Between Compact Fluorescent and Incandescent Lights

	Incandescent	Compact Fluorescent
Initial Cost of Bulb	75 cents	22 dollars
Wattage	75 watts	26 watts
Life of Bulb (hours) ...	750 hours	10,000 hours
Hours Used per Day ...	6.7 hours	6.7 hours

Sources: Energy Information Administration, Office of Energy Markets and End Use; Lighting Research Center, Rensselaer Polytechnic Institute, *The Lighting Pattern Book for Homes, 1993.*

Assumptions Used in the Calculation of Potential Savings

Cost and Life of Bulb

A 75-watt incandescent bulb costs about 75 cents and has a rated life of 750 hours. A 26-watt compact fluorescent bulb costs about 22 dollars and has a rated life of 10,000 hours. The calculations in this report assume there are no additional costs involved in the replacement of incandescent lights, such as bulb breakage or the purchase of new fixtures. They also assume the bulbs last their rated number of hours, although the actual life of light bulbs varies from bulb to bulb.

Light Output

Light output is measured in lumens. A 75-watt incandescent bulb emits approximately 1,190 to 1,220 lumens while a 26-watt compact fluorescent bulb emits about 1,550 lumens. Although an 18-watt compact fluorescent has the same light output rating as a 75-watt incandescent (1,100 to 1,250 lumens), a bulb's rated light output is not the only consideration in choosing a replacement bulb. The location and position of the fixture affect the actual output of compact fluorescent bulbs, and the quality of the light may differ between compact fluorescents and incandescents. Consequently, for satisfactory light output, a compact fluorescent bulb may need a higher rated light output than the incandescent it is replacing. For these reasons, a 26-watt compact fluorescent bulb is used in the calculations, rather than an 18 watt bulb.

Hours of Use

Repeatedly switching a compact fluorescent light on and off reduces the life of the bulb. Therefore, compact fluorescent lights provide the biggest savings when they are used to replace incandescent lights that are used several hours per day. The calculations in this report are based on lights that are used four or more hours per day. According to the Lighting Supplement data, these lights are on an average of 6.7 hours per day.

Simple Payback

The calculations are based on 1993 dollars. They do not take into account changes in energy costs or changes in the value of the dollar over the lifespan of a compact fluorescent bulb.

Universal Replacement

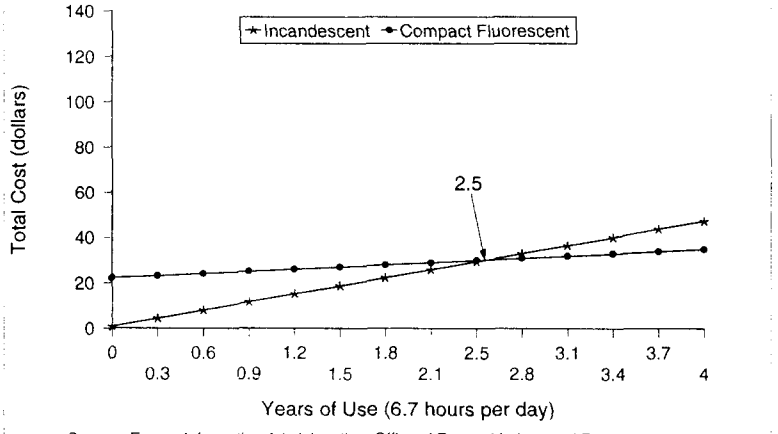
This report assumes that all incandescent lights used four or more hours per day can easily be replaced by compact fluorescent lights. This assumption ignores the fact that some compact fluorescent bulbs may not fit into fixtures designed for incandescent bulbs. The EIA does not have data on the percent of fixtures that could be successfully converted to compact fluorescent lights, so it is unclear how erroneous this assumption is.

Calculation of Savings

At a rate of use of 6.7 hours per day, a compact fluorescent bulb lasts, on average, about 4.1 years. By contrast, an incandescent bulb lasts about 3.5 months. Figures 3.1 through 3.3 show the savings that accrue over the expected life span of a compact fluorescent bulb. The figures include the cost of repeatedly replacing the incandescent bulb. The cost comparisons are calculated for three different electric rates--5, 10, and 15 cents per kWh.

When electricity costs 5 cents per kWh, compact fluorescent bulbs save money after about 2.5 years and result in a total savings of approximately 12 dollars by the end of the life span of the compact fluorescent bulb (Figure 3.1). At a cost of 10 cents per kWh, compact fluorescents save money after 1.5 years and result in a total savings of 36 dollars (Figure 3.2). With the highest priced electricity--15 cents per kWh, compact fluorescents save money after only 1.1 years and result in a total savings of 60 dollars per bulb (Figure 3.3). The average household has only 2.5 incandescent lights that are on 4 hours or more, so assuming the same amount of savings per light, their total savings due to replacement would be twice the savings listed above. Therefore, even at the most expensive electric rates, an average household would save only about 120 dollars over a period of 4 years. For many households, this may not be incentive enough for them to purchase compact fluorescent bulbs.

Figure 3.1. Total Cost of Compact Fluorescent Bulb Compared to Incandescent Bulb (5 cents per kWh)



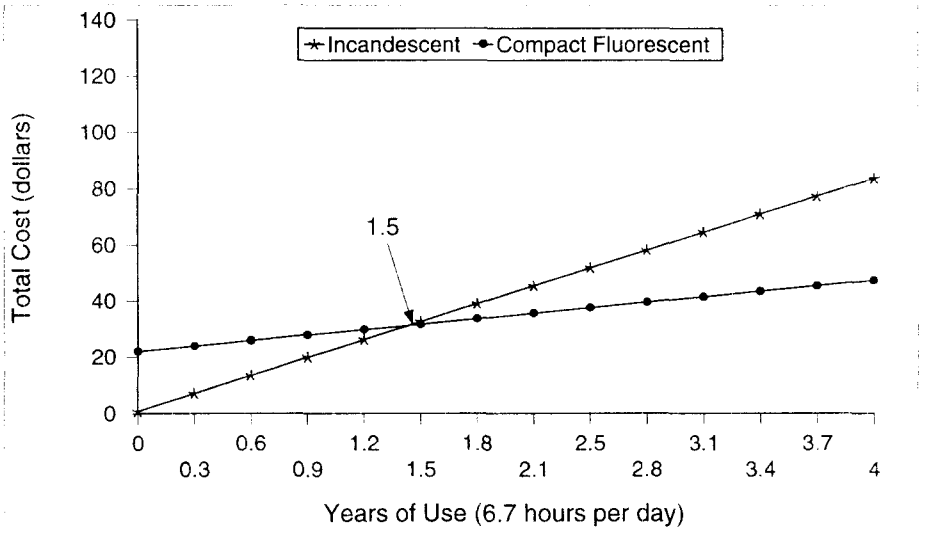
Source: Energy Information Administration, Office of Energy Markets and End Use.

Although these comparisons do not show a tremendous dollar savings in using compact fluorescent lights, they do show a sizable savings in electricity. In each of these three figures, the line plotting the cost of the incandescent bulb has a steeper slope than the line plotting the cost of the compact fluorescent, especially at higher electric rates. What this shows is that with incandescent bulbs, the life-cycle cost is composed largely of electricity costs. On the other hand, the life-cycle cost of compact fluorescent bulbs is made up mostly of the cost of the bulb itself.

For example, over a period of 4.1 years, at 5 cents per kWh, the price of electricity accounts for 37 percent of the life-cycle cost of a compact fluorescent light, but for 78 percent of the life-cycle cost of an incandescent light. Table 3.2 shows the cost of electricity and the cost of bulbs for fluorescent and incandescent lights, over a period of 4.1 years, by the price of electricity. The cost of powering a compact fluorescent bulb at the highest electric rate is little more than the cost of powering an incandescent at the lowest electric rate.

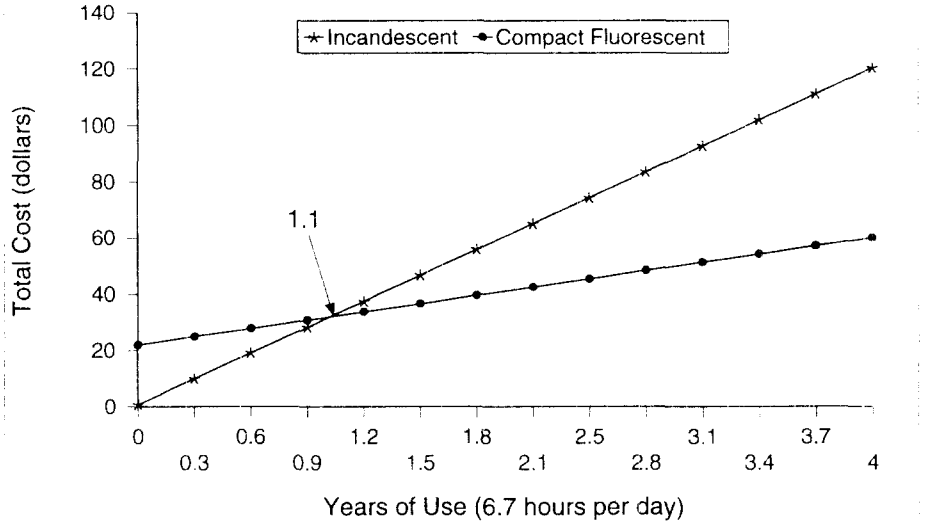
Another advantage of compact fluorescent bulbs is convenience. Incandescent bulbs need to be replaced about 13 times more frequently than compact fluorescent bulbs. In areas such as hallways, where bulbs are hard to reach, and light quality is not of utmost importance, the convenience of compact fluorescent bulbs is a particular advantage.

Figure 3.2. Total Cost of Compact Fluorescent Bulb Compared to Incandescent Bulb (10 cents per kWh)



Source: Energy Information Administration, Office of Energy Markets and End Use.

Figure 3.3. Total Cost of Compact Fluorescent Bulb Compared to Incandescent Bulb (15 cents per kWh)



Source: Energy Information Administration, Office of Energy Markets and End Use.

Table 3.2 Electricity Costs Versus Bulb Costs of Compact Fluorescent and Incandescent Light Bulbs, by Cost of Electricity

Cost of Electricity (cents per kWh)	Compact Fluorescent		Incandescent	
	Bulb Cost (dollars)	Electricity Cost (dollars)	Bulb Cost (dollars)	Electricity Cost (dollars)
5	22	12.68	10.5[a]	36.56
10	22	25.35	10.5	73.13
15	22	38.03	10.5	109.69

[a] Over a period of 4.1 years, a 75-watt incandescent bulb would have to be replaced 13 times. The initial cost of the first bulb, plus 13 replacement bulbs, times the cost of each bulb equals $10.5 (i.e., 14 bulbs at 75 cents each).

Source: Energy Information Administration, Office of Energy Markets and End Use.

Aggregate-Level Savings

Potential aggregate U.S. household energy savings for replacement of all incandescent bulbs used more than 4 hours per day amounts to 31.7 billion kWh annually.[15] This assumes that the average incandescent bulb is 75 watts and is replaced by a 26-watt compact fluorescent bulb. Thirty-eight percent of this savings, or 12 billion kWh, would come from replacing the 44.1 million bulbs used 12 or more hours per day and 62 percent, or 19.7 billion kWh, would come from replacing the 196.6 million lights used 4 to 12 hours per day. These potential energy savings are 35 percent of the electricity used for lighting in 1993 (91 billion kWh).

Two programs designed to encourage households to use compact fluorescent lights found that most of the participating households would not be willing to pay more than 10 dollars for a compact fluorescent bulb.[16] Given compact fluorescent bulbs cost 20 dollars or more, individual households may need some incentive to use them and to contribute to the aggregate savings in electricity.

[15]Because electricity generation requires the use of other fuels as input, the energy required to generate this 31.7 billion kWh is about 326 trillion Btu (see Table A8 of Energy Information Administration, *Monthly Energy Review*, DOE/EIA-0035(96/08). (Washington, DC, August 1996), p. 143.

[16]Leona Michelson and Brian Lonergan, "Bright Ideas in Residential Lighting," *Proceedings from the ACEEE Summer Study on Energy. Efficiency in Buildings, 1992*

4. Detailed Tables

These detailed tables are of three types. The tables displaying the number of households by hours of lighting use and household characteristics (Tables 4.1 through 4.8) were compiled from data collected on the RECS Household Questionnaire. The data in Tables 4.9 through 4.17 are based on information collected from the RECS Household Questionnaire and estimates derived from models developed with the Lighting Supplement data. Tables 4.18 through 4.23 contain data collected directly from the Lighting Supplement. Figure 4.1 provides a summary of the three types of detailed tables.

Figure 4.1 Summary of Detailed Tables

Table Numbers	Source of Table	Source of Cell Estimates	Number of Households	Estimates of Standard Error
4.1- 4.8	1993 RECS Household Survey	Weighted Survey Data	7,111	Presented in row and column factors
4.9-4.17	1993 RECS Household Survey and Lighting Supplement Questionnaire	Regression Estimates	7,111	Standard errors of data presented in row and column factors. Regression model errors not included.
4.18-4.23	1993 RECS Lighting Supplement Questionnaire	Unweighted Survey Data	474	No estimates of standard errors.

The sample selected for the RECS Household Questionnaire was designed to provide population estimates by applying weights to the household data. In contrast, the Lighting Supplement sample was designed only to collect data upon which to base a model of lighting consumption, not to provide population estimates. Consequently, Tables 4.18 through 4.23 do not contain estimates of standard errors. Tables 4.1 through 4.17 contain relative standard errors (RSE's) in terms of row and column factors.

Statistical Significance of Data

Row and Column Factors

Tables 4.1 through 4.17 provide row factors in the far-right column and column factors on the top line of each table. These factors are to be used to determine the Relative Standard Error (RSE) for each estimate, which, in turn, can be used to determine the standard error and the confidence level of the estimate and to determine whether the difference between any two figures is statistically significant. However, since the RSE's are only approximate, standard errors, confidence intervals, and statistical tests must also be regarded as only approximate.

To calculate the RSE for a specific estimate, multiply the row factor by the column factor, as illustrated in Figure 4.2, an excerpt from Table 4.3 of this report. This table shows that there are 14.9 million households in the United States that have three to five rooms and have two lights on one to four hours a day. Multiplying the row factor (6.3) by the column factor (0.7) yields a relative standard error of 4.41 percent.

Standard Errors

Because the estimates presented in the following tables are based on a sample of residential housing units, they are subject to sampling error, or standard error. To determine the standard error for an estimate in these tables, multiply the approximate RSE by the estimate. For example, to determine the standard error of the estimate of the number of

households with three to five rooms that have two lights on one to four hours per day, multiply .0441 by 14.9 million. The result, .66 million households, is the approximate standard error for the estimate.

Confidence Levels

For each of the estimates given in Tables 4.1 through 4.17, a 95-percent confidence range can be determined with the estimate at the mid-point. To calculate the 95-percent confidence range for a given figure:

1. Multiply the RSE row factor by the RSE column factor to determine the approximate RSE.
2. Multiply the approximate RSE (divided by 100) by the estimate given in the table to determine the approximate standard error.
3. Multiply the result by 1.96 to determine approximate 2 standard errors.
4. Subtract the result of Step 3 from the given estimate to determine the bottom of the range.
5. Add the result of Step 3 to the given estimate to determine the top of the range.

The result of these steps will yield a range with the property whereby, in repeated surveys, the estimate would fall in the range constructed in this way 95 percent of the time.

For example, to determine the confidence range for the estimate highlighted in Figure 4.2:

1. Multiply 6.3 (the RSE row factor) by 0.7 (the RSE column factor), which yields 4.41 percent (the approximate RSE).
2. Multiply .0441 (the approximate RSE) by 14.9 million households (the estimate), which yields 0.657 million households (the approximate standard error).
3. Multiply 0.657 million households by 1.96, which yields 1.29 million households (approximate 2 standard errors).
4. To determine the bottom of the range, subtract 1.29 million households from 14.9 million, which yields 13.61 million households.
5. To determine the top of the range, add 1.29 million households to 14.9 million, which yields 16.19 million households.

It can then be said with 95-percent confidence that, in 1993, the number of households with three to five rooms, that used two lights for one to four hours each day falls between 13.61 and 16.19 million households.

Statistical Significance Between Two Statistics

The difference between any two estimates given in the detailed tables may or may not be statistically significant. Statistical significance for the difference between two independent variables is computed as:

$$S_{x_1-x_2} = \sqrt{[S_{x_1}]^2 + [S_{x_2}]^2}$$

where S is the standard error, x_1 is the first estimate, and x_2 is the second estimate. The result of this computation is to be multiplied by 1.96, and if this result is less than the difference between the two estimates, the difference is statistically significant.

Figure 4.2 Use of RSE Row and Column Factors

Table 4.3. Light Usage by Total Number of Rooms. Million U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Total Number of Rooms (Excluding Bathrooms)				RSE Row Factors
		1 or 2	3 to 5	6 to 8	9 or More	
RSE Column Factors	0.4	2.9	0.7	0.7	1.7	
Total	96.6	3.2	47.4	40.2	5.8	3.6
Indoor Electric Lights Total Number of Lights on 1 to 4 Hours						
None	9.6	.5	5.0	3.8	.3	11.8
1	22.1	1.2	13.1	7.2	.6	6.8
2	27.4	.9	14.9	10.4	1.2	6.3
3	16.8	.4	7.8	7.5	1.1	7.8
4	9.2	Q	3.2	5.1	.8	10.9
5 or More	11.5	Q	3.4	6.2	1.7	10.1

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Residential Energy Consumption Survey.

For example, from Figure 4.2, you can see that 13.1 million households have three to five rooms and use one light one to four hours per day. The number of households with six to eight rooms that use one light one to four hours per day is 7.2 million. The difference between the two estimates is 5.9 million households. The standard error for the 13.1 million households (x_1) is 0.62 million. The standard error for the 7.2 million (x_2) households is 0.34 million:

$$S_{x_1-x_2} = \sqrt{0.62^2 + 0.34^2}$$

$$S_{x_1-x_2} = 0.707$$

Multiplying 0.707 by 1.96 yields 1.39 million households. Since 1.39 million households is less than the 5.9 million difference between the two estimates, the difference is statistically significant.

Table 4.1. Light Usage by Heated Floorspace Category, Million U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Heated Floorspace Category (square feet)							RSE Row Factors
		Fewer than 600	600 to 999	1,000 to 1,599	1,600 to 1,999	2,000 to 2,399	2,400 to 2,999	3,000 or More	
RSE Column Factor:	0.4	1.7	0.9	0.8	1.1	1.2	1.2	1.2	
Total	96.6	7.5	21.8	27.8	12.4	9.6	8.2	9.3	3.62
Indoor Electric Lights									
Total Number Lights									
1 to 4 Hours									
None	9.6	1.2	2.2	2.7	1.1	0.9	0.7	0.6	11.83
1	22.1	2.4	6.7	6.5	2.5	1.5	1.5	1.1	7.39
2	27.4	2.4	6.9	8.0	3.6	2.4	2.1	2.0	6.60
3	16.8	0.8	3.4	5.2	2.2	2.0	1.5	1.8	8.57
4	9.2	0.4	1.4	2.5	1.4	1.1	1.0	1.3	11.13
5 or More	11.5	0.3	1.2	2.8	1.6	1.7	1.4	2.5	11.10
4 to 12 Hours									
None	13.4	2.0	4.2	3.9	1.1	0.9	0.6	0.7	10.20
1	20.8	2.4	6.3	6.3	2.3	1.4	1.1	0.9	7.55
2	26.4	1.8	6.3	7.8	3.6	2.5	2.3	2.2	6.51
3	16.7	0.8	2.9	5.1	2.6	2.0	1.7	1.7	7.64
4	9.2	0.4	1.1	2.8	1.4	1.2	1.1	1.3	10.46
5 or More	10.0	Q	0.9	2.0	1.4	1.7	1.4	2.5	10.40
More than 12 Hours per Day									
None	66.4	6.0	15.4	18.7	8.2	6.5	5.2	6.3	4.15
1	16.6	1.1	4.2	5.4	2.1	1.4	1.3	1.2	8.90
2	7.6	0.3	1.5	2.1	1.2	0.9	0.9	0.7	12.32
3	3.3	Q	0.5	0.9	0.6	0.5	0.3	0.5	17.49
4	1.5	Q	0.2	0.4	0.2	0.2	0.3	0.3	26.11
5 or More	1.2	Q	Q	0.3	0.1	0.2	0.2	0.2	28.67
Incandescent Lights Used									
1 to 4 Hours per Day									
None	14.8	1.6	3.5	4.1	1.8	1.4	1.3	1.0	9.69
1	24.4	2.6	6.9	7.3	2.8	1.7	1.7	1.5	7.02
2	25.3	2.1	6.2	7.6	3.3	2.4	1.8	2.1	6.38
3	15.3	0.7	3.0	4.6	2.1	1.8	1.5	1.7	8.77
4	7.5	0.3	1.1	2.1	1.2	1.0	0.9	0.9	12.40
5 or More	9.4	0.3	1.0	2.1	1.2	1.4	1.1	2.2	12.28
4 to 12 Hours per Day									
None	17.4	2.3	5.1	5.0	1.8	1.1	1.0	1.1	8.68
1	24.5	2.6	6.7	7.4	2.9	2.1	1.4	1.3	7.07
2	25.8	1.5	5.9	7.6	3.5	2.6	2.3	2.3	6.49
3	13.9	0.7	2.4	4.0	2.0	1.5	1.6	1.7	8.66
4	7.4	0.3	0.9	2.3	1.2	1.1	0.8	0.9	12.06
5 or More	7.5	Q	0.7	1.4	1.0	1.2	1.1	2.0	11.81
More than 12 Hours per Day									
None	70.4	6.2	16.1	19.9	8.9	6.9	5.6	6.9	3.98
1	15.7	1.0	3.9	5.1	1.9	1.5	1.2	1.1	9.23
2	6.3	0.2	1.2	1.7	0.9	0.7	0.8	0.7	12.35
3	2.4	Q	0.4	0.7	0.5	0.2	0.2	0.3	21.42
4	1.0	Q	Q	0.2	0.1	Q	0.1	0.2	30.54
5 or More	0.8	Q	Q	0.2	Q	Q	0.2	0.1	33.47

See footnotes at end of table.

Table 4.1. Light Usage by Heated Floorspace Category, Million U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Heated Floorspace Category (square feet)							RSE Row Factors
		Fewer than 600	600 to 999	1,000 to 1,599	1,600 to 1,999	2,000 to 2,399	2,400 to 2,999	3,000 or More	
RSE Column Factor:	0.4	1.7	0.9	0.8	1.1	1.2	1.2	1.2	
Fluorescent Lights Used									
1 to 4 Hours per Day									
None	75.5	6.4	18.3	21.8	9.5	7.0	6.0	6.5	4.21
1	16.1	1.0	2.9	4.8	2.3	1.9	1.5	1.7	8.48
2	3.8	Q	0.5	1.0	0.5	0.4	0.5	0.7	16.20
3 or More	1.2	Q	Q	0.2	0.2	0.3	0.1	0.3	26.77
4 to 12 Hours per Day									
None	75.1	6.6	18.6	21.9	9.0	7.0	5.9	6.1	4.20
1	15.9	0.8	2.5	4.6	2.5	1.8	1.7	2.0	8.49
2	4.3	Q	0.6	1.1	0.6	0.5	0.5	0.9	14.72
3 or More	1.4	Q	Q	0.2	0.2	0.3	0.2	0.3	25.48
More than 12 Hours per Day									
None	88.2	7.2	20.5	25.4	11.0	8.7	7.4	8.1	3.76
1	6.7	0.2	1.1	2.0	1.3	0.6	0.6	0.9	14.16
2	1.1	Q	Q	0.2	Q	0.3	0.1	0.2	28.48
3 or More	0.6	Q	Q	0.2	Q	Q	Q	0.1	36.44
Compact Fluorescent Light Bulbs Used									
Yes	8.6	0.4	1.2	2.1	1.3	1.1	1.1	1.3	11.20
No	88.1	7.1	20.6	25.7	11.1	8.5	7.1	7.9	3.79
Halogen Light Bulbs Used									
Yes	11.2	0.5	1.6	2.9	1.7	1.6	1.2	1.8	9.89
No	85.4	7.0	20.2	24.9	10.7	8.1	7.0	7.5	3.87
Outdoor Lights									
Yes (more than one may apply)	63.5	2.6	11.5	18.8	9.6	7.1	6.5	7.5	4.89
Evening Only	25.9	0.9	3.9	7.6	3.9	3.1	3.0	3.6	7.31
All Night	16.6	0.7	3.3	5.1	2.6	1.7	1.6	1.7	8.87
Automatic Control	18.2	0.3	2.2	4.7	3.3	2.5	2.3	2.9	8.90
High Intensity	3.2	Q	0.4	0.9	0.4	0.4	0.6	0.4	22.60
All Wattage Less than 150	31.5	1.5	6.8	9.8	4.8	3.2	2.6	2.8	8.23
Gas Light[1]	0.5	Q	Q	Q	Q	Q	Q	0.2	35.99
No	33.1	4.9	10.3	9.0	2.8	2.5	1.7	1.8	7.47

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.2. Light Usage by Heated Floorspace Category, Percent of U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Heated Floorspace Category (square feet)							RSE Row Factors
		Fewer than 600	600 to 999	1,000 to 1,599	1,600 to 1,999	2,000 to 2,399	2,400 to 2,999	3,000 or More	
RSE Column Factor:	0.4	1.6	0.9	0.8	1.1	1.2	1.3	1.2	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Indoor Electric Lights									
Total Number Lights									
1 to 4 Hours									
None	10.0	16.5	10.2	9.9	9.2	9.4	9.1	6.7	11.42
1	22.9	31.3	30.9	23.5	19.9	15.3	17.9	11.5	6.62
2	28.4	32.3	31.9	28.7	28.7	24.8	26.0	21.5	5.64
3	17.4	10.5	15.4	18.7	17.9	20.5	18.0	19.4	7.72
4	9.5	5.8	6.2	9.1	11.6	11.8	12.2	13.7	10.88
5 or More	11.9	3.6	5.4	10.1	12.7	18.1	16.8	27.1	10.17
4 to 12 Hours									
None	13.9	26.7	19.4	14.0	9.0	9.2	7.7	7.3	9.57
1	21.6	32.3	29.0	22.6	18.8	14.9	13.7	10.1	6.97
2	27.4	23.6	28.9	27.9	29.3	26.1	27.8	23.4	5.52
3	17.3	10.3	13.5	18.2	20.9	20.3	20.7	18.3	6.99
4	9.5	5.2	5.0	10.2	11.0	12.3	12.9	13.7	9.94
5 or More	10.4	Q	4.3	7.1	11.1	17.2	17.2	27.3	9.39
More than 12 Hours per Day									
None	68.7	80.3	70.6	67.3	66.0	67.6	63.3	68.2	2.44
1	17.2	14.1	19.1	19.3	16.5	14.7	16.1	13.2	8.16
2	7.9	3.6	6.8	7.6	9.7	9.3	11.4	7.8	11.69
3	3.5	Q	2.4	3.2	4.7	5.1	3.4	5.0	17.11
4	1.5	Q	0.7	1.3	1.9	1.7	3.1	3.1	25.65
5 or More	1.2	Q	Q	1.2	1.0	1.6	2.6	2.6	27.85
Incandescent Lights Used									
1 to 4 Hours per Day									
None	15.3	21.0	15.9	14.8	14.7	14.9	16.0	10.9	9.22
1	25.2	34.4	31.8	26.1	22.3	17.6	20.1	15.6	6.11
2	26.2	27.4	28.5	27.3	26.6	24.5	21.4	22.2	5.50
3	15.9	9.1	13.9	16.4	17.2	18.7	18.2	17.8	7.89
4	7.8	4.6	5.1	7.7	9.6	9.9	10.5	9.7	12.01
5 or More	9.7	3.6	4.8	7.7	9.6	14.4	13.8	23.7	11.43
4 to 12 Hours per Day									
None	18.0	31.0	23.6	18.0	14.5	11.2	11.7	11.4	8.06
1	25.4	34.5	30.9	26.6	23.6	22.3	17.3	14.3	6.32
2	26.7	19.9	26.8	27.5	28.4	27.5	28.3	25.2	5.60
3	14.4	9.5	11.1	14.3	16.3	15.5	19.9	18.1	8.08
4	7.7	3.7	4.3	8.3	9.3	11.0	9.6	9.7	11.42
5 or More	7.8	Q	3.3	5.2	7.9	12.6	13.1	21.4	10.86
More than 12 Hours per Day									
None	72.9	82.6	74.0	71.6	71.5	71.6	68.0	73.8	2.20
1	16.3	13.2	17.8	18.4	15.4	15.6	14.7	12.2	8.36
2	6.6	3.1	5.7	6.0	7.5	7.7	10.1	7.6	12.11
3	2.5	Q	1.9	2.5	3.7	2.5	3.0	3.0	20.94
4	1.0	Q	Q	0.8	1.2	Q	1.7	2.4	30.13
5 or More	0.8	Q	Q	0.7	Q	Q	2.5	1.0	32.03

See footnotes at end of table.

Table 4.2. Light Usage by Heated Floorspace Category, Percent of U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Heated Floorspace Category (square feet)							RSE Row Factors
		Fewer than 600	600 to 999	1,000 to 1,599	1,600 to 1,999	2,000 to 2,399	2,400 to 2,999	3,000 or More	
RSE Column Factor:	0.4	1.6	0.9	0.8	1.1	1.2	1.3	1.2	
Fluorescent Lights Used									
1 to 4 Hours per Day									
None	78.2	84.8	84.1	78.5	76.5	73.0	73.3	70.0	1.96
1	16.6	13.5	13.3	17.1	18.2	19.5	18.7	18.5	7.94
2	3.9	Q	2.3	3.6	3.9	4.4	6.4	7.9	15.67
3 or More	1.3	Q	Q	0.8	1.3	3.2	1.7	3.6	26.57
4 to 12 Hours per Day									
None	77.7	87.5	85.5	78.7	72.8	73.1	71.3	65.3	1.97
1	16.4	10.3	11.5	16.4	20.6	18.8	20.5	21.6	7.95
2	4.4	Q	2.7	4.0	4.8	4.7	5.9	9.5	14.21
3 or More	1.5	Q	Q	0.8	1.8	3.4	2.3	3.6	24.83
More than 12 Hours per Day									
None	91.3	95.8	93.9	91.5	88.4	90.3	90.1	87.0	1.18
1	6.9	3.2	5.3	7.0	10.4	6.4	7.0	9.5	13.86
2	1.1	Q	Q	0.7	Q	2.7	1.7	1.9	27.40
3 or More	0.6	Q	Q	0.8	Q	Q	Q	1.5	35.79
Compact Fluorescent Light Bulbs Used									
Yes	8.9	5.6	5.6	7.5	10.4	11.9	13.0	14.5	10.72
No	91.1	94.4	94.4	92.5	89.6	88.1	87.0	85.5	1.27
Halogen Light Bulbs Used									
Yes	11.6	6.8	7.2	10.3	14.0	16.3	15.0	19.0	9.31
No	88.4	93.2	92.8	89.7	86.0	83.7	85.0	81.0	1.46
Outdoor Lights									
Yes (more than one may apply)	65.8	35.1	52.6	67.6	77.3	74.0	79.0	80.3	3.11
Evening Only	26.9	12.4	18.1	27.2	31.2	31.7	36.6	38.7	6.28
All Night	17.2	8.7	15.2	18.5	20.6	17.6	18.9	17.8	8.25
Automatic Control	18.8	4.4	10.1	17.0	26.2	25.9	28.2	31.2	8.37
High Intensity	3.3	Q	2.0	3.2	3.4	4.1	7.5	3.8	22.33
All Wattage Less than 150	32.6	20.3	31.0	35.3	38.8	33.0	31.5	30.1	7.00
Gas Light[1]	0.6	Q	Q	Q	Q	Q	Q	1.7	35.22
No	34.2	64.9	47.4	32.4	22.7	26.0	21.0	19.7	6.47

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.3. Light Usage by Total Number of Rooms, Million U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Total Number of Rooms (excluding bathrooms)				RSE Row Factors
		1 or 2	3 to 5	6 to 8	9 or More	
RSE Column Factor:	0.4	2.9	0.7	0.7	1.7	
Total	96.6	3.2	47.4	40.2	5.8	3.59
Indoor Electric Lights						
Total Number Lights						
1 to 4 Hours						
None	9.6	0.5	5.0	3.8	0.3	11.81
1	22.1	1.2	13.1	7.2	0.6	6.84
2	27.4	0.9	14.9	10.4	1.2	6.27
3	16.8	0.4	7.8	7.5	1.1	7.77
4	9.2	Q	3.2	5.1	0.8	10.88
5 or More	11.5	Q	3.4	6.2	1.7	10.07
4 to 12 Hours						
None	13.4	0.9	8.1	4.1	0.4	9.79
1	20.8	1.1	13.0	6.3	0.5	6.33
2	26.4	0.8	13.7	10.7	1.3	6.04
3	16.7	0.3	7.2	8.1	1.1	7.33
4	9.2	Q	3.1	5.1	0.8	8.41
5 or More	10.0	Q	2.3	6.0	1.7	8.84
More than 12 Hours per Day						
None	66.4	2.6	33.9	26.1	3.7	4.04
1	16.6	0.4	8.4	7.1	0.6	8.52
2	7.6	Q	3.0	3.8	0.7	10.83
3	3.3	Q	1.2	1.8	0.3	16.40
4	1.5	Q	0.5	0.8	0.2	24.08
5 or More	1.2	Q	0.4	0.6	0.2	26.11
***Incandescent* Lights Used**						
1 to 4 Hours per Day						
None	14.8	0.7	7.5	6.0	0.6	9.54
1	24.4	1.3	14.2	8.0	0.8	6.26
2	25.3	0.8	13.6	9.6	1.3	6.16
3	15.3	0.3	6.6	7.4	1.1	8.16
4	7.5	Q	2.6	4.2	0.6	11.81
5 or More	9.4	Q	2.8	5.0	1.5	11.42
4 to 12 Hours per Day						
None	17.4	1.0	10.0	5.8	0.6	8.31
1	24.5	1.2	14.4	8.1	0.9	6.16
2	25.8	0.6	12.9	10.9	1.4	6.04
3	13.9	0.2	5.9	6.9	0.9	8.20
4	7.4	Q	2.5	4.1	0.7	10.55
5 or More	7.5	Q	1.7	4.4	1.4	10.46
More than 12 Hours per Day						
None	70.4	2.7	35.5	28.2	4.1	3.81
1	15.7	0.4	8.1	6.5	0.7	9.53
2	6.3	Q	2.4	3.3	0.6	10.68
3	2.4	Q	0.9	1.2	0.2	20.55
4	1.0	Q	0.3	0.6	Q	31.05
5 or More	0.8	Q	0.2	0.4	0.2	30.23

See footnotes at end of table.

Table 4.3. Light Usage by Total Number of Rooms, Million U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Total Number of Rooms (excluding bathrooms)				RSE Row Factors
		1 or 2	3 to 5	6 to 8	9 or More	
RSE Column Factor:	0.4	2.9	0.7	0.7	1.7	
Fluorescent Lights Used						
1 to 4 Hours per Day						
None	75.5	2.8	38.4	30.3	4.0	4.01
1	16.1	0.4	7.4	7.3	1.1	8.29
2	3.8	Q	1.3	2.0	0.5	14.15
3 or More	1.2	Q	0.3	0.6	0.2	24.63
4 to 12 Hours per Day						
None	75.1	2.8	39.2	29.2	3.9	4.01
1	15.9	0.3	6.7	7.8	1.1	8.50
2	4.3	Q	1.2	2.5	0.5	12.88
3 or More	1.4	Q	0.3	0.8	0.3	25.13
More than 12 Hours per Day						
None	88.2	3.1	44.3	36.0	4.9	3.76
1	6.7	Q	2.7	3.4	0.6	13.55
2	1.1	Q	0.3	0.5	0.3	25.05
3 or More	0.6	Q	0.2	0.3	Q	40.52
Compact Fluorescent Light Bulbs Used						
Yes	8.6	0.2	3.0	4.4	1.0	11.13
No	88.1	3.1	44.4	35.8	4.8	3.85
Halogen Light Bulbs Used						
Yes	11.2	0.2	4.4	5.5	1.2	9.64
No	85.4	3.0	42.9	34.7	4.7	3.95
Outdoor Lights						
Yes (more than one may apply)	63.5	0.9	27.2	30.8	4.7	4.98
Evening Only	25.9	0.3	9.6	13.7	2.4	7.86
All Night	16.6	0.3	7.3	7.9	1.2	8.53
Automatic Control	18.2	0.1	5.7	10.4	2.0	8.05
High Intensity	3.2	Q	1.0	1.8	0.3	22.64
All Wattage Less than 150	31.5	0.5	15.7	13.7	1.6	8.51
Gas Light[1]	0.5	Q	Q	0.3	0.2	31.23
No	33.1	2.4	20.2	9.4	1.1	6.84

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.4. Light Usage by Total Number of Rooms, Percent of U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Total Number of Rooms (excluding bathrooms)				RSE Row Factors
		1 or 2	3 to 5	6 to 8	9 or More	
RSE Column Factor:	0.5	2.6	0.7	0.7	1.6	
Total	100.0	100.0	100.0	100.0	100.0	0.0
Indoor Electric Lights						
Total Number Lights						
1 to 4 Hours						
None	10.0	16.8	10.5	9.4	5.8	11.52
1	22.9	36.5	27.7	17.8	10.7	5.96
2	28.4	29.3	31.4	25.8	21.1	5.33
3	17.4	11.1	16.5	18.7	19.0	7.20
4	9.5	Q	6.7	12.8	13.5	10.03
5 or More	11.9	Q	7.1	15.5	29.8	8.94
4 to 12 Hours						
None	13.9	27.4	17.1	10.2	6.3	9.05
1	21.6	33.8	27.4	15.6	8.9	5.94
2	27.4	24.1	28.9	26.6	21.5	4.72
3	17.3	9.8	15.2	20.1	19.0	6.57
4	9.5	Q	6.6	12.7	14.4	7.89
5 or More	10.4	Q	4.8	14.8	29.9	7.77
More than 12 Hours per Day						
None	68.7	81.8	71.6	64.8	64.2	2.48
1	17.2	13.6	17.8	17.8	10.3	8.10
2	7.9	Q	6.4	9.5	11.8	9.90
3	3.5	Q	2.5	4.5	5.9	15.29
4	1.5	Q	1.0	2.0	3.7	23.54
5 or More	1.2	Q	0.8	1.4	4.2	25.14
Incandescent Lights Used						
1 to 4 Hours per Day						
None	15.3	21.1	15.8	14.9	10.2	9.11
1	25.2	40.0	30.0	20.0	13.7	5.28
2	26.2	23.6	28.7	24.0	22.3	5.44
3	15.9	9.5	13.9	18.3	19.0	7.14
4	7.8	Q	5.6	10.5	9.5	11.17
5 or More	9.7	Q	5.9	12.3	25.3	10.24
4 to 12 Hours per Day						
None	18.0	31.3	21.1	14.4	9.7	7.64
1	25.4	37.6	30.4	20.1	15.2	5.51
2	26.7	20.0	27.1	27.1	24.3	4.82
3	14.4	6.6	12.5	17.2	15.6	7.61
4	7.7	Q	5.3	10.3	11.4	9.85
5 or More	7.8	Q	3.6	10.9	23.7	9.41
More than 12 Hours per Day						
None	72.9	83.9	74.8	70.2	69.7	2.21
1	16.3	13.8	17.1	16.3	11.2	9.24
2	6.6	Q	5.0	8.2	10.9	9.80
3	2.5	Q	1.9	3.1	4.1	19.52
4	1.0	Q	0.7	1.4	Q	29.36
5 or More	0.8	Q	0.5	0.9	2.7	29.29

See footnotes at end of table.

Table 4.4. Light Usage by Total Number of Rooms, Percent of U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Total Number of Rooms (excluding bathrooms)				RSE Row Factors
		1 or 2	3 to 5	6 to 8	9 or More	
RSE Column Factor:	0.5	2.6	0.7	0.7	1.6	
Fluorescent Lights Used						
1 to 4 Hours per Day						
None	78.2	86.6	81.0	75.5	69.0	1.76
1	16.6	11.3	15.5	18.0	18.8	7.57
2	3.9	Q	2.7	4.9	8.2	13.62
3 or More	1.3	Q	0.7	1.6	4.0	23.96
4 to 12 Hours per Day						
None	77.7	88.3	82.7	72.6	66.8	1.76
1	16.4	9.0	14.2	19.3	18.9	7.70
2	4.4	Q	2.6	6.1	9.2	12.31
3 or More	1.5	Q	0.6	2.0	5.2	24.44
More than 12 Hours per Day						
None	91.3	95.7	93.4	89.5	84.2	1.19
1	6.9	Q	5.6	8.4	9.4	12.64
2	1.1	Q	0.6	1.3	4.8	24.39
3 or More	0.6	Q	0.4	0.8	Q	38.36
Compact Fluorescent Light Bulbs Used						
Yes	8.9	Q	6.2	11.0	17.7	9.30
No	91.1	95.2	93.8	89.0	82.3	1.30
Halogen Light Bulbs Used						
Yes	11.6	6.1	9.4	13.6	19.7	9.47
No	88.4	93.9	90.6	86.4	80.3	1.35
Outdoor Lights						
Yes (more than one may apply)	65.8	26.6	57.4	76.5	81.1	3.37
Evening Only	26.9	8.2	20.4	34.0	40.5	6.78
All Night	17.2	8.7	15.4	19.6	19.7	7.63
Automatic Control	18.8	4.6	12.0	25.9	33.5	7.50
High Intensity	3.3	Q	2.1	4.6	4.8	21.66
All Wattage Less than 150	32.6	16.7	33.1	34.1	26.6	7.72
Gas Light[1]	0.6	Q	Q	0.7	2.6	30.03
No	34.2	73.4	42.6	23.5	18.9	5.64

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.5. Light Usage by Family Income Category, Million U.S. Households, 1993

Housing Unit and Household Characteristics	Total	1993 Family Income Category									RSE Row Factors
		Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 to $74,999	$75,000 or More	
RSE Column Factor:	0.4	1.9	1.2	1.1	1.2	1.2	0.9	0.8	0.9	1.2	
Total	96.6	4.1	10.6	11.1	9.6	8.7	14.1	17.5	12.6	8.3	3.98
Indoor Electric Lights											
Total Number Lights											
1 to 4 Hours											
None	9.6	0.8	1.5	1.4	1.0	0.9	1.3	1.3	1.0	0.5	12.52
1	22.1	1.5	3.5	3.3	2.7	2.0	3.4	2.8	1.8	1.2	7.83
2	27.4	0.9	3.1	3.3	2.9	3.2	3.8	4.9	3.3	2.0	7.22
3	16.8	0.5	1.6	1.6	1.5	1.4	2.4	3.5	2.6	1.6	9.18
4	9.2	0.2	0.4	0.8	0.8	0.6	1.2	2.3	1.7	1.2	13.02
5 or More	11.5	0.2	0.5	0.8	0.7	0.7	1.9	2.6	2.2	1.9	13.17
4 to 12 Hours											
None	13.4	1.0	2.8	2.1	1.5	1.2	1.8	1.3	1.1	0.7	10.40
1	20.8	1.3	3.5	3.2	2.3	2.0	2.8	3.2	1.7	0.9	8.06
2	26.4	1.0	2.8	3.0	2.5	2.6	4.4	4.9	3.4	1.7	7.19
3	16.7	0.4	0.9	1.6	1.8	1.5	2.5	3.9	2.7	1.5	9.14
4	9.2	0.2	0.4	0.6	1.0	0.8	1.3	2.1	1.6	1.3	12.49
5 or More	10.0	0.2	0.2	0.5	0.6	0.6	1.4	2.1	2.2	2.2	13.58
More than 12 Hours per Day											
None	66.4	2.7	7.4	7.8	6.2	6.3	9.6	11.9	8.5	5.9	4.61
1	16.6	0.9	2.0	1.9	2.0	1.5	2.2	2.9	2.2	1.1	9.54
2	7.6	0.4	0.8	0.8	0.8	0.6	1.3	1.3	0.9	0.6	12.83
3	3.3	Q	0.2	0.4	0.4	0.1	0.6	0.7	0.5	0.3	20.85
4	1.5	Q	0.1	0.1	Q	Q	0.2	0.4	0.3	Q	30.65
5 or More	1.2	Q	Q	Q	Q	Q	0.2	0.2	0.2	0.2	33.07
Incandescent Lights Used											
1 to 4 Hours per Day											
None	14.8	1.0	2.1	2.0	1.5	1.5	2.0	2.0	1.6	0.9	9.96
1	24.4	1.5	3.7	3.5	2.9	2.2	3.6	3.4	2.2	1.4	7.50
2	25.3	0.9	2.7	2.9	2.6	2.7	3.5	4.8	3.2	2.1	7.26
3	15.3	0.4	1.3	1.5	1.4	1.2	2.3	3.3	2.6	1.4	9.61
4	7.5	0.2	0.3	0.6	0.6	0.6	1.1	1.9	1.3	1.0	14.38
5 or More	9.4	0.2	0.5	0.7	0.6	0.5	1.5	2.1	1.8	1.5	15.00
4 to 12 Hours per Day											
None	17.4	1.0	3.2	2.7	2.1	1.6	2.3	1.9	1.6	0.9	8.96
1	24.5	1.4	3.7	3.3	2.5	2.3	3.5	4.1	2.5	1.3	7.38
2	25.8	0.9	2.5	3.0	2.3	2.5	4.1	5.2	3.4	1.9	7.09
3	13.9	0.3	0.8	1.3	1.6	1.3	1.9	3.2	2.2	1.4	10.25
4	7.4	0.2	0.3	0.5	0.7	0.6	1.1	1.5	1.4	0.9	14.14
5 or More	7.5	Q	0.1	0.4	0.5	0.4	1.1	1.6	1.5	1.8	15.76
More than 12 Hours per Day											
None	70.4	2.8	7.8	8.2	6.7	6.5	10.4	12.7	9.2	6.2	4.38
1	15.7	0.9	1.9	1.8	1.9	1.5	1.9	2.8	2.0	1.1	9.98
2	6.3	0.3	0.6	0.7	0.8	0.4	1.0	1.2	0.8	0.6	13.77
3	2.4	Q	0.1	0.4	0.1	0.1	0.5	0.5	0.4	0.2	23.84
4	1.0	Q	0.1	Q	Q	Q	Q	0.2	Q	Q	32.58
5 or More	0.8	Q	Q	Q	Q	Q	0.2	Q	0.1	Q	36.41

See footnotes at end of table.

Table 4.5. Light Usage by Family Income Category, Million U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	1993 Family Income Category									RSE Row Factors
		Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 to $74,999	$75,000 or More	
RSE Column Factor:	0.4	1.9	1.2	1.1	1.2	1.2	0.9	0.8	0.9	1.2	
Fluorescent Lights Used											
1 to 4 Hours per Day											
None	75.5	3.5	8.9	9.1	7.8	6.9	11.0	13.5	9.1	5.8	4.50
1	16.1	0.5	1.3	1.7	1.4	1.4	2.4	3.0	2.6	1.7	9.50
2	3.8	Q	0.4	0.2	0.4	0.3	0.5	0.6	0.7	0.7	20.47
3 or More	1.2	Q	Q	Q	Q	0.2	0.2	0.3	0.2	0.2	30.43
4 to 12 Hours per Day											
None	75.1	3.6	9.4	9.4	7.6	6.9	11.0	12.8	8.8	5.6	4.47
1	15.9	0.4	1.0	1.2	1.4	1.6	2.4	3.5	2.6	1.8	9.84
2	4.3	Q	0.1	0.4	0.5	0.2	0.5	0.9	0.9	0.7	18.81
3 or More	1.4	Q	Q	Q	Q	Q	0.2	0.2	0.4	0.3	28.07
More than 12 Hours per Day											
None	88.2	3.8	9.9	10.4	8.8	8.2	12.6	15.8	11.2	7.6	4.08
1	6.7	0.3	0.6	0.6	0.6	0.5	1.2	1.4	1.0	0.6	15.45
2	1.1	Q	Q	Q	Q	Q	0.2	Q	0.4	Q	32.32
3 or More	0.6	Q	Q	Q	Q	Q	Q	0.2	Q	Q	40.38
Compact Fluorescent Light Bulbs Used											
Yes	8.6	0.3	0.4	0.5	0.6	0.8	1.1	2.0	1.6	1.2	12.95
No	88.1	3.8	10.2	10.6	9.0	8.0	12.9	15.5	11.0	7.1	4.13
Halogen Light Bulbs Used											
Yes	11.2	0.4	0.3	0.7	0.7	1.1	1.6	2.8	2.0	1.8	12.07
No	85.4	3.7	10.3	10.5	8.9	7.7	12.4	14.7	10.6	6.6	4.17
Outdoor Lights											
Yes (more than one may apply)	63.5	1.8	5.3	6.3	6.3	5.6	9.6	12.4	9.9	6.5	5.41
Evening Only	25.9	0.6	1.7	2.1	2.4	2.2	3.6	5.7	4.6	3.0	8.30
All Night	16.6	0.5	1.5	1.9	1.8	1.3	2.8	2.8	2.2	1.8	9.27
Automatic Control	18.2	0.4	0.8	1.3	1.7	1.5	2.5	3.9	3.4	2.6	9.51
High Intensity	3.2	Q	0.1	0.3	0.3	0.2	0.5	0.8	0.5	0.4	25.70
All Wattage Less than 150	31.5	1.1	3.0	3.5	3.2	3.1	4.7	6.0	4.3	2.6	8.22
Gas Light[1]	0.5	Q	Q	Q	Q	Q	Q	0.2	Q	Q	43.65
No	33.1	2.2	5.3	4.8	3.4	3.2	4.5	5.0	2.8	1.9	7.22

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.6. Light Usage by Family Income Category, Percent of U.S. Households, 1993

Housing Unit and Household Characteristics	Total	1993 Family Income Category									RSE Row Factors
		Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 to $74,999	$75,000 or More	
RSE Column Factor:	0.4	1.8	1.2	1.1	1.1	1.2	0.9	0.8	0.9	1.1	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Indoor Electric Lights											
Total Number Lights											
1 to 4 Hours											
None	10.0	18.7	14.0	12.7	10.0	10.2	9.0	7.6	8.0	6.3	12.08
1	22.9	35.8	33.0	29.5	28.4	22.6	24.1	16.1	13.9	14.1	6.91
2	28.4	23.2	29.2	29.5	30.1	36.4	27.3	28.1	26.4	23.6	6.07
3	17.4	11.4	15.5	14.2	15.9	16.3	17.4	20.2	20.8	18.7	8.22
4	9.5	5.4	3.7	7.1	7.9	6.4	8.9	13.3	13.2	14.7	12.67
5 or More	11.9	5.5	4.7	7.0	7.7	8.0	13.4	14.7	17.6	22.5	12.40
4 to 12 Hours											
None	13.9	23.7	26.2	19.2	15.3	14.2	12.7	7.4	8.6	8.1	9.68
1	21.6	31.7	33.1	29.2	23.8	23.1	19.6	18.1	13.4	10.8	7.07
2	27.4	25.4	26.7	27.0	25.7	30.1	31.2	28.3	26.8	20.8	6.32
3	17.3	9.4	8.1	14.5	18.9	16.9	17.5	22.4	21.2	18.1	8.17
4	9.5	5.3	4.1	5.3	10.2	8.9	9.0	11.8	12.6	15.4	11.70
5 or More	10.4	4.6	1.8	4.9	6.0	6.9	10.0	12.0	17.4	26.8	12.97
More than 12 Hours per Day											
None	68.7	66.2	70.3	70.4	64.8	71.7	68.2	68.2	67.1	71.0	2.66
1	17.2	21.1	18.6	17.3	20.6	17.0	15.6	16.5	17.8	12.9	8.70
2	7.9	10.1	7.8	7.1	8.8	7.2	9.1	7.6	7.5	7.4	12.41
3	3.5	Q	1.6	3.7	4.3	1.6	4.2	4.0	4.0	4.1	20.14
4	1.5	Q	1.2	1.3	Q	Q	1.6	2.4	2.1	Q	29.96
5 or More	1.2	Q	Q	Q	Q	Q	1.3	1.3	1.6	2.8	31.97
Incandescent Lights Used											
1 to 4 Hours per Day											
None	15.3	23.6	20.2	18.4	15.8	17.6	14.5	11.5	12.3	11.4	9.25
1	25.2	36.3	34.5	31.2	30.1	25.2	25.8	19.3	17.8	16.9	6.50
2	26.2	21.1	25.2	26.2	26.9	31.2	25.0	27.2	25.2	25.3	6.28
3	15.9	9.2	12.6	13.1	14.7	13.9	16.0	19.1	20.3	16.8	8.71
4	7.8	4.9	3.0	5.2	6.3	6.4	7.9	10.7	10.0	11.9	14.08
5 or More	9.7	4.9	4.3	6.0	6.2	5.8	10.8	12.1	14.4	17.7	14.27
4 to 12 Hours per Day											
None	18.0	25.8	30.4	24.3	21.7	18.3	16.6	10.7	12.6	11.0	8.18
1	25.4	35.0	34.6	29.3	25.7	26.1	24.8	23.4	20.2	15.9	6.35
2	26.7	23.0	23.3	27.0	23.8	28.9	29.4	29.6	26.6	23.2	6.11
3	14.4	7.3	7.5	11.4	16.2	15.0	13.4	18.4	17.4	17.0	9.39
4	7.7	5.4	3.2	4.3	7.4	7.3	8.2	8.8	11.1	11.0	13.64
5 or More	7.8	Q	1.0	3.6	5.2	4.5	7.7	9.0	12.1	21.7	15.09
More than 12 Hours per Day											
None	72.9	68.5	73.6	73.9	69.4	74.3	74.0	72.6	72.8	74.1	2.36
1	16.3	21.8	17.9	15.8	19.3	17.6	13.7	15.8	16.0	13.4	9.04
2	6.6	7.9	5.7	5.9	8.7	4.7	7.0	6.6	6.2	7.2	13.47
3	2.5	Q	1.3	3.3	1.3	1.5	3.3	2.9	3.0	2.9	23.27
4	1.0	Q	1.3	Q	Q	Q	Q	1.3	Q	Q	31.84
5 or More	0.8	Q	Q	Q	Q	Q	1.3	Q	1.1	Q	34.33

See footnotes at end of table.

Table 4.6. Light Usage by Family Income Category, Percent of U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	1993 Family Income Category									RSE Row Factors
		Less than $5,000	$5,000 to $9,999	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 to $74,999	$75,000 or More	
RSE Column Factor:	0.4	1.8	1.2	1.1	1.1	1.2	0.9	0.8	0.9	1.1	
Fluorescent Lights Used											
1 to 4 Hours per Day											
None	78.2	86.5	83.8	82.2	80.6	78.5	78.2	77.3	72.2	69.3	2.10
1	16.6	11.9	12.3	14.9	14.9	16.3	17.3	17.5	20.8	19.9	8.78
2	3.9	Q	3.6	2.1	4.0	3.4	3.3	3.7	5.2	8.0	20.05
3 or More	1.3	Q	Q	Q	Q	1.8	1.2	1.6	1.9	2.8	29.78
4 to 12 Hours per Day											
None	77.7	88.7	88.7	84.6	79.1	78.3	78.1	73.4	69.7	67.5	1.99
1	16.4	9.3	9.1	11.2	14.9	18.2	17.2	19.9	20.4	21.5	9.04
2	4.4	Q	1.3	3.5	5.2	2.5	3.4	5.3	7.0	7.9	18.43
3 or More	1.5	Q	Q	Q	Q	Q	1.3	1.4	2.9	3.1	27.51
More than 12 Hours per Day											
None	91.3	93.7	93.7	93.9	91.2	93.2	89.4	90.3	89.0	90.5	1.17
1	6.9	6.2	5.4	5.3	6.7	5.9	8.6	7.7	7.7	7.1	14.85
2	1.1	Q	Q	Q	Q	Q	1.4	Q	2.9	Q	30.93
3 or More	0.6	Q	Q	Q	Q	Q	Q	1.3	Q	Q	38.59
Compact Fluorescent Light Bulbs Used											
Yes	8.9	7.0	4.0	4.8	6.1	9.1	8.0	11.2	13.0	14.7	12.32
No	91.1	93.0	96.0	95.2	93.9	90.9	92.0	88.8	87.0	85.3	1.20
Halogen Light Bulbs Used											
Yes	11.6	9.3	2.5	6.0	7.1	12.1	11.4	15.8	16.1	21.3	11.22
No	88.4	90.7	97.5	94.0	92.9	87.9	88.6	84.2	83.9	78.7	1.37
Outdoor Lights											
Yes (more than one may apply)	65.8	45.0	49.6	56.9	65.1	63.6	68.0	71.1	78.2	77.5	3.42
Evening Only	26.9	15.5	16.2	19.0	24.6	24.8	25.7	32.6	36.8	36.0	7.23
All Night	17.2	12.5	14.0	17.4	19.1	14.3	19.7	16.1	17.5	21.3	8.46
Automatic Control	18.8	9.7	7.4	11.9	17.3	17.5	17.9	22.4	27.3	31.6	8.59
High Intensity	3.3	Q	1.4	2.5	3.4	2.4	3.3	4.3	4.3	4.8	25.01
All Wattage Less than 150	32.6	26.3	28.2	31.8	32.8	35.3	33.4	34.6	33.9	31.6	7.27
Gas Light[1]	0.6	Q	Q	Q	Q	Q	Q	1.1	Q	Q	41.61
No	34.2	55.0	50.4	43.1	34.9	36.4	32.0	28.9	21.8	22.5	6.27

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.7. Light Usage by Household Size, Million U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Household Size						RSE Row Factors
		1 Person	2 Persons	3 Persons	4 Persons	5 Persons	6 or More Persons	
RSE Column Factor:	0.4	0.9	0.7	1.0	1.0	1.5	2.2	
Total	96.6	23.5	31.7	16.6	14.6	6.8	3.5	3.17
Indoor Electric Lights								
Total Number Lights								
1 to 4 Hours								
None	9.6	3.2	3.1	1.5	1.1	0.5	0.3	11.81
1	22.1	7.5	7.4	3.4	2.2	1.1	0.5	6.82
2	27.4	7.6	9.5	4.4	3.5	1.6	0.7	6.07
3	16.8	3.0	5.7	3.1	3.0	1.3	0.7	7.46
4	9.2	1.1	3.0	1.8	1.9	0.9	0.4	10.28
5 or More	11.5	1.0	3.1	2.3	2.9	1.4	0.8	9.64
4 to 12 Hours								
None	13.4	5.1	4.0	2.1	1.1	0.7	0.5	9.29
1	20.8	7.2	7.0	2.9	2.3	0.8	0.7	6.97
2	26.4	6.6	8.9	4.3	3.8	1.9	0.8	5.76
3	16.7	2.6	5.8	3.8	2.8	1.2	0.6	7.53
4	9.2	1.2	3.0	1.6	2.1	0.8	0.5	9.50
5 or More	10.0	0.8	3.0	1.9	2.5	1.3	0.5	10.23
More than 12 Hours per Day								
None	66.4	17.8	22.3	11.1	9.3	4.0	1.9	3.63
1	16.6	3.9	5.0	3.0	2.5	1.3	0.9	8.05
2	7.6	1.1	2.5	1.5	1.6	0.8	0.2	10.87
3	3.3	0.5	1.0	0.6	0.7	0.4	0.2	16.29
4	1.5	Q	0.5	0.2	0.3	0.2	Q	25.07
5 or More	1.2	Q	0.3	0.3	0.3	0.1	Q	27.40
Incandescent Lights Used								
1 to 4 Hours per Day								
None	14.8	4.6	5.3	2.1	1.6	0.7	0.3	9.39
1	24.4	7.8	8.4	3.8	2.5	1.2	0.6	6.79
2	25.3	6.9	8.4	4.3	3.6	1.5	0.7	6.29
3	15.3	2.4	5.0	3.0	3.0	1.3	0.7	7.84
4	7.5	1.0	2.3	1.5	1.5	0.9	0.4	11.49
5 or More	9.4	0.9	2.3	1.9	2.4	1.2	0.7	11.00
4 to 12 Hours per Day								
None	17.4	6.1	5.7	2.6	1.6	0.8	0.6	7.98
1	24.5	8.1	7.8	3.6	3.0	1.3	0.8	6.54
2	25.8	5.7	9.1	4.7	3.7	1.8	0.8	5.85
3	13.9	2.3	4.6	2.8	2.6	1.1	0.5	8.48
4	7.4	0.8	2.2	1.3	1.9	0.7	0.4	10.81
5 or More	7.5	0.5	2.2	1.4	1.8	1.1	0.4	11.16
More than 12 Hours per Day								
None	70.4	18.5	23.6	11.9	10.0	4.3	2.1	3.45
1	15.7	3.7	4.9	2.7	2.4	1.2	0.8	8.34
2	6.3	0.8	1.9	1.4	1.2	0.8	0.2	11.36
3	2.4	0.4	0.7	0.4	0.5	0.2	0.1	19.89
4	1.0	Q	0.2	Q	0.2	0.2	Q	27.82
5 or More	0.8	Q	0.2	0.2	0.2	Q	Q	32.69

See footnotes at end of table.

Table 4.7. Light Usage by Household Size, Million U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Household Size						RSE Row Factors
		1 Person	2 Persons	3 Persons	4 Persons	5 Persons	6 or More Persons	
RSE Column Factor:	0.4	0.9	0.7	1.0	1.0	1.5	2.2	
Fluorescent Lights Used								
1 to 4 Hours per Day								
None	75.5	19.6	23.8	12.9	11.0	5.4	2.9	3.21
1	16.1	3.4	5.9	2.8	2.6	1.0	0.4	8.21
2	3.8	0.5	1.5	0.8	0.6	0.2	Q	17.55
3 or More	1.2	Q	0.5	Q	0.4	0.2	Q	24.10
4 to 12 Hours per Day								
None	75.1	19.6	24.1	12.7	10.7	5.1	2.9	3.21
1	15.9	3.1	5.6	2.8	2.9	1.2	0.4	7.99
2	4.3	0.7	1.5	0.8	0.7	0.3	0.2	13.95
3 or More	1.4	Q	0.5	0.3	0.4	0.1	Q	25.10
More than 12 Hours per Day								
None	88.2	22.2	28.7	15.2	13.0	6.0	3.1	3.32
1	6.7	1.1	2.3	1.2	1.3	0.6	0.3	12.65
2	1.1	Q	0.5	Q	0.2	Q	Q	29.41
3 or More	0.6	Q	0.2	Q	Q	Q	Q	39.76
Compact Fluorescent Light Bulbs Used								
Yes	8.6	1.4	3.4	1.6	1.3	0.6	0.3	11.88
No	88.1	22.1	28.3	15.0	13.3	6.2	3.2	3.35
Halogen Light Bulbs Used								
Yes	11.2	2.1	4.2	2.1	1.6	0.9	0.3	9.58
No	85.4	21.4	27.5	14.5	13.0	5.9	3.1	3.51
Outdoor Lights								
Yes (more than one may apply)	63.5	12.0	21.0	11.8	11.1	5.1	2.5	4.13
Evening Only	25.9	3.3	8.1	5.2	5.6	2.5	1.3	6.65
All Night	16.6	3.4	5.1	3.1	2.9	1.3	0.8	7.89
Automatic Control	18.2	3.1	6.9	3.4	3.2	1.1	0.5	7.89
High Intensity	3.2	0.5	1.1	0.6	0.5	0.2	0.2	20.62
All Wattage Less than 150	31.5	7.0	10.2	5.5	5.0	2.6	1.2	7.14
Gas Light[1]	0.5	Q	0.3	Q	Q	Q	Q	34.58
No	33.1	11.5	10.7	4.8	3.5	1.6	1.0	6.51

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.8. Light Usage by Household Size, Percent of U.S. Households, 1993

Housing Unit and Household Characteristics	Total	Household Size						RSE Row Factors
		1 Person	2 Persons	3 Persons	4 Persons	5 Persons	6 or More Persons	
RSE Column Factor:	0.5	1.0	0.8	1.0	1.0	1.4	2.0	
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	0.0
Indoor Electric Lights								
Total Number Lights								
1 to 4 Hours								
None	10.0	13.8	9.8	8.8	7.2	7.5	8.0	11.39
1	22.9	32.0	23.2	20.7	15.1	15.6	15.4	6.49
2	28.4	32.3	30.0	26.8	24.3	23.9	20.1	5.64
3	17.4	12.9	17.9	18.9	20.6	18.5	20.2	6.89
4	9.5	4.9	9.3	11.1	13.0	13.8	11.9	9.93
5 or More	11.9	4.2	9.7	13.7	19.8	20.8	24.4	9.02
4 to 12 Hours								
None	13.9	21.6	12.7	12.6	7.6	9.7	13.4	8.94
1	21.6	30.8	22.0	17.4	15.5	12.4	18.7	6.55
2	27.4	28.1	28.2	26.0	26.3	28.2	23.5	5.18
3	17.3	11.0	18.3	22.6	19.3	17.9	15.8	6.98
4	9.5	5.1	9.4	9.9	14.1	12.3	14.7	9.07
5 or More	10.4	3.3	9.6	11.5	17.2	19.5	13.8	9.79
More than 12 Hours per Day								
None	68.7	75.7	70.4	66.8	63.4	58.9	55.7	2.61
1	17.2	16.5	15.8	18.3	17.2	19.2	25.3	7.52
2	7.9	4.6	7.8	8.9	11.0	11.6	6.9	10.84
3	3.5	2.0	3.2	3.4	4.8	5.8	5.5	16.09
4	1.5	Q	1.7	1.0	1.8	3.0	Q	24.80
5 or More	1.2	Q	1.1	1.6	1.8	1.5	Q	26.98
Incandescent Lights Used								
1 to 4 Hours per Day								
None	15.3	19.7	16.8	12.8	11.2	10.1	10.0	8.90
1	25.2	33.0	26.6	23.2	17.2	18.3	16.3	6.54
2	26.2	29.2	26.4	25.8	24.3	22.4	21.2	5.70
3	15.9	10.1	15.8	18.1	20.4	19.1	19.5	7.41
4	7.8	4.2	7.2	8.8	10.2	13.1	11.5	11.17
5 or More	9.7	3.7	7.2	11.3	16.7	17.1	21.5	10.47
4 to 12 Hours per Day								
None	18.0	25.9	17.9	15.8	11.0	12.1	16.3	7.60
1	25.4	34.5	24.6	22.0	20.3	18.5	22.1	6.10
2	26.7	24.0	28.9	28.5	25.6	26.3	22.3	5.31
3	14.4	9.8	14.5	17.1	17.9	16.3	14.8	7.90
4	7.7	3.6	7.0	8.1	13.0	10.2	11.6	10.54
5 or More	7.8	2.3	7.1	8.5	12.3	16.5	12.9	10.67
More than 12 Hours per Day								
None	72.9	78.5	74.6	71.5	68.4	64.2	61.0	2.35
1	16.3	15.7	15.5	16.0	16.7	17.7	24.3	7.97
2	6.6	3.5	6.1	8.2	8.5	11.2	6.2	11.19
3	2.5	1.5	2.3	2.4	3.8	3.2	3.7	19.81
4	1.0	Q	0.7	Q	1.4	2.6	Q	27.33
5 or More	0.8	Q	0.7	1.1	1.1	Q	Q	31.81

See footnotes at end of table.

Table 4.8. Light Usage by Household Size, Percent of U.S. Households, 1993 — Continued

Housing Unit and Household Characteristics	Total	Household Size						RSE Row Factors
		1 Person	2 Persons	3 Persons	4 Persons	5 Persons	6 or More Persons	
RSE Column Factor:	0.5	1.0	0.8	1.0	1.0	1.4	2.0	
Fluorescent Lights Used								
1 to 4 Hours per Day								
None	78.2	83.1	75.0	78.0	75.7	79.2	83.1	1.83
1	16.6	14.5	18.5	16.8	17.5	15.4	12.5	7.76
2	3.9	2.3	4.9	4.6	4.4	3.1	Q	16.93
3 or More	1.3	Q	1.7	Q	2.5	2.3	Q	23.72
4 to 12 Hours per Day								
None	77.7	83.5	75.9	76.5	73.1	75.5	83.7	1.74
1	16.4	13.0	17.6	16.7	19.6	17.9	11.2	7.54
2	4.4	3.0	4.8	5.1	4.9	4.9	4.5	13.79
3 or More	1.5	Q	1.6	1.8	2.4	1.7	Q	24.83
More than 12 Hours per Day								
None	91.3	94.4	90.6	91.6	89.1	89.1	89.1	1.23
1	6.9	4.7	7.2	7.0	8.9	8.5	7.5	12.37
2	1.1	Q	1.5	Q	1.4	Q	Q	28.44
3 or More	0.6	Q	0.7	Q	Q	Q	Q	38.05
Compact Fluorescent Light Bulbs Used								
Yes	8.9	6.1	10.7	9.5	9.1	8.2	7.5	11.54
No	91.1	93.9	89.3	90.5	90.9	91.8	92.5	1.15
Halogen Light Bulbs Used								
Yes	11.6	8.9	13.2	12.7	11.1	13.3	9.9	9.34
No	88.4	91.1	86.8	87.3	88.9	86.7	90.1	1.32
Outdoor Lights								
Yes (more than one may apply)	65.8	51.2	66.2	70.9	76.3	75.7	72.4	2.80
Evening Only	26.9	13.9	25.6	31.5	38.2	37.1	36.5	5.80
All Night	17.2	14.7	16.1	18.5	19.6	19.7	21.7	7.32
Automatic Control	18.8	13.3	21.7	20.4	21.7	16.8	14.4	7.21
High Intensity	3.3	2.0	3.5	3.4	3.7	3.6	6.9	20.26
All Wattage Less than 150	32.6	29.9	32.3	33.0	34.2	37.7	33.5	6.46
Gas Light[1]	0.6	Q	0.9	Q	Q	Q	Q	33.04
No	34.2	48.8	33.8	29.1	23.7	24.3	27.6	6.16

[1] Gas includes LPG and natural gas.

Q = Data withheld either because the Relative Standard Error (RSE) was greater than 50 percent or fewer than 10 households were sampled.

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.9. Mean Annual Electricity Consumption for Lighting, by Family Income by Number of Household Members, 1993

(Kilowatthours)

Family Income	All Households	Number of Household Members					RSE Row Factors
		One	Two	Three	Four	Five or More	
RSE Column Factors:	0.6	1.4	0.8	1.2	1.0	1.3	
All Households	940	604	923	1,023	1,198	1,265	2.02
Less than $10,000	668	557	657	793	952	943	5.35
$10,000 to $14,999	753	547	789	905	968	986	6.02
$15,000 to $19,999	888	695	831	865	1,227	1,321	5.89
$20,000 to $24,999	856	641	889	921	976	1,208	5.97
$25,000 to $34,999	962	630	1,000	1,015	1,095	1,247	4.64
$35,000 to $49,999	1,018	658	962	1,032	1,184	1,294	3.75
$50,000 to $74,999	1,130	646	982	1,127	1,345	1,403	4.24
$75,000 or More	1,331	616	1,239	1,384	1,494	1,574	6.81

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.10. Mean Annual Electricity Consumption for Lighting, by Family Income by Number of Rooms, 1993

(Kilowatthours)

Family Income	Total Households	Number of Rooms						RSE Row Factors
		One to Three	Four	Five	Six	Seven	Eight or More	
RSE Column Factors:	0.5	1.6	1.1	0.9	0.9	1.1	1.2	
All Households	940	497	690	875	1,003	1,181	1,420	2.08
Less than $10,000	668	452	610	728	852	1,012	1,149	6.04
$10,000 to $14,999	753	482	680	789	797	1,151	1,231	6.25
$15,000 to $19,999	888	521	732	885	1,047	1,066	1,410	6.16
$20,000 to $24,999	856	532	723	841	1,000	973	1,313	5.56
$25,000 to $34,999	962	581	713	972	945	1,196	1,390	4.92
$35,000 to $49,999	1,018	537	717	954	1,064	1,155	1,313	4.35
$50,000 to $74,999	1,130	471	700	901	1,109	1,291	1,421	4.62
$75,000 or More	1,331	378	913	993	1,130	1,316	1,625	8.24

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.11. Mean Annual Electricity Consumption for Lighting, by Number of Household Members by Number of Rooms, 1993

(Kilowatthours)

Number of Household Members	All Households	Number of Rooms						RSE Row Factors
		One to Three	Four	Five	Six	Seven	Eight or More	
RSE Column Factors:	0.5	2.0	1.1	0.9	0.8	1.0	1.1	
All Households	940	497	690	875	1,003	1,181	1,420	2.08
One	604	443	545	629	745	910	1,028	4.76
Two	923	580	705	884	968	1,141	1,264	3.35
Three	1,023	611	789	914	1,059	1,104	1,446	4.40
Four	1,198	544	854	1,066	1,113	1,365	1,522	4.36
Five or More	1,265	597	846	1,125	1,161	1,294	1,707	5.10

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.12. Mean Annual Electricity Expenditures for Lighting, by Family Income by Number of Household Members, 1993

(Dollars)

Family Income	All Households	Number of Household Members					RSE Row Factors
		One	Two	Three	Four	Five or More	
RSE Column Factors:	0.6	1.3	0.8	1.1	1.0	1.4	
All Households	83	55	80	92	106	112	2.28
Less than $10,000	61	49	60	71	90	90	5.22
$10,000 to $14,999	68	50	70	82	88	90	6.62
$15,000 to $19,999	75	61	70	73	108	104	5.49
$20,000 to $24,999	74	57	76	87	75	102	6.11
$25,000 to $34,999	82	59	83	87	94	104	4.95
$35,000 to $49,999	91	61	84	95	104	116	3.90
$50,000 to $74,999	99	60	83	101	119	123	4.24
$75,000 or More	125	69	112	131	137	158	7.36

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.13. Mean Annual Electricity Expenditures for Lighting, by Family Income by Number of Rooms, 1993

(Dollars)

Family Income	All Households	Number of Rooms						RSE Row Factors
		One to Three	Four	Five	Six	Seven	Eight or More	
RSE Column Factors:	0.5	1.6	1.1	0.9	0.9	1.1	1.2	
All Households	83	49	63	76	87	104	124	2.34
Less than $10,000	61	44	56	63	76	94	105	6.09
$10,000 to $14,999	68	46	62	70	75	94	109	6.92
$15,000 to $19,999	75	51	64	76	84	91	111	6.43
$20,000 to $24,999	74	53	65	72	84	80	111	6.06
$25,000 to $34,999	82	61	63	80	80	99	120	5.00
$35,000 to $49,999	91	53	68	87	93	99	116	4.61
$50,000 to $74,999	99	51	71	80	98	113	120	4.68
$75,000 or More	125	43	101	95	99	130	149	8.25

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.14. Mean Annual Electricity Expenditures for Lighting, by Number of Household Members by Number of Rooms, 1993

(Dollars)

Number of Household Members	All Households	Number of Rooms						RSE Row Factors
		One to Three	Four	Five	Six	Seven	Eight or More	
RSE Column Factors:	0.5	1.8	1.1	0.9	0.9	1.0	1.2	
All Households	83	49	63	76	87	104	124	2.34
One	55	44	51	54	69	78	87	5.33
Two	80	56	63	77	82	96	107	3.38
Three	92	60	73	82	95	97	131	4.75
Four	106	64	78	93	96	124	134	4.53
Five or More	112	70	83	98	99	117	150	5.89

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.15 Total Annual Electricity Expenditures for Lighting, by Family Income, Million U.S. Households, 1993

Electricity Expenditures (Dollars)	Total	Family Income								RSE Row Factors
		Less than $10,000	$10,000 to $14,999	$15,000 to $19,999	$20,000 to $24,999	$25,000 to $34,999	$35,000 to $49,999	$50,000 to 74,999	$75,000 or More	
RSE Column Factors:	0.4	1.1	1.1	1.3	1.3	1.0	0.9	1.0	1.3	
All Households	96.6	14.6	11.1	9.6	8.7	14.1	17.5	12.6	8.3	3.68
25 or Less	9.2	3.0	1.8	0.9	0.9	1.0	0.9	0.4	0.1	12.40
26 to 50	21.0	4.4	3.2	2.4	2.2	3.3	2.8	1.8	0.8	8.20
51 to 75	21.7	2.9	2.4	2.5	2.2	3.2	4.3	2.8	1.4	7.53
76 to 100	16.1	2.0	1.6	1.6	1.4	2.5	3.5	2.2	1.2	8.98
101 to 125	11.1	1.0	0.8	1.0	0.9	1.6	2.2	2.2	1.4	11.02
126 to 150	6.8	0.5	0.6	0.4	0.6	0.9	1.4	1.4	0.9	13.75
More than 150	10.8	0.7	0.6	0.8	0.6	1.4	2.3	1.9	2.5	12.69

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.16. Total Annual Electricity Expenditures for Lighting, by Number of Rooms, Million U.S. Households, 1993

Electricity Expenditures (Dollars)	Total	Number of Rooms						RSE Row Factors
		One to Three	Four	Five	Six	Seven	Eight or More	
RSE Column Factors:	0.4	1.7	1.1	0.9	1.0	1.2	1.3	
All Households	96.6	11.4	17.9	21.3	19.5	12.8	13.8	3.41
25 or Less	9.2	3.2	2.6	1.9	1.0	0.3	0.2	12.40
26 to 50	21.0	3.9	5.6	5.1	3.6	1.7	1.1	7.40
51 to 75	21.7	2.1	4.5	5.4	4.9	2.5	2.3	6.23
76 to 100	16.1	1.1	2.4	3.8	3.8	2.6	2.4	7.39
101 to 125	11.1	0.5	1.3	2.4	2.5	2.2	2.1	9.55
126 to 150	6.8	0.2	0.7	1.1	1.7	1.3	1.8	12.25
More than 150	10.8	0.3	0.8	1.6	2.0	2.2	4.0	11.94

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.17. Total Annual Electricity Expenditures for Lighting, by Number of Household Members, Million U.S. Households, 1993

Electricity Expenditures (Dollars)	Total	Number of Household Members					RSE Row Factors
		One	Two	Three	Four	Five or More	
RSE Column Factors:	0.5	1.1	0.8	1.2	1.3	1.4	
All Households	96.6	23.5	31.7	16.6	14.6	10.2	2.56
25 or Less	9.2	5.7	2.5	0.5	0.2	0.2	13.05
26 to 50	21.0	7.8	7.5	3.1	1.5	1.1	6.34
51 to 75	21.7	4.7	7.8	4.0	3.3	2.0	5.30
76 to 100	16.1	2.4	5.1	3.2	3.2	2.1	6.57
101 to 125	11.1	1.3	3.7	2.4	2.1	1.5	8.06
126 to 150	6.8	0.6	2.2	1.4	1.4	1.1	10.88
More than 150	10.8	0.9	2.9	1.9	2.8	2.3	9.84

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 A-C, E, and H of the 1993 Residential Energy Consumption Survey. (For specific titles of forms, see Appendix A.)

Table 4.18. Number of Lights by Room by Hours Used, 1993

Hours Used	Total	Bath-room	Bed-room	Dining Room	Den Family/ Rec Room	Hallway/ Stairs	Kitchen	Living Room	Laundry Room/ Other
Total	4,196	621	1,121	218	279	193	820	711	233
Unknown	104	6	19	10	12	3	21	21	12
Less than One	1,106	179	359	59	61	92	126	125	105
1 to 1.9	994	225	306	61	32	46	154	112	58
2 to 3.9	1,003	145	297	57	69	24	215	160	36
4 to 7.9	739	46	121	25	81	12	202	240	12
8 to 11.9	109	11	10	3	11	5	36	29	4
12 or More	141	9	9	3	13	11	66	24	6

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E, and H of the 1993 Residential Energy Consumption Survey.

Table 4.19. Number of Lights by Type of Bulb by Hours Used, 1993

Hours Used	Total	Bulb Type								
		Incandescent				Fluorescent			Other	
		Low	Medium	High	Unknown	Short	Long	Compact	Halogen	Other/ Unknown
Total	4,196	431	2,811	409	14	159	173	34	24	141
Unknown	104	11	58	19	0	1	2	0	0	13
Less than One	1,106	162	746	92	3	31	26	2	4	40
1 to 1.9	994	105	710	80	3	36	27	5	4	24
2 to 3.9	1,003	58	705	113	3	30	49	11	5	29
4 to 7.9	739	52	474	81	3	36	43	12	11	27
8 to 11.9	109	9	64	17	0	8	9	1	0	1
12 or More	141	34	54	7	2	17	17	3	0	7

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E, and H of the 1993 Residential Energy Consumption Survey.

Table 4.20. Number of Lights by Bulb Type by Room, 1993

Room	Total	Bulb Type								
		Incandescent				Fluorescent			Other	
		Low	Medium	High	Unknown	Short	Long	Compact	Halogen	Other/ unknown
Total	4,196	431	2,811	409	14	159	173	34	24	141
Bathroom	621	44	417	81	4	35	14	2	1	23
Bedroom	1,121	119	868	66	6	8	5	9	8	32
Dining Room	218	28	119	51	2	0	1	1	2	14
Den/Family/ Rec Room	279	28	171	42	1	7	12	2	3	13
Hallway/Stairs	193	42	136	6	0	1	3	0	0	5
Kitchen	820	80	440	70	1	85	104	12	1	27
Living Room	711	65	511	80	0	11	8	8	8	20
Laundry Room/Other	233	25	149	13	0	12	26	0	1	7

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E, and H of the 1993 Residential Energy Consumption Survey.

Table 4.21. Number of Households by Daily Kilowatthours by Number of Rooms

Number of Kilowatthours	Total	Number of Rooms			
		One to Four Rooms	Five Rooms	Six Rooms	Seven or More Rooms
All Households	474	145	96	113	120
One or Less	117	58	27	15	17
One to Two	153	51	30	42	30
Two to Three	89	19	20	23	27
Three to Four	58	11	9	20	18
More than Four	57	6	10	13	28

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E and H of the 1993 Residential Energy Consumption Survey.

Table 4.22. Number of Households by Daily Kilowatthours by Number of Household Members

Number of Kilowatthours	Total	Number of Household Members			
		One	Two	Three	Four or More
All Households	474	117	149	83	125
One or Less	117	51	35	17	14
One to Two	153	44	46	25	38
Two to Three	89	11	38	19	21
Three to Four	58	5	17	11	25
More than Four	57	6	13	11	27

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E and H of the 1993 Residential Energy Consumption Survey.

Table 4.23. Number of Households by Daily Kilowatthours by Family Income (Dollars)

Number of Kilowatthours	Total	Family Income				
		Less than 10,000	10,000 to 19,999	20,000 to 34,999	35,000 to 49,999	50,000 or More
All Households	474	69	113	110	88	94
One or Less	117	25	36	37	8	11
One to Two	153	27	39	35	27	25
Two to Three	89	11	19	19	22	18
Three to Four	58	3	11	10	18	16
More than Four	57	3	8	9	13	24

Note: These data represent the 474 households included in the Lighting Supplement. The supplement was not designed to weight the data to the population level.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A-C, E and H of the 1993 Residential Energy Consumption Survey.

Appendix A

Survey Forms

This appendix contains lighting questions from the 1993 RECS Household Questionnaire as well as a complete copy of the Lighting Supplement Questionnaire. Table A1 presents a brief summary of the questions included in each of the questionnaires. A complete list of all forms used in the 1993 Residential Energy Consumption Survey follows. *Household Energy Consumption and Expenditures, 1993* contains a copy of each form.

- EIA-457A Household Questionnaire (lighting questions only)
- EIA-457B Household Mail Questionnaire (not included)
- EIA-457C Rental Agent Form (not included)
- EIA-457D Liquefied Petroleum Gas Usage (not included)
- EIA-457E Electricity Usage (not included)
- EIA-457F Utility Gas Usage (not included)
- EIA-457G Fuel Oil or Kerosene Usage (not included)
- EIA-457H Lighting Supplement

Table A1. Lighting Information Collected by the Household Questionnaire and Lighting Supplement

Indoor Lights

Household Questionnaire (7,111 households)

Number of Lights on:
- 1 to 4 hours
- 4 to 12 hours
- 12 or more hours

How Many of Above are Fluorescent

Lighting Supplement (474 households)

Number of Lights on:
- 15 minutes or more
- 1-2 hours
- 2-4 hours
- 4-8 hours
- 8-12 hours
- 12 or more hours

Room
- Kitchen, Living Room, etc.

Type and Wattage:
- Incandescent
  - low (10-40 watts)
  - medium (41-149 watts)
  - high (150 watts or more)
- Fluorescent
  - short (< 24 inches)
  - long (24 inches or more)
  - compact
- Halogen

Outdoor Lights

Household Questionnaire

Does Household Use Outdoor Lights

Use:
- Evening
- All night
- Timer/Motion Detector

Type:
- Electric
- Gas
- High Intensity Discharge

Total Wattage Less than 150 Watts

Lighting Supplement

No Information Collected

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457A and H of the 1993 Residential Energy Consumption Survey.

Lighting-Related Questions from the RECS Household Questionnaire

INDOOR LIGHTS

F-1. Please turn to Exhibit F-1. Thinking of a typical November weekday, please tell me the number of indoor lights your household has turned on for each of the following time periods.

	F-1. NUMBER OF LIGHTS	F-2. NUMBER OF FLUORESCENT LIGHTS	
a. More than 12 hours per day	NONE 00	NONE 00	*293-96*
b. Between 4 hours and 12 hours per day	NONE 00	NONE 00	*297-300*
c. Between 1 hour and 4 hours per day	NONE 00	NONE 00	*301-04*

FOR EACH ANSWER OF 1 LIGHT OR MORE IN "a" THROUGH "c" IN F-1 ABOVE, ASK F-2:

F-2. Of the (NUMBER) indoor lights on (HOURS), how many are fluorescent?

Lighting-Related Questions from the RECS Household Questionnaire (Continued)

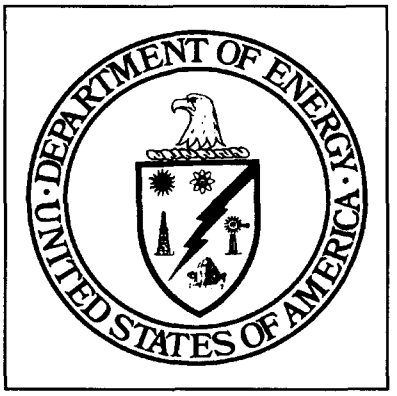
OUTDOOR LIGHTS

F-3. Please turn to Exhibit F-3. Thinking about a typical November weekday, please indicate all the statements that describe the outdoor lights used by your household.

		YES	NO	
a.	NO OUTDOOR LIGHTS OR RARELY USED	1	0	*305*
b.	OUTDOOR LIGHTS TURNED ON DURING THE EVENING, BUT TURNED OFF BEFORE BEDTIME	1	0	*306*
c.	OUTDOOR LIGHTS LEFT ON ALL NIGHT	1	0	*307*
d.	OUTDOOR LIGHTS WITH A TIMER, MOTION SENSOR, OR PHOTOSENSOR	1	0	*308*
e.	OUTDOOR GAS LIGHT	1	0	*309*
f.	HIGH INTENSITY DISCHARGE (HID) OUTDOOR LIGHTS, SUCH AS METAL HALIDE OR HIGH PRESSURE SODIUM LIGHTS	1	0	*310*
g.	TOTAL WATTAGE OF ALL OUTDOOR LIGHTS IS LESS THAN 150 WATTS	1	0	*311*
h.	DON'T KNOW	1	0	*312*

1993 RESIDENTIAL ENERGY CONSUMPTION SURVEY

1-4



HOUSEHOLD LIGHTING USAGE SUPPLEMENT

INTERVIEWER READ: In 1990, ten percent of all electricity used in homes was for lighting. Since lighting is so important, we need additional information on how lights are used in your home. Then the Department of Energy can provide more accurate information on home lighting usage and the potential for energy conservation.

INTERVIEWER: FOR THE DEFINITION OF A LIGHT, REFER RESPONDENT TO EXHIBIT F-1.

LS-1. Think of a typical 24-hour November weekday. For each indoor light used in your home for at least 15 minutes, please identify the light, how long that light is on, and what type of bulb is in the light. As we list each room, keep in mind all activities and times-of-day that the light is used.

INTERVIEWER: IN COLUMN A, USE THE APPROPRIATE CODES BELOW FOR THE ROOM. ASK ABOUT THE ROOMS IN THE ORDER LISTED.

ROOM

KI - Kitchen	DR - Dining	RR - Recreation	LA - Laundry/Work
LR - Living	BR - Bedroom	DN - Den/Library	UF - Unfinished
FR - Family	BA - Bathroom	HS - Hallway/Stairs	OT - Other-Specify

INTERVIEWER: READ ACROSS ALL THE COLUMNS BEFORE STARTING THE NEXT ROW.

	COLUMN A	COLUMN B	COLUMN C						
	LS-2. Describe the (FIRST/NEXT) light in your home's (ROOM).	LS-3. Approximately how many hours is this light used in a typical 24-hour November weekday?	LS-4. IF DK IN COLUMN B: Please turn to Exhibit LS-4. Which range best describes this light's usage in a typical 24-hour period?						
	ENTER ROOM CODES FROM BOX ABOVE	ENTER "LESS THAN 1 HR" OR NUMBER OF HOURS OR CIRCLE DK FOR DON'T KNOW	15 mins - 1 hr	1-2	2-4	4-8	8-12	12+	DK
21-26		DK	01	02	03	04	05	06	96
27-32		DK	01	02	03	04	05	06	96
33-38		DK	01	02	03	04	05	06	96
39-44		DK	01	02	03	04	05	06	96
45-50		DK	01	02	03	04	05	06	96
51-56		DK	01	02	03	04	05	06	96
57-62		DK	01	02	03	04	05	06	96
63-68		DK	01	02	03	04	05	06	96
69-74		DK	01	02	03	04	05	06	96
75-80		DK	01	02	03	04	05	06	96
81-86		DK	01	02	03	04	05	06	96
87-92		DK	01	02	03	04	05	06	96
93-98		DK	01	02	03	04	05	06	96
99-104		DK	01	02	03	04	05	06	96
105-110		DK	01	02	03	04	05	06	96

INTERVIEWER: IF A LIGHT HAS MORE THAN ONE INCANDESCENT (STANDARD) BULB, THE WATTAGE OF EACH BULB MUST BE ADDED TOGETHER.

INCANDESCENT/STANDARD
- **LOW = TOTAL BETWEEN 10 AND 40 WATTS - SMALL AMOUNT OF LIGHT**
- **MED = TOTAL BETWEEN 41 AND 149 WATTS - AVERAGE AMOUNT OF LIGHT**
- **HIGH = TOTAL OF 150 WATTS OR MORE - LARGE AMOUNT OF LIGHT**

FLUORESCENT
- **LONG BULB = 24 OR MORE INCHES IN LENGTH (Include U tubes)**
- **SHORT BULB = LESS THAN 24 INCHES IN LENGTH (Include circular tubes)**
- **COMPACT = COMPACT FLUORESCENT LIGHT**

HALOGEN = HALOGEN LIGHT

INTERVIEWER: AFTER COLUMN D, GO BACK TO THE NEXT ROW IN COLUMN A. CONTINUE COLUMNS A - D UNTIL YOU HAVE RECORDED ALL INDOOR LIGHTS ON FOR AT LEAST 15 MINUTES OR UNTIL THE GRID IS COMPLETELY FILLED.

COLUMN D

LS-5. Please turn to Exhibit LS-5. Please indicate the type of bulb(s) used in this light.

TYPE OF BULB

(CIRCLE APPROPRIATE BULB TYPE)

INCANDESCENT (STANDARD)				FLUORESCENT				HALOGEN	OTHER (CHECK BOX)	DK BULB TYPE	
LOW	MED	HIGH	DK	SHORT	LONG	COMPACT	DK				
01	02	03	04	05	06	07	08	09	10 ☐	96	*111-112*
01	02	03	04	05	06	07	08	09	10 ☐	96	*113-114*
01	02	03	04	05	06	07	08	09	10 ☐	96	*115-116*
01	02	03	04	05	06	07	08	09	10 ☐	96	*117-118*
01	02	03	04	05	06	07	08	09	10 ☐	96	*119-120*
01	02	03	04	05	06	07	08	09	10 ☐	96	*121-122*
01	02	03	04	05	06	07	08	09	10 ☐	96	*123-124*
01	02	03	04	05	06	07	08	09	10 ☐	96	*125-126*
01	02	03	04	05	06	07	08	09	10 ☐	96	*127-128*
01	02	03	04	05	06	07	08	09	10 ☐	96	*129-130*
01	02	03	04	05	06	07	08	09	10 ☐	96	*131-132*
01	02	03	04	05	06	07	08	09	10 ☐	96	*133-134*
01	02	03	04	05	06	07	08	09	10 ☐	96	*135-136*
01	02	03	04	05	06	07	08	09	10 ☐	96	*137-138*
01	02	03	04	05	06	07	08	09	10 ☐	96	*139-140*

CONTINUE TO LS-6 ON BACK OF THIS FORM.

INTERVIEWER: IF THE GRID IS NOT COMPLETE, PROBE TO DETERMINE THAT YOU HAVE A COMPLETE LIST OF INDOOR LIGHTS.

IF YOU HAVE FILLED ALL THE LINES IN THE GRID, ASK LS-6.

LS-6. How many <u>more</u> indoor lights does your home <u>use</u> for 15 minutes or more in a typical 24-hour November weekday?

NUMBER:_____ *169-70*

INTERVIEWER: RETURN TO SECTION O. HOUSING MEASUREMENTS ON PAGE 98.

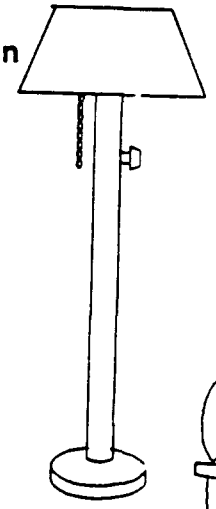
Exhibit F-1

General Instructions For Counting Lights

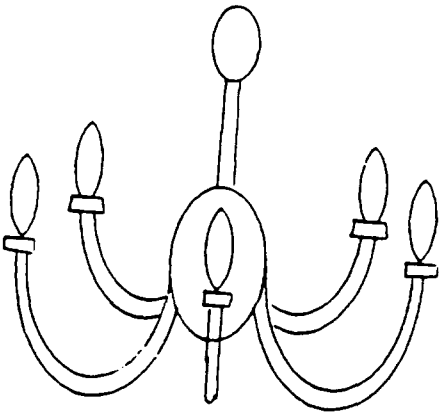
- Count any and all lights in home
- A light is defined as every light bulb turned on by a single light switch
- A fixture or lamp with two switches is counted as two lights

Examples:

If light has more than one bulb and more than one switch, count as two lights. Example: Floor Lamp.



If light has only one switch, count as one light even if it has more than one bulb. Example: Chandelier



If light can be turned on by a single switch, count it as one light. Example: Track Lighting

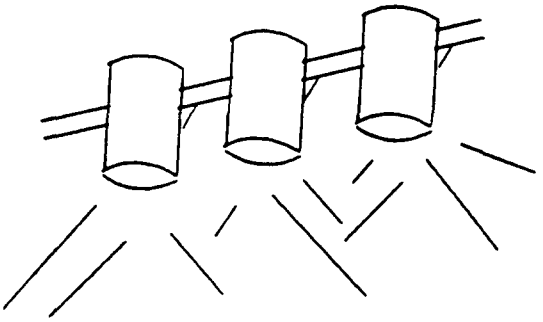


Exhibit F-3

Outdoor Lights

- No Outdoor Lights or Rarely Used
- Outdoor Lights Turned On During the Evening, but Turned Off Before Bedtime
- Outdoor Lights Left on All Night
- Outdoor Lights with a Timer, Motion Sensor, or Photosensor
- Outdoor Gas Light
- High Intensity Discharge (HID) Outdoor Lights (Such as metal halide or high pressure sodium lights)
- Total Wattage of Outdoor lights is less Than 150 Watts

Appendix B

End-Use Estimation Methodology

Two Approaches

Two approaches for estimating the kilowatthours used for lighting that are based upon data from the 1993 RECS were used in this report. The first approach used only bulb type and hours of usage data from the RECS Lighting Supplement. The second approach is a regression-based approach that uses the full RECS dataset. This appendix will provide more details concerning both of these methods.

The main purpose of the Lighting Supplement, which collected data from a subsample of the 1993 RECS respondents, was to develop a model of kilowatthours used for lighting as a function of variables obtained on the full RECS Household Questionnaire. The resulting model was used to create an index of lighting usage. This index was then used as a predictor variable in a regression analysis. The results of the regression analysis were used to disaggregate the total electricity usage into consumption by end use. One of these end uses is lighting.

Using Lighting Supplement Data

The RECS Lighting Supplement (Form EIA-457H) is a short questionnaire completed by 474 of the 7,111 households that responded to the RECS Household Questionnaire (Form EIA-457A). The Lighting Supplement was not administered to all of the 1993 RECS respondents because of cost and respondent burden constraints. The Lighting Supplement provides detailed information on indoor lights used 15 minutes or more (up to a maximum of 15 lights) by type of bulb, hours used, and the room in which the light is located. If the respondents reported that there were more than 15 lights that met the criteria covered by the Lighting Supplement, only the number of additional bulbs was recorded.

Calculating Kilowatthours

Lights in the Lighting Supplement database were assigned a wattage amount based upon the bulb type reported. Similarly, the hours used for a light were inferred from the respondent's estimate of the number of hours the light was used.

$$\text{Kilowatthours} = \frac{\text{Wattage} * \text{Hours Used}}{1{,}000}$$

The kilowatthours for each light equals the wattage times the hours, divided by 1,000. The kilowatthours for each respondent to the Lighting Supplement equal the sum of the estimated kilowatthours for all the lights for that respondent.

Assigning Wattage to Lights

Respondents categorized lights by type, such as incandescent, fluorescent, halogen, or other. The specific wattage was assigned to each type by using the values in Table B.1.

Wattage for Incandescent Lights

Incandescent lights in the Lighting Supplement database were assigned a wattage based upon the respondents' estimates of their wattage. Lighting fixtures with more than one bulb were counted as one light. The wattage for these fixtures was the total wattage of all bulbs in the fixture. The respondents were asked to categorize incandescent lights by their total wattage. Lights with total wattage less than 10 (night lights) were excluded from the Lighting Supplement. Incandescent lights with a total between 10 and 40 were coded as "low" incandescent. Those with wattage between 41 and 149 were coded as "medium" incandescent and those with 150 or more were coded as "high" incandescent. It is

assumed that some of the lights coded as "medium" incandescent are actually fixtures with multiple bulbs. The same applies to "high" incandescent. Incandescent lights coded as "low" were assigned a wattage of 30, "medium" were assigned a wattage of 100, and "high" were assigned a wattage of 200. Incandescent lights for which the respondent did not provide a wattage estimate were assigned a wattage of 60.

Table B.1 Bulb Type and Wattage

Bulb Type	Assigned Wattage
Incandescent	
Low	30
Medium	100
High	200
Unknown	60
Fluorescent	
Short	17
Long	40
Compact	13
Unknown	40
Halogen	250
Other	60
Don't Know, No Answer	60
Lights Beyond 15 Listed	60

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Residential Energy Consumption Survey.
Note: Wattage assignments for fluorescent lights are based on data from various lighting industry literature. Incandescent wattages are based on the Lighting Supplement Questionnaire.

Wattage for Fluorescent Lights

Fluorescent lights in the Lighting Supplement data base were assigned a wattage based upon the respondents' description of the lights. Lights categorized as "short" fluorescent were assigned a wattage of 17, "Long" fluorescent lights were assigned a wattage of 40, and "compact" fluorescent lights were assigned a wattage of 13. Fluorescent lights for which the type was coded as "unknown" were assumed to be long fluorescent and were assigned a wattage of 40.

Wattage for Halogen Lights

The Lighting Supplement did not distinguish between the different types of halogen lights. Halogen desk lights may have a low wattage (10 to 20), while halogen floor lights may have a high wattage (200 to 500). Only 24 out of the 4,196 lights in the Lighting Supplement data base are Halogen lights. All halogen lights were assigned a wattage of 250 as a compromise.

Wattage for Other Bulb Types

Lights in the Lighting Supplement data base that were not classified as incandescent, fluorescent, or halogen were assigned a wattage of 60. This category includes lights where the respondent classified the lights as "other," where the respondent did not know the type, and lights where no type was recorded because the limit of 15 lights for a respondent had been reached.

Assigning Hours of Usage

For each light listed in the Lighting Supplement, the respondents were asked:

> "Think of a typical 24-hour November weekday. For each indoor light used in your home for at least 15 minutes, please identify the light, how long that light is on, and what type of bulb is in the light fixture. As we list each room, keep in mind all activities and times-of-day that the light is used."

The responses were either the number of hours, a category for the number of hours, or "don't know." If the respondent reported the number of hours, then the light was assigned the reported number of hours. If a category for the number of hours was given, but not the actual number, the light was assigned the midpoint of the category. The only exception was the lowest category (15 minutes to 1 hour). In this case, the light was assigned the value of .5. If the respondent did not give either an estimate of the number of hours or a category, the lights were assigned a value of 1 hour. Similarly, lights beyond the 15 listed were given a value of 1 hour.

Modeling Kilowatthours by Using Lighting Supplement Data

The regression analysis of the Lighting Supplement data was done in two steps. In both steps, a stepwise linear regression program was used and the dependent variable was the kilowatthour estimate for lighting obtained from the bulb type and hours data described above. In addition, both steps used the same set of independent variables. In the first step, all of the observations received the same weight. In the second step, the Lighting Supplement observations were given a weight equal to the inverse of the predicted kilowatthours obtained from the first step. This weighting was used to adjust for the higher variance of the error term for households that were projected to use more electricity for lighting.

The set of independent variables used in both regression steps were obtained from the full 1993 RECS data set. The variables used are as follows:

Full RECS lighting variables

- X1: Number of lights on more than 12 hours
- X2: Number of lights on between 4 and 12 hours
- X3: Number of lights on between 1 and 4 hours
- X4: Number of fluorescent lights on more than 12 hours
- X5: Number of fluorescent lights on between 4 and 12 hours
- X6: Number of fluorescent lights on between 1 and 4 hours

Functions of full RECS lighting variables

- X7-X12: The square root of the above variables
- X13: An indicator variable that equals 1 if at least one light was on more than 12 hours

Full RECS variables on the size of the dwelling

- X14: Number of rooms
- X15: Total square footage of housing units (heated and unheated)
- X16: Heated square footage
- X17: Number of Windows

Full RECS variables on number of household members

- X18: Number of household members
- X19: Square root of the number of household members
- X20: Number of household members aged 13 to 65
- X21: Square root of the number of household members aged 13 to 65
- X22: Number of household members aged 6 to 65
- X23: Square root of the number of household members aged 6 to 65

Type of housing unit

- X24: Single-Family attached unit
- X25: Mobile Home
- X26: Apartment units in a building with 2 to 4 units

X27: Apartment units in a building with 5 or more units

Family-Income Level
- X28: low (less than $20,000)
- X29: Medium ($75,000 - $99,999)
- X30: High ($100,000+)

Age of householder
- X31: 75 or more
- X32: 70 or more
- X33: 65 or more
- X34: 34 or less

Daytime use of home
- X35: Operation of a home-based service or business
- X36: Other activity requiring a lot of energy
- X37: Someone home all day

Results

The second step produced the following model:

Kilowatthours=		-90.7		
	+	115.4	x	X2
	+	44.3	x	X3
	+	282.2	x	X4
	+	0.0491	x	X15
	+	184.7	x	X19

Using Full RECS Data

Introduction

For each household that responded to the 1993 RECS, the annual amount of electricity used for five end-use categories--space heating, water heating, air-conditioning, refrigerators, and general appliance usage--was estimated. The end-use amounts were not based on data produced by placing meters on individual appliances; rather, they were obtained by estimating how much of the total annual consumption for electricity can be attributed to each of the end-use categories for each household by using a regression technique. The data from the Lighting Supplement allowed us to estimate lighting as a subcomponent of the appliance end-use estimates for the first time in the RECS history.

The annual consumption attributed to each of the end-use categories can be estimated by use of regression equations. The regression equations are also used to impute electricity consumption when the billing data are missing or inadequate. The dependent variable was the annual electricity consumption for the 1993 calendar year. The desire to use a large number of independent variables without using a large number of interaction terms and the desire to adapt the regression procedures to account for heteroscedastic[17] error terms led to the use of a nonlinear regression technique. The use of linear regression would have greatly restricted the ability to adequately model household energy consumption.

This section of the appendix provides an overview of the methodology used for the 1993 RECS end-use estimation. The specific regression equations used are not presented here. (For more detailed information, please contact the person cited as the end-use estimation contact on the Contacts page at the beginning of this report.) The procedure used for the 1993 RECS is very similar to that used in the 1990 RECS. Detailed equations for the 1990 RECS were published in Appendix D, "End-Use Estimation Methodology," of *Household Energy Consumption and Expenditures 1990* (Energy Information Administration, February 1993, DOE/EIA-0321(90)).

[17]Error terms are heteroscedastic when the variance of the error terms is not constant but, instead, is a function of the independent variables.

Electricity Consumption Equation

Basic Equation

For electricity, the basic equation is:

Total Consumption = Space-Heating Component

+ Water-Heating Component

+ Air-Conditioning Component

+ Refrigerator Component

+ Appliance Component.

Discussions of each component of the general consumption equation will be followed by a discussion of the nonlinear regression technique.

General Space-Heating Component

The space-heating component was defined as all electricity used to generate heat by space-heating equipment. The equipment could be the main space-heating equipment or secondary space-heating equipment. Hence, a household could have had a positive amount of electricity assigned to the space-heating component even if the electricity source was not used as the main space-heating energy source.

For the electricity equation in the 1987 and subsequent RECS, the electricity associated with the operation of fans in any central forced-air heating equipment was assigned to the electricity appliance component and not to the space-heating component.[18]

General Water-Heating Component

The component for water heating was defined as all electricity used to heat water for hot running water, as well as water heated at point sources (such as stoves or auxiliary water-heating equipment) for bathing, cleaning and other noncooking applications of hot water. Electricity used at point sources to heat water for cooking and hot drinks was considered part of the general appliance component, as was electricity used to heat water for a swimming pool, hot tub, spa, or jacuzzi.

General Air-Conditioning Component

The electricity air-conditioning component was defined as all electricity associated with (1) electric air-conditioning equipment and (2) fans in any central air-conditioning equipment including natural gas air-conditioning equipment. The regression equations for electricity do not contain specific terms for whole-house fans, window fans, and evaporative (swamp) coolers, because the terms were only marginally significant. Hence, the consumption of electricity to operate these fans and evaporative coolers was not assigned to the air-conditioning component; it was included in the appliance component.[19] The term for ceiling fans is in the electricity appliance component.

[18]In previous RECS (prior to 1987), the electricity used to run fans for central forced-air heating systems was assigned to the space-heating components. This was changed in the 1987 and subsequent RECS so that the households that did not use electricity as a space-heating energy source (either main or secondary), by definition, did not have positive amounts of electricity assigned to the space-heating component.

[19]Previous RECS (prior to 1987) included a term for evaporative coolers, whole-house fans, ceiling fans, and window fans in the air-conditioning component of the electricity equation. Therefore, the consumption of electricity to operate these types of coolers and fans was assigned to the air-conditioning component. Consequently, some households that did not have air-conditioning equipment, had positive consumption assigned to their air-conditioning component.

In the 1993 RECS, the households that reported that they had air-conditioning equipment but did not use the equipment, were assigned a value of zero for their electricity air-conditioning component. In RECS prior to 1987, these households were assigned small but positive values for their electricity air-conditioning component.

General Refrigerator Component

The refrigerator component for electricity consisted of all electricity used to operate refrigerators. The electricity used to operate freezers that are not part of a refrigerator was assigned to a separate component under General Appliance.

General Appliance Component

The general appliance component consisted of all electricity not used specifically for any of the other end uses. For electricity, the general appliance component was split into six subcomponents: (1) Appliance Subcomponent, (2) Lighting Subcomponent, (3) Cooking Subcomponent, (4) Dishwasher Subcomponent, (5) Clothes Dryer Subcomponent, and (6) Freezer Subcomponent.

Electricity used in appliances during the winter will frequently help heat the housing unit. This secondary effect of the appliance consumption was not included in the estimation of the space-heating component. In addition, during the summer, energy used in general appliances may add to the load on the air-conditioning system. This was not included in the air-conditioning component.

Appliance Subcomponent. The appliance subcomponent consisted of all electricity not used for any of the other five subcomponents or the other four main components. This included electricity used to heat water beds, hot tubs and pools, and the electricity used to operate fans (including fans for forced-air, space-heating systems), evaporative coolers, water pumps, small kitchen appliances (such as toasters, mixers, and can openers), home entertainment equipment (such as radios, televisions, stereos, video cassette recorders, electronic games, and computers), and numerous other appliances and uses not covered elsewhere.

Lighting Subcomponent. This subcomponent consists of all electricity used for indoor and outdoor lighting.

Cooking Subcomponent. The cooking subcomponent was positive if the household reported that electricity was the main cooking fuel; otherwise, the subcomponent was zero. The definition of the subcomponent did not involve the type of cooking equipment that was used. Consequently, households with some electric cooking equipment (including microwave ovens) could have been assigned a zero value for the electricity cooking subcomponent if the household did not list electricity as a cooking fuel. The electricity used to operate the electric cooking equipment in households that did not list electricity as a cooking fuel was included in the appliance subcomponent. Similarly, electricity used to operate common kitchen appliances, such as toasters and mixers, was included in the appliance subcomponent.

Dishwasher Subcomponent. This subcomponent consisted of all electricity used to operate dishwashers.

Clothes Dryer Subcomponent. This subcomponent consists of all electricity used to operate clothes dryers.

Freezer Subcomponent. The freezer subcomponent for electricity consisted of all electricity used to operate freezers that were not part of a refrigerator.

Nonlinear Regression Technique

The nonlinear regression technique was used to produce electricity end-use estimates for each household. The end-use estimates were normalized so that the sum of the end-use estimates was equal to the actual or imputed yearly electricity consumption used by the household. The individual household end-use estimates were used to estimate averages and totals for end-use consumption over selected household categories. Following is an overview of the basic nonlinear

equations. (To obtain the detailed equations and individual coefficients, please see the Contacts page at the beginning of this report for the end use estimation contact person.[20])

General Regression Equation

The general regression equation splits estimated electricity consumption into its end-use components. The result is:

$$YCOM = SPHTCOM + WTHTCOM + AIRCCOM + RFRGCOM + APPLCOM,$$

where:

YCOM is the estimated annual consumption,
SPHTCOM is the estimated space-heating component,
WTHTCOM is the estimated water-heating component,
AIRCCOM is the estimated air-conditioning component,
RFRGCOM is the estimated refrigerator component, and
APPLCOM is the estimated appliance component.

Electricity Regression Equation

The regression equation for electricity splits estimated consumption for the appliance component into six additional subcomponents:

$$\begin{aligned} YCOM = {} & SPHTCOM + WTHTCOM + AIRCCOM + RFRGCOM \\ & + FZZRCOM \\ & + DISHCOM \\ & + COOKCOM \\ & + LITECOM \\ & + DRYRCOM \\ & + APPSCOM, \end{aligned}$$

where:

FZZRCOM is the estimated freezer subcomponent,
DISHCOM is the estimated dishwasher subcomponent,
COOKCOM is the estimated cooking subcomponent,
LITECOM is the estimated lighting subcomponent,
DRYRCOM is the estimated clothes dryer subcomponent, and
APPSCOM is the estimated other appliances subcomponent.

The actual annual consumption is called Y. The unit of measure for Y and YCOM is thousands of Btu. The typical regression error term is as follows:

$$e_i = Y - YCOM .$$

[20]For a detailed discussion of the end-use estimation procedures and the correlation of variables, see the *National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption*, DOE/EIA-072 (Washington, DC, July 1981); the *National Interim Energy Consumption Survey: Exploring the Variability in Energy Consumption - A Supplement*, DOE/EIA-0272/S (Washington, DC, October 1981); and *Residential Energy Consumption Survey: Regression Analysis of Energy Consumption by End Use*, DOE/EIA-0431 (Washington, DC, October 1983).

Unfortunately, the variance of e_1 tends to increase as YCOM increases. Furthermore, the distribution of e_1 is skewed in the positive direction. These two facts violate the assumptions associated with linear least-squares regression. On the other hand, the distribution of

$$e_2 = (Y)^{1/4} - (YCOM)^{1/4}$$

is closer to being normally distributed with a constant variance. Hence, a nonlinear least-squares regression procedure that minimizes the sum of squares of e_2 was used.

The dependent variable was the household's electricity consumption as reported on the RECS Suppliers Survey in thousands of Btu. Most of the independent variables are derived from information reported by the individual households on the Household Survey. The end-use components consisted of sums or products of terms that themselves may have been sums or products of the independent variables. The overall methodology may seem complex at first glance, but there was a common structure. In general, the components consisted of an overall term multiplied by various adjustments. This format allowed the components to be adjusted by many factors. The relative size of the adjustments was easy to determine.

The disadvantage of the format was that it yields a basic equation that is intrinsically nonlinear. As a result, standard multivariate linear regression techniques could not be used to estimate the parameters. A nonlinear technique was used instead. The parameters were estimated by using the nonlinear regression procedure (PROC NLIN) contained in the statistical computer package, SAS.[21]

Details of Lighting Component

The lighting component covers the consumption of electricity for both indoor and outdoor lighting. The indoor lighting is modeled by using the equation (converted to thousand Btu) developed from the Lighting Supplement as an independent variable. Outdoor lighting is modeled by using variables that describe the presence and use of outdoor lights. As with all components, the lighting component is multiplied times common adjustment terms. These terms are functions of the price of electricity, presence of household members during the day, family income, age of dwelling, housing unit type, and demographic characteristics of the house holder.

The resulting equation for the lighting component is given below:

Lighting component = 0.82710 x Y1
+ 1,016.05323 x Y2
+ 1,124.08710 x Y3
+ 1,773.86255 x Y4
+ 339.23403 x Y5
+ 734.26589 x Y6
+ 791.90744 x Y7

where

Y1 = 3.412 x kWh estimate from second step of Lighting Supplement regression (p 58)

Y2 = Indicator function for presence of outdoor light on all night

Y3 = Indicator function for presence of outdoor light on all night and the light is 150 watts or more

Y4 = Indicator function for presence of outdoor light controlled by a timer but there is not an outdoor light on all night

[21]Statistical Analysis System (SAS) Institute (Cary, North Carolina).

Y5 = Indicator function for presence of outdoor light (150 watts or more) controlled by a timer but there is not an outdoor light on all night

Y6 = Indicator function for presence of outdoor light on during the evening but there is not an outdoor light on all night or one controlled by a timer

Y7 = Indicator function for presence of outdoor light on during the evening (150 Watts or more) but there is not an outdoor light on all night or one controlled by a timer.

Appendix C

Data Quality

RECS Compared to Engineering Studies

Data from the RECS can be used to assess potential bias that can occur in engineering studies which are based on small samples that may not be representative of the larger population of interest. The RECS sample covers all types of households and housing units in the United States, and the sample was selected in such a way that the sampling error of its estimates are measured and provided to users along with the estimates themselves.

For example, an engineering study of 53 homes, where two light loggers had been used in each home, produced an annual estimate of 2,930 kWh for lighting.[22] The authors noted that it might be dangerous to estimate for all lights in the house from a sample of two and they noted that their estimates were higher than estimates commonly used by utilities. The study suggested an annual lighting budget for a home of 1,200 to 1,500 kWh. The RECS estimated that only 27 percent of households used 1,200 or more kWh for lighting. If the engineering study represented single-family households only, the lighting budget still applied to about 25 percent of single-family homes (25 percent of single-family homes used between 953 and 1,397 kWh per annum).

It is not certain in this study whether the unusually high estimate, compared to RECS, came from sampling lights that were used more often (the authors thought their sample of lights were used less often than other lights in the house) or because the sampled of households were high users of lighting. Whichever the source, the unusually high estimates could be detected and an estimate derived from RECS data that would quantify how unusual the estimates were. The assumption that these high estimates are typical of national usage would lead to bias in any analysis that uses the engineering data. Therefore, researchers who conduct small-scale studies purporting to represent a customer base that is a cross section of the general population of homes should compare their data to the RECS data.

A recent survey of utility companies inquiring about the prevalence of end-use metering reported that 68 percent did end-use monitoring. The return rate was small, but it is an indication that a number of utilities conduct these studies for use in their planning and evaluation. The difference between the RECS lighting estimates and the engineering studies is a major issue for them.[23]

Bias in RECS Estimates of Lighting Consumption

Data on lighting usage can be collected in several ways. The 1993 RECS used self-reported data gathered during in-person household interviews. Self-reported data can also be collected via phone interviews and diaries. Other methods that do not rely on self-reported data include mechanical devices, such as light loggers. To what extent do self-reported data, especially in-person self-reported data, give an accurate picture of the amount of time a light is turned on? Respondents may have some difficulty knowing how many hours each light in the household is used. They may not be home during all of the times that lights are turned on and, even if home, may not know how others in the household are using lights.

A study comparing various types of self-reported data to light logger data found that self-reported data gave higher estimates of light usage than data from the light loggers.[24] Light logger data were 81 percent of the on-site estimates and 72 percent of the diary estimates. Estimates over the telephone were inflated compared to on-site estimates (on site estimates were 72 percent of the telephone estimates). A regression analysis of the RECS electricity consumption data yielded a similar result (see Appendix B).

[22]Bruce Manclark, "Of Sockets, Housecalls, and Hardware," *Home Energy*, November/December 1991, p. 25.

[23]Frazer Dougherty, "The State of DSM End-Use Monitoring," *Home Energy*, March/April 1994.

[24]Leslie A. Carlson, et al., "Elements of Residential Efficient Lighting Savings," *ACEEE 1994 Summer Study on Energy Efficiency in Buildings*, Tables 3 and 4, p. 8.21.

These findings may lead one to believe that RECS overestimates the amount of electricity used for lighting. While it is true that the RECS relies on self-report usage data, those data are not used directly to model electricity consumption for lighting. The RECS estimates of the amount of electricity used for lighting are regression-based estimates (see Appendix B). They are not based upon light loggers or submetering. For each RECS respondent, the regression equation, whose coefficients were estimated by a nonlinear regression procedure, was used to estimate the proportion of the total annual electricity consumption that was used for each of 10 end-use categories. Lighting is one of the categories. The estimated amount of electricity for each end-use category is the total annual electricity consumption (derived from utility bills) times the proportion for the end use. As a consequence, the end-use consumption estimates for the 10 categories will add up to the actual total annual electricity consumption. The tendency of respondents to overestimate how long lights are on is reflected in the coefficients estimated by the regression procedure.

Appendix D

Related EIA Information on Energy Consumption

For information about how to obtain these publications, see the inside cover of this report. Please note that the prices quoted here are subject to change.

In addition to the reports listed below, data diskettes and public-use data tapes for the residential, residential transportation, and commercial sectors are available from the National Technical Information Service (NTIS). To obtain information on how to order the tapes/diskettes, you may call NTIS at 703-487-4650, FAX number 703-321-8547. Data diskettes can also be obtained from the Office of Scientific and Technical Information (OSTI). For OSTI ordering information, call 615-576-8401. Data from earlier years than those listed are microfiched. Call NTIS for a copy.

The most recent publication for each of the consumption surveys is available on the Energy Information Administration's (EIA) Energy InfoDisc (CD-ROM). This new media provides instant access to comprehensive energy data. Order forms for the CD-ROM are available on EIA's Homepage site at http://www.eia.doe.gov.

Residential Sector

Housing Characteristics

Housing Characteristics, 1993; June 1995, DOE/EIA-0314(93), GPO Stock No. 061-003-00912-3, $23.00.

Housing Characteristics 1990; May 1992, DOE/EIA-0314(90), GPO Stock No. 061-003-00754-6, $23.00.

Consumption and Expenditures

Household Energy Consumption and Expenditures 1993, October 1995, DOE/EIA-0321(93), GPO Stock No. 061-00932-08, $21.00.

Household Energy Consumption and Expenditures 1990; February 1993, DOE/EIA-0321/1(90), GPO Stock No. 061-003-00795-3, $22.00.

Household Energy Consumption and Expenditures 1990\S; DOE/EIA-0321/2(90), GPO Stock No. 061-003-00796-1, $21.00.

Other Publications on the Residential Sector

Energy Consumption Series—Residential Energy Consumption Survey Quality Profile, March 1996, DOE/EIA-0555(96)/1, GPO Stock No. 061-003-00956-5, $6.50.

Energy Consumption Series—*Sample Design for the Residential Energy Consumption Survey*, August 1994, DOE/EIA-0555(94)/1, GPO Stock No. 061-003-00865-8, $6.50.

Energy Consumption Series—*User-Needs Study of the 1993 Residential Energy Consumption Survey*, September 1993, DOE/EIA-0555(93)/2, GPO Stock No. 061-003-00819-4, $13.00..

Residential Transportation Sector

Household Vehicles Energy Consumption 1991; December 1993, DOE/EIA-0464(91), GPO Stock No. 061-003-00652-3, $14.00.

Household Vehicles Energy Consumption 1988; February 1990, DOE/EIA-0464(88), GPO Stock No. 061-003-00652-3, $11.00.

Commercial Sector

Characteristics of Buildings

Commercial Buildings Characteristics 1992; April 1994, DOE/EIA-0246(92), GPO Stock No. 061-003-00850-0, $28.00.

Commercial Buildings Characteristics 1989; June 1991, DOE/EIA-0246(89), GPO Stock No. 061-003-00699-0, $18.00.

Consumption and Expenditures

Commercial Buildings Consumption and Expenditures 1992; April 1995, DOE/EIA-0318(92), GPO Stock No. 061-003-00904-2, $31.00.

Commercial Buildings Consumption and Expenditures 1989; April 1992, DOE/EIA-0318(89), GPO Stock No. 061-003-00753-8, $25.00.

Other Publications on the Commercial Sector

Energy Consumption Series— *Energy End-Use Intensities in Commercial Buildings*, September 1994, DOE/EIA-0555(94)/2, GPO Stock No. 061-003-0087-9, 9.00.

Energy Consumption Series—*Assessment of Energy Use in Multibuilding Facilities*, August 1993, DOE/EIA-0555(93)/1, GPO Stock No. 061-003-00817-8, $7.50.

Energy Consumption Series—*User-Needs Study for the 1992 Commercial Buildings Energy Consumption Survey*, September 1992, DOE/EIA-0555(92)/4, GPO Stock No. 061-003-00770-8, $8.50.

Energy Consumption Series—*Lighting in Commercial Buildings*; March 1992, DOE/EIA-0555(92)/1, GPO Stock No. 061-003-00749-0, $6.50.

Industrial Sector

Changes in Energy Intensity in the Manufacturing Sector 1985-1991, October 1995, DOE/EIA-0552(85-91). GPO Stock No. 061-003-00925-5, $9.00.

Manufacturing Consumption of Energy 1991, December 1994, DOE/EIA-0512(91), GOP Stock No. 061-003-0087-9, $34.00.

Manufacturing Energy Consumption Survey: Consumption of Energy, 1988; May 1991, DOE/EIA- 0512(88), GPO Stock No. 061-003-00703-8, $11.00.

Other Publications on the Transportation and Industrial Sector

Transportation

Describing Current and Potential Markets for Alternative-Fuel Vehicles, March 1996, DOE/EIA-604 (No Cost).

Profile of Motor-Vehicle Fleets in Atlanta 1994, November 1995, DOE/EIA-0601, GPO Stock No. 061-003-00938-7, $3.50.

Industrial

Energy Consumption Series—*Derived Annual Estimates of Manufacturing Energy Consumption 1974-1988*, August 1992, DOE/EIA-0555(92)/3, GPO Stock No. 061-003-00766-0, $7.00.

Energy Consumption Series—*Development of the 1991 Manufacturing Energy Consumption Survey*, May 1992, DOE/EIA-0555(92)/2, GPO Stock No. 061-003-00757-1, $5.50.

Cross-Sector

Energy Consumption--Measuring Energy Efficiency in the United States' Economy: A Beginning; October 1995, DOE/EIA-0555(95)/2, GPO Stock No. 061-003-00935-2, $6.50.

Energy Consumption Series-Buildings and Energy in the 1980's, June 1995, DOE/EIA-0555(95)/1, GPO Stock No. 061-003-00914-0, $6.00.

Energy Consumption by End-Use Sector: A Comparison of Measures by Consumption and Supply Surveys; April 6, 1990, DOE/EIA-0533 (no GPO Stock No. available), $2.50.

Public-Use Diskettes

Note: Diskettes are available through the Office of Scientific and Technical Information (OSTI) and NTIS.

Commercial Buildings Consumption and Expenditures, 1992 data, **OSTI** - ASCII or dBASE format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII or dBASE format, order by title, call for prices.

Commercial Buildings Characteristics 1992 data, **OSTI** - ASCII or dBASE format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII or dBASE format: Order No. PB-94-504305, call for prices.

Commercial Buildings Energy Consumption Survey 1989 data, **OSTI** - ASCII format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII format: Order No. PB92-504232, $140.

Residential Transportation Energy Consumption Survey 1991 Data, OSTI-ASCII (3 diskettes) or dBASE, order by title, $10.00 per diskette (3 diskettes). **NTIS**-ASCII Order No. PB94-500824, dBASE Order No. PB94-500816.

Residential Transportation Energy Consumption Survey 1988 Data, **OTSI** - ASCII or dBASE format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII format: Order No. PB91-507269, dBASE format: Order No. PB91-507277, $50 each.

Residential Energy Consumption Survey 1990 Data, OSTI-ASCII (3 diskettes) or dBASE format, order by title, $10.00 per diskette (2 diskettes). **NTIS**-ASCII format, Order No. PB93-506103 or dBASE format, Order No. PB93-506095.

Residential Energy Consumption Survey 1987 Data, **OSTI** - ASCII or dBASE format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII format: Order No. PB-91-505115, $130, and dBASE format: Order No. PB-91-505107, $130.

*Nonresidential Buildings Energy Consumption Survey 1986 Data,***OSTI** - ASCII format, order by title, $10 per diskette (4 diskettes). **NTIS** - ASCII format: Order No. PB91-506808, $130.

Public-Use Tapes

Note: Public use data from earlier surveys are available on 9-track tapes through NTIS.

Residential and Residential Transportation Sectors

Residential Energy Consumption Survey: 1987 and Residential Transportation Energy Consumption Survey, 1988, Order No. PB90-501461, $220.

Residential Energy Consumption Survey: 1984 and Residential Transportation Energy Consumption Survey, 1985; Order No. PB87-186540, $220.

Residential Energy Consumption Survey: 1982 and Residential Transportation Energy Consumption Survey, 1983; Order No. PB85-221760, $220.

Residential Energy Consumption Survey: Consumption and Expenditures, 1980-1981; Monthly Billing Data; Order No. PB84-166230, $220.

Residential Energy Consumption Survey: Housing Characteristics, 1981; Consumption and Expenditures, 1981-1982; Monthly Billing Data; Order No. PB84-120476, $220.

Residential Energy Consumption Survey: Housing Characteristics, Annualized Consumption and Expenditures, 1980-1981; Order No. PB83-199554, $220.

Residential Energy Consumption Survey: Household Transportation Panel Monthly Gas Purchases and Vehicle and Household Characteristics, 6/79-9/81; Order No. PB84-162452, $220.

Residential Energy Consumption Survey: Household Screener Survey, 1979-1980; Order No. PB82-114877, $220.

Residential Energy Consumption Survey: Household Monthly Energy Consumption and Expenditures, 1978-1979; Order No. PB82-114901, $220.

National Interim Energy Consumption Survey (Residential), 1978; Order No. PB81-108714, $220.

Commercial Sector

Note: The name of the Nonresidential Buildings Energy Consumption Survey was changed to the Commercial Buildings Energy Consumption Survey, beginning with the 1989 survey. The survey name was also dropped from the report title at that time and subsequently.

Nonresidential Buildings Energy Consumption Survey: 1986 Data; Order No. PB90-500034, $220.

Nonresidential Buildings Energy Consumption Survey: 1979 and 1983 Data; Order No. PB88-245162, $220.

CD-ROM

EIA publications and data are available. For ordering CD-ROM, see EIA's Homepage site located at http://www.eia.doe.gov. (Also, see the CD-ROM's contents listing on the Homepage.)

Planned Publications

Profile of Motor-Vehicle Fleets in Denver 1995, planned for November 1996.

A Guide to Surveys of Motor Vehicle Fleets, planned for December 1996.

Household Vehicles Energy Consumption 1994, planned for December 1996.

Note: The Energy Information Administration also publishes annually the *State Energy Data Report, Consumption Estimates*, DOE/EIA-0214; the *State Energy Price and Expenditures Report*, DOE/EIA-0376; and the *Monthly Energy Review*, DOE/EIA-0035. These reports contain annual and monthly consumption information derived from EIA supply surveys.

Glossary

Air-Conditioning: Air-conditioning is one of the five end-use categories in this report. It is defined as cooling and dehumidification of the air in a building by a refrigeration unit driven by electricity or gas. This definition excludes fans, blowers, or evaporative cooling systems ("swamp coolers") that are not connected to a refrigeration unit. Air-conditioning units that are not currently in working condition or are not used are still included in the RECS if they are in place in the housing unit. If the household did not use its air-conditioning equipment during the summer of 1993, no consumption and expenditures are imputed for air-conditioning.

Apartments. A housing unit in a building with multiple units--a structure that is divided into living quarters for more than one family or household and where one household lives above another. Apartments can be located in large buildings, garden apartment buildings, or in houses originally intended for occupancy by one family (or some other use) that have since been converted to separate dwellings for more than one family.

Appliances: One of the main end-use categories in RECS. It is defined as the use of energy for all uses except those covered by space heating, water heating, refrigerators (starting with the 1990 RECS), and air-conditioning. This includes energy used for freezers, lights, televisions, personal computers, washing machines, and most small appliances. Special energy uses for appliances are energy used to heat: food, water for cooking, water for hot drinks, air to dry clothes, water for a swimming pool, water in a water bed. Also included is energy to operate fans for a central forced-air space-heating system and energy for an evaporative cooling system (swamp coolers). (See **End-Use** and for a more complete listing of appliances, see **Appliances Used**.)

Appliances Used: Appliances used in the home during the year, including those loaned to the householder for regular use. Appliances possessed by the household but not used are not counted, except for air-conditioning equipment. Appliances temporarily not in working condition but generally used by the household are included only if a repair person has been called or the appliance has been taken to a repair shop, except for air-conditioning equipment. Cooking appliances include the following: toaster oven, gas stove-top or burners, gas oven, electric stove-top or burners, electric oven, microwave oven, gas grill (that uses bottled gas or propane), and natural gas grill. Stove-top or burners include range tops and stand-alone cook tops. Range burners and ovens are counted as separate appliances. Cooling appliances include: evaporative cooler (swamp cooler), whole-house or attic fan, exhaust fan, window fan, ceiling fan, portable or table fan. Other appliances counted include: refrigerator, freezer, dishwasher, clothes washer and dryer, swimming pool and hot tub pump and heater, television, personal computer, laser printer, waterbed heater, heated aquarium, humidifier, air cleaner, facsimile machine, photocopier, portable space heater, and dehumidifier.

Average: The simple arithmetic average for a population; that is, the sum of all the values in a population divided by the size of the population. Population means are estimated by computing the weighted sum of the sample values, then dividing by the sum of the sample weights. (See **Weight**.)

Ballast: See **High-Efficiency Ballast.**

Bathroom: For this report, a full bathroom contains a sink with running water, a flush toilet, and a bathtub or shower. A half bathroom contains a toilet or bathtub or shower.

Bedroom: Room intended for sleeping, even if not presently used for sleeping. Number of bedrooms are those that would be listed as descriptive of the apartment or house if it were on the market for sale or rent. A one-room efficiency or studio apartment has no bedrooms.

British Thermal Unit: See **Btu**.

Btu (British Thermal Unit): A Btu is defined as the amount of energy required to increase the temperature of 1 pound of water by 1 degree Fahrenheit, at normal atmospheric pressure. (See **Metric Conversion Factors.**)

Btu Conversion Factors: The Btu conversion factors used for this survey are listed below:

Electricity (site)	3,412	Btu/kilowatthour
Electricity (primary)	10,280	Btu/kilowatthour[25]
Natural gas	1,028	Btu/cubic foot
Fuel Oil No.1	135,000	Btu/gallon
Kerosene	135,000	Btu/gallon
Fuel Oil No.2	138,690	Btu/gallon
LPG (propane)	91,330	Btu/gallon
Wood	20,000,000	Btu/cord.

Census Division: A geographic area consisting of several States defined by the U.S. Department of Commerce, Bureau of the Census. The States are grouped into nine divisions and four regions.

Region	Division	States
Northeast	New England	Connecticut, Maine, Massachusetts, New Hampshire, Vermont, and Rhode Island
	Middle Atlantic	New Jersey, New York, and Pennsylvania
Midwest	East North Central	Illinois, Indiana, Michigan, Ohio, and Wisconsin
	West North Central	Iowa, Kansas, Minnesota, Missouri, Nebraska, North Dakota, and South Dakota
South	South Atlantic	Delaware, the District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia
	East South Central	Alabama, Kentucky, Mississippi, and Tennessee
	West South Central	Arkansas, Louisiana, Oklahoma, and Texas
West	Mountain	Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming
	Pacific	Alaska, California, Hawaii, Oregon, and Washington

Census Region: See **Census Division.**

Clothes Dryer: An appliance that dries laundry through the application of heat and rapid air movement. The hot air used is typically heated by electricity or gas, either natural gas or liquefied petroleum gas.

Clothes Washer: An appliance for automatically cleaning home laundry. It has an opening on its top or its front offering access to the washer tub. An agitator, located within the tub, moves the articles to be cleaned through the wash water. The machine is powered by an electric motor connected to the tub and agitator via a transmission, clutches, and linkages. In front-loading machines, the articles are moved by a rotating tube rather than an agitator.

[25]Average energy input of the generation process for fossil-fuel utility plants in the United States for 1993. See Table A8, Energy Information Administration, *Monthly Energy Review*, August 1996, p. 143.

Consumption: The amount of electricity or natural gas used by, or delivered to, the household during a 365-day period. For fuel oil, kerosene, and LPG, the quantity represents fuel purchased, not fuel consumed. If the level of fuel in the tank was the same at the beginning and end of the annual period, then the quantity consumed would be the same as the quantity purchased. Measurements or reports of the level of fuel in the tank were not included in the RECS data collection.

Conversion Factors: See **Btu Conversion Factors** and **Metric Conversion Factors.**

Demand-Side Management (DSM) Programs: These are organized utility-sponsored activities that are intended to affect the amount and timing of customer electricity or natural gas use.

Dishwasher: A built-in or portable appliance used for automatically cleaning dishware, utensils, and cutlery. The national appliance efficiency standards required that, by 1988, dishwashers be equipped with an option to dry without heat.

Electricity: Metered electric power supplied by a central utility company to a residence via power lines. Since there are no volumetric measures of electricity, as there are with the fossil fuels, electricity is measured as the amount of power used at any instant (demand expressed in watts or kilowatts) or as power used over a given time (consumption expressed in kilowatthours). The heat equivalent for electricity is 3,412 Btu per kWh, but this is a derived form of energy and does not represent the amount of energy needed to generate the electricity and transmit it to the building. Generation and transmission requires about 3 times 3,412 Btu per kWh. Energy is used in preparing other fuels for consumption from their condition as mined and delivering them to a site for use, but these amounts of energy are relatively small compared to the Btu value of the fuel consumed. (See **Primary Electricity** and **Btu Conversion Factors**.)

End Use: A function for which energy sources or fuels are used in the household. Five main energy end-use categories were estimated: space heating, air-conditioning, water heating, refrigerator, and appliance usage. The amount of energy used for these end uses is estimated by means of a nonlinear regression technique, rather than by using metered data. Although not shown in the tables in Chapter 5, end-use estimates were also made for the following uses of electricity: freezers, lighting, dishwashers, clothes dryers, and cooking (ranges and ovens). (See Appendix B, "End-Use Estimation Methodology.")

Energy: The capacity for doing work as measured by the capability of doing work (potential energy) or the conversion of the capability to motion (kinetic energy). Energy has several forms, some of which are easily convertible and can be changed to another form useful for work. Most of the world's convertible energy comes from fossil fuels that are burned to produce heat that is then used as a transfer medium to mechanical or other means in order to accomplish tasks. Electrical energy is usually measured in kilowatthours, while heat energy is usually measured in British thermal units (Btu).

Expenditures: Charges spent for the energy consumed in, or delivered to, a building during a given period of time. For this report, all expenditure statistics are presented on an annual basis, for calendar year 1993. The total dollar amount includes State and local taxes but excludes merchandise, repairs, or special service charges. For households on a budget plan, the expenditures are for the actual consumption. Electricity and natural gas expenditures are for the amount of those energy sources consumed. Fuel oil, kerosene, and LPG expenditures are for the amount of fuel purchased, which may differ from the amount of fuel consumed. For households that do not pay their fuel supplier directly, the expenditures for fuels are estimated and included in the tables. (See **Consumption.**)

Family Income Category: The income grouping for the total combined income (before taxes and deductions) of all members of the family from all sources, for the 12 months prior to the interview. Sources of income include the following: wages, salaries, tips, commissions, interest, dividends, rental income, Social Security or railroad retirement, pensions, food stamps, Aid to Families with Dependent Children, unemployment compensation, Supplemental Security Income, General Assistance and other public assistance. This definition includes the total income of all family members who lived in the household during the 12 months prior to the interview, regardless of whether they were living there at the time of the interview. Income of nonfamily members of the household is not included. "Family" includes the following types of relationships: mother, father, sister, brother, son, daughter, father-in-law, uncle, aunt, niece, grandchild, foster child (and similar relationships).

Floodlights: Lights that illuminate large areas, often used outdoors. Incandescent floodlights, the most common, are at least 150 watts. Mercury vapor or sodium vapor floodlights are at least 100 watts. Floodlights cannot be fluorescent lights.

Floorspace: The floor area of the housing unit that is enclosed from the weather. For RECS, the following are included in the floorspace: basements, whether or not they contain finished space; finished and/or heated space in attics; and garages, if they have a wall in common with the house. Not included are: crawl spaces, even if they are enclosed from the weather; and sheds and other buildings that are not attached to the house. Floorspace (in square feet) is derived from an actual measurement made by the RECS interviewer using a metallic, retractable, 50-foot tape measure.

"Heated Floorspace" is the portion of the floorspace that is heated during most of the winter season. Rooms that are shut off during the heating season to save fuel are not counted as heated square footage. Attached garages that are unheated and unheated areas in basements and attics are not counted as heated square feet.

"Cooled Floorspace" is computed as total floorspace times the percentage of rooms that are cooled over total rooms. This method for calculating cooled floorspace is different from the method used in *Housing Characteristics 1993* that used heated floorspace rather than total floorspace.

Fluorescent Lamps: Usually long, narrow, white tubes connected to a fixture at both ends; some are circular. The tube is coated on the inside with fluorescent material. The lamp produces light by passing electricity through mercury vapor, which causes the fluorescent coating to glow or fluoresce. These lights are typically found in kitchen and basement work areas. Newer types ("compact" fluorescent lamps), looking somewhat more like a conventional bulbs, can be screwed into fixtures. (See **Lights**.)

Halogen Lamp: A type of incandescent lamp that lasts much longer and is more efficient than the common incandescent lamp. The lamp uses a halogen gas, usually iodine or bromine, that causes the evaporating tungsten to be redeposited on the filament, thus prolonging its life. (See **Incandescent Lamp**.)

Heated Floorspace: See **Floorspace**.

High-Efficiency Ballast (HEB): The ballast is the transformer for florescent and High-Intensity Discharge Lamps, which provides the necessary current, voltage, and wave-form conditions to operate the lamp.

High-Intensity Discharge (HID) Lamp: A lamp that produces light by passing electricity through gas, which causes the gas to glow. Examples of HID lamps are mercury vapor lamps, metal halide lamps, and high-pressure sodium lamps. HID lamps have an extremely long life and emit far more lumens per fixture than do florescent lights.

Household: A family, an individual, or a group of up to nine unrelated persons, occupying the same housing unit. "Occupy" means the housing unit was the person's usual or permanent place of residence at the time of the first field contact. Household members include babies, lodgers, boarders, employed persons who live in the housing unit, and persons who usually live in the household but are away traveling or in a hospital. The household does not include (1) persons who are normally members of the household but who were away from home as college students or members of the armed forces at the time of the contact; (2) persons temporarily visiting with the household if they have a place of residence elsewhere; (3) persons who take their meals with the household but usually lodge or sleep elsewhere; (4) domestic employees or other persons employed by the household who do not sleep in the same housing unit; and (5) persons who are former members of the household, but have since become inmates of correction or penal institutions, mental institutions, homes for the aged or needy, homes or hospitals for the chronically ill or handicapped, nursing homes, convents or monasteries, or other places in which residents may remain for long periods of time. By definition, in the RECS, the number of households is the same as the number of occupied housing units.

Household Member: See **Household**.

Householder: The person (or one of the people) in whose name the home is owned or rented. If there is no lease or similar agreement, or if the person who owns the home or pays the rent does not live in the housing unit, the householder is the person responsible for paying the household bills, or whoever is generally in charge.

Housing Unit: A house, an apartment, a group of rooms, or a single room if it is either occupied, or intended for occupancy, as separate living quarters by a family, an individual, or a group of one to nine unrelated persons. Separate living quarters means the occupants (1) live and eat separately from other persons in the house or apartment and (2) have direct access from the outside of the building or through a common hall--that is, they can get to it without going through someone else's living quarters. Housing units do not include group quarters, such as prisons or nursing homes where ten or more unrelated persons live. Hotel and motel rooms are considered housing units if occupied as the usual or permanent place of residence.

Incandescent Lamp: The most common and among the least energy-efficient of all household lamps. A lamp that produces light by electrically heating a tungsten filament so that it glows and produces a soft, warm light. Because so much of the energy used is lost as heat, these are highly inefficient sources of light. Included in this category are the familiar household light bulbs that screw into sockets, as well as more energy-efficient incandescent bulbs, such as Tungsten Halogen (spotlights), Reflector or R-lamps (accent and task lighting), Parabolic Aluminized Reflector (PAR) lamps (flood and spot lighting), and Ellipsoidal Reflector (ER) lamps (recessed lighting).

Intensity: This is a method of adjusting either the amount of energy consumed or expenditures spent, for the effects of various housing unit and/or household characteristics, such as size of the housing unit, climate, and number of household members, to facilitate comparisons of energy across time, regions of the country, fuels, and housing units.

Kilowatthour: See **kWh**.

kWh (Kilowatthour): A unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu. (See **Btu** and **Btu Conversion Factor**.)

Lamp: A term generally used to describe a manmade source of light. The term is often used when referring to a "bulb" or "tube." (See **Lights**.)

Lights: For the RECS, all of the light bulbs controlled by one switch were counted as one light. For example, a chandelier with multiple lights controlled by one switch is counted as one light. A floor lamp with two separate globes or bulbs controlled by two separate switches would be counted as two lights. Indoor and outdoor lights were counted if they were under the control of the householder. This would exclude lights in the hallway of multifamily buildings. (See **Floodlights**, **Fluorescent, High-Intensity Discharge**, and **Incandescent Lamps**.)

Metric Conversion Factors: In this report, estimates are presented in customary U.S. units. Floorspace estimates may be converted to metric units by using this relationship: 1 square foot is approximately equal to .0929 square meters. Energy estimates may be converted to metric units by using this relationship: 1 Btu is approximately equal to 1,055 joules. One kilowatthour is exactly equal to 3,600,000 joules. One gigajoule is approximately 278 kilowatthours (kWh). (See **Btu** and **Btu Conversion Factors**.)

Mobile home: A housing unit built on a movable chassis and moved to the site. It may be placed on a permanent or temporary foundation and may contain one room or more. If rooms are added to the structure, it is considered a single-family housing unit. A manufactured house assembled on site is a single-family housing unit, not a mobile home.

Occupied Housing Unit: A unit in which someone was living as his or her usual or permanent place of residence when the first RECS field contact was made. (See **Housing Unit**.)

Owned/Rented: The relationship of a housing unit's occupants to the structure itself, not the land on which the structure is located. "Owned" means the owner or co-owner is a member of the household and the housing unit is either fully paid for or mortgaged. A household is classified "rented" even if the rent is paid by someone not living in the unit. Rent free means the unit is not owned or being bought and no money is paid or contracted for rent. Such units are usually provided in exchange for services rendered or as an allowance or favor from a relative or friend not living in the unit. Unless shown separately, rent-free households are grouped with rented households.

Ownership: See **Owned/Rented**.

Peak Demand: The maximum rate of energy consumption per unit time over a period of measurement.

Potential Savings: Savings that could be realized if households adopted more energy-efficient equipment and appliances, such as compact fluorescent lights.

Primary Electricity: A measurement of electricity that includes the approximate amount of energy used to generate electricity. To approximate the adjusted amount of electricity, the site-value of the electricity is multiplied by a factor of three. This conversion factor of three is a rough approximation of the Btu value of raw fuels used to generate electricity in a steam-generation power plant. In this report, electricity is represented as site energy. (See **Site Energy** and **Btu Conversion Factors**.)

Relative Standard Error: See **RSE** or **Relative Standard Error**.

Rent: See **Owned/Rented**.

Residential: Occupied housing units, including mobile homes, single-family housing units (attached and detached), and apartments. The definition of "occupied housing units" is the same as that used by the U.S. Bureau of the Census. (See **Household** and **Housing Unit**.)

Residential Building: A structure used primarily as a dwelling for one or more households.

Rooms: Subdivisions of a housing unit. Whole rooms are rooms such as living rooms, dining rooms, bedrooms, kitchens, lodgers' rooms, finished basements or attic rooms, recreation rooms, and permanently enclosed sun porches that are used year round. Rooms used for offices by a person living in the unit are included in this survey. "Finished" means that the ceiling and walls are covered with finishing materials.

Not considered to be rooms in this survey are bathrooms, halls, foyers, or vestibules, balconies, closets, alcoves, pantries, strip or Pullman kitchens, laundry or furnace rooms, unfinished attics or basements, open porches, and unfinished space used for storage.

A partially divided room, such as a dinette next to a kitchen or a living room, is considered a separate room only if there is a partition from floor to ceiling--but not if the partition consists solely of shelves or cabinets. If a room is used by occupants of more than one unit, the room is included with the unit from which it is most easily reached. (See **Bedroom** and **Bathroom**.)

RSE Column Factor: An adjustment factor used to compute RSE's. For a survey estimate in a particular row and column of a table (that is, a particular "cell"), the approximate RSE is obtained by multiplying the RSE row factor by the RSE column factor for that cell (See **RSE or Relative Standard Error, RSE Row Factor**).

RSE or Relative Standard Error: A measure of the reliability or precision of a survey statistic. The Relative Standard Error, or RSE, is defined as the standard error of a survey estimate, expressed as a percent of the estimate. For example, an RSE of 10 percent means that the standard error is one-tenth as large as the survey estimate. The RSE is also known as the coefficient of variation.

RSE Row Factor: A factor used to compute RSE's. The row factor is equal to the geometric mean of the RSE's in a particular row of main tables. For a survey estimate in a particular row and column of a table (that is, a particular "cell"), the approximate RSE is obtained by multiplying the RSE row factor by the RSE column factor for that cell. (See **RSE or Relative Standard Error, RSE Column Factor**.)

Sampling: The procedure used to select housing units for interview from the population of all residential housing units in the United States.

Single-Family: A housing unit that provides living space for one household or family. The structure may be detached or attached to another unit. Attached houses are considered single-family houses as long as the house itself is not divided into more than one housing unit and has an independent outside entrance. A single-family house is contained within walls that go from the basement (or the ground floor, if there is no basement) to the roof. Townhouses, rowhouses, and duplexes are considered single-family attached housing units, as long as there is no household living above another one

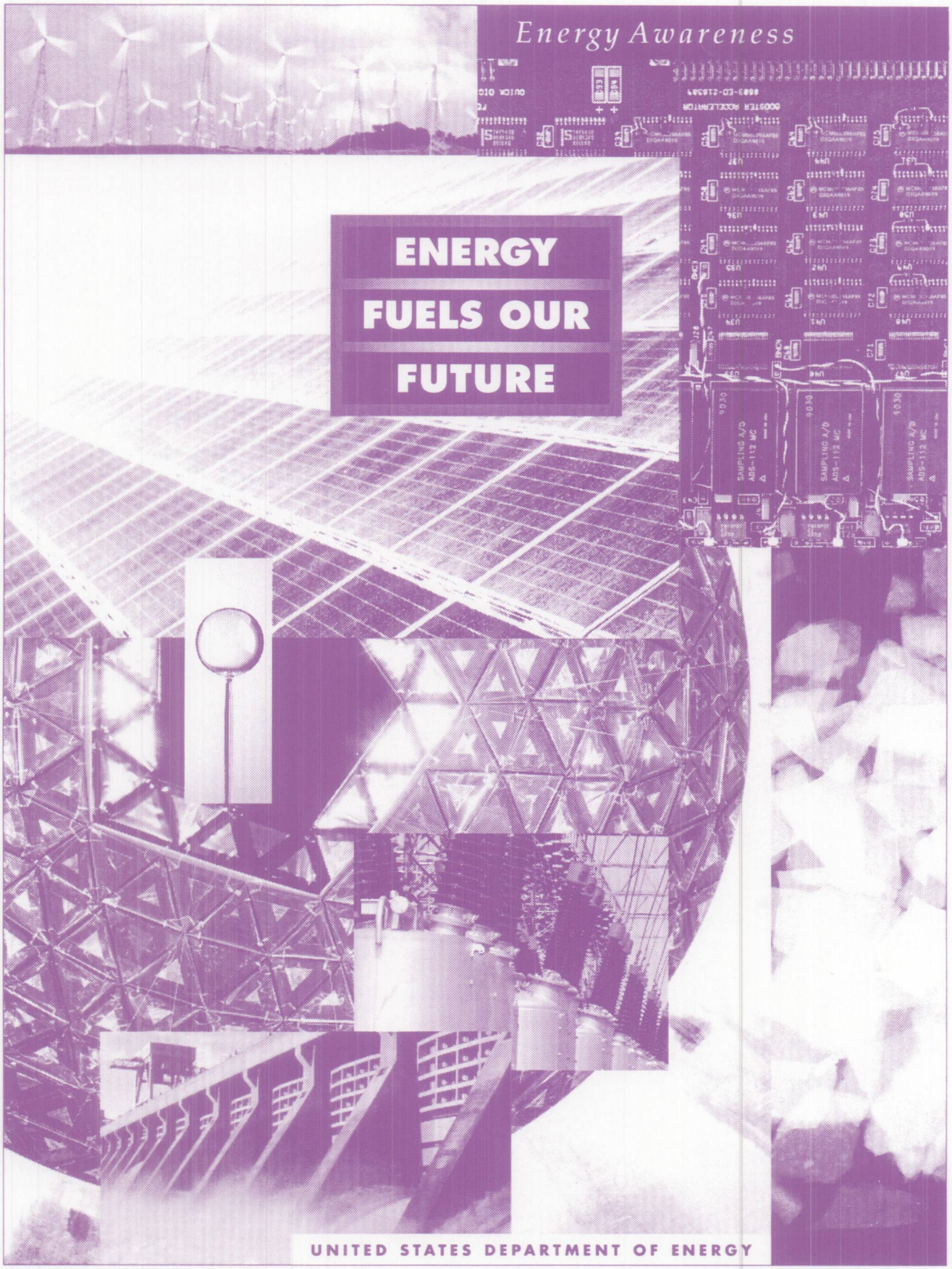
within the walls that go from the basement to the roof to separate the units. A mobile home with one or more rooms added is classified as a single-family home.

Site Energy: The Btu value of energy at the point it enters the home, sometimes referred to as "delivered" energy. In this report, electricity is represented as site electricity. (See **Primary Electricity** and **Btu Conversion Factors**.)

Space Heating: The use of mechanical equipment (including wood stoves and active solar-heating devices) to heat all, or part, of a building to at least 50 degrees Fahrenheit. The equipment could be the main space-heating equipment or secondary space-heating equipment. It does not include the use of energy to operate appliances (such as lights, televisions, and other appliances) that give off heat as a byproduct.

Square Feet: See **Floorspace.**

Weight: The number of households in the United States that a particular sample unit represents. To estimate the total value of an attribute (such as floorspace) in the U.S. residential population as a whole, each sample household's value is multiplied by the household's weight. Summing the weighted sample values provides an estimate of the nationwide total.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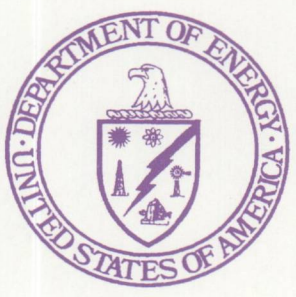

Energy Consumption Series Residential Lighting: Use and Potential Savings
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