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A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures

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CBECS Public Use Data are available on the Internet at: http://www.eia.doe.gov.

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1. Overview

Introduction

The commercial sector consists of business establishments and other organizations that provide services. The sector includes service businesses, such as retail and wholesale stores, hotels and motels, restaurants, and hospitals, as well as a wide range of facilities that would not be considered "commercial" in a traditional economic sense, such as public schools, correctional institutions, and religious and fraternal organizations. Excluded from the sector are the goods-producing industries: manufacturing, agriculture, mining, forestry and fisheries, and construction.

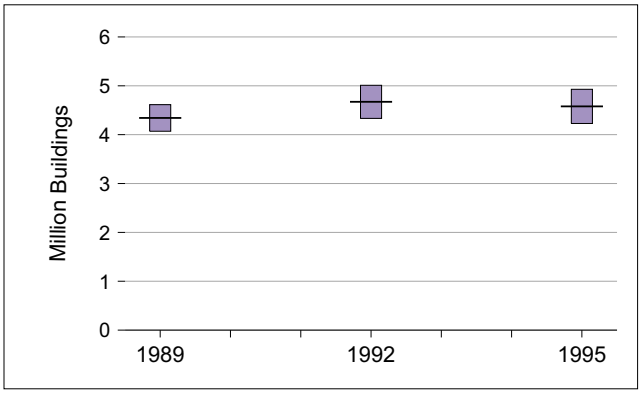
Nearly all energy use in the commercial sector takes place in, or is associated with, the buildings that house these commercial activities. Analysis of the structures, activities, and equipment associated with different types of buildings is the clearest way to evaluate commercial sector energy use. The Commercial Buildings Energy Consumption Survey (CBECS) is a national-level sample survey of commercial buildings and their energy suppliers conducted quadrennially (previously triennially) by the Energy Information Administration (EIA). The target population for the 1995 CBECS consisted of all commercial buildings in the United States with more than 1,000 square feet of floorspace (see box on page 4).

Decision makers, businesses, and other organizations that are concerned with the use of energy—building owners and managers, regulators, legislative bodies and executive agencies at all levels of government, utilities and other energy suppliers—are confronted with a buildings sector that is complex. Data on major characteristics (e.g., type of building, size, year constructed, location) collected from the buildings, along with the amount and types of energy the buildings consume, help answer fundamental questions about the use of energy in commercial buildings.

Commercial Buildings in 1995

In 1995, there were 4.6 (0.4) million commercial buildings in the United States comprising 58.8 (3.9) billion square feet of floorspace. That amount of commercial floorspace exceeds the total area of the State of Delaware and amounts to more than 200 square feet for every resident in the United States. The commercial building population in the 1995 CBECS was defined differently from that of previous CBECS. Two types of buildings, parking garages and commercial buildings on multibuilding manufacturing facilities, that were included in previous cycles, were excluded in 1995. Figures 1 and 2 show estimates for the number of buildings and floorspace and Figures 3 and 4 show estimates for total energy consumption and energy inten-

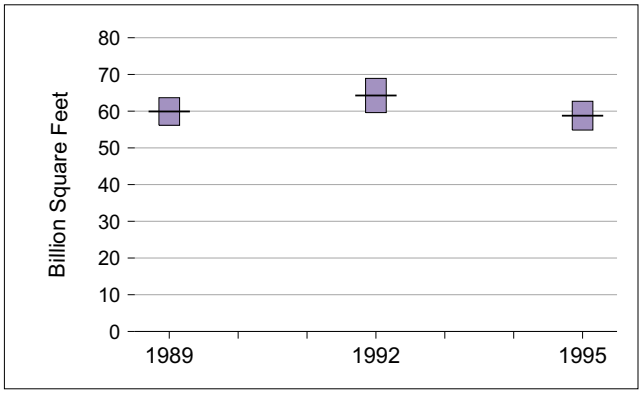
Figure 1. Total Commercial Buildings, 1989 to 1995



Note: 1989 and 1992 estimates are adjusted to match 1995 CBECS building definition.

Sources: Energy Information Administration; 1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys.

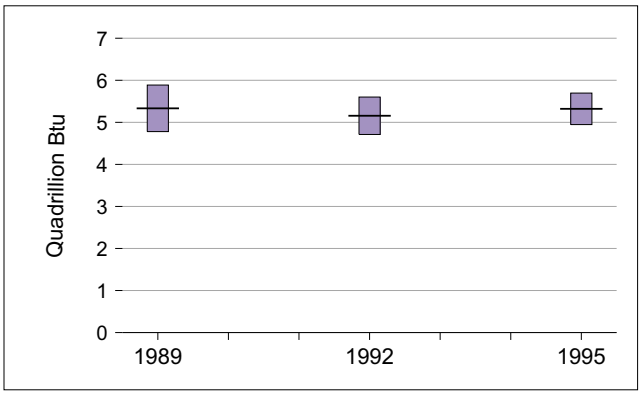
Figure 2. Total Commercial Floorspace, 1989 to 1995



Note: 1989 and 1992 estimates are adjusted to match 1995 CBECS building definition.

Sources: Energy Information Administration; 1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys.

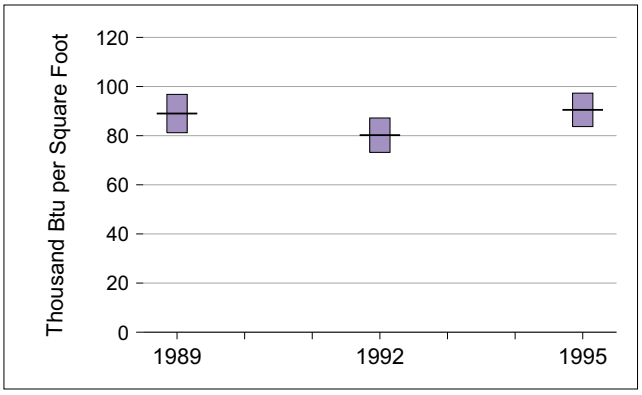
Figure 3. Total Site Energy Consumption in Commercial Buildings, 1989 to 1995



Note: 1989 and 1992 estimates are adjusted to match 1995 CBECS building definition.

Sources: Energy Information Administration; 1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys.

Figure 4. Total Site Energy Intensity in Commercial Buildings, 1989 to 1995



Note: 1989 and 1992 estimates are adjusted to match 1995 CBECS building definition.

Sources: Energy Information Administration; 1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys.

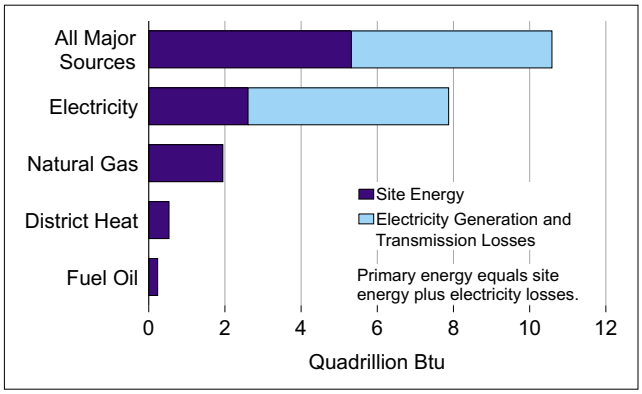
sity for all commercial buildings for 1989, 1992, and 1995. The 95-percent confidence ranges for the estimates are also shown in the four figures. Because of the sampling error associated with the estimates (see box on page 5), the apparent differences between the estimates for different survey years are not statistically significant. To compare the 1995 CBECS with the 1989 CBECS and 1992 CBECS, an adjustment was made to the 1989 and 1992 estimates to match the 1995 definition.

Energy consumption can be expressed as the amount consumed within the building (site energy) or it can include the energy consumed in generating and transmitting electricity (primary energy) (see box on page 6). All consumption data referred to in this report are site energy, unless otherwise indicated. Total primary energy consumption was 10.6 quadrillion Btu and primary electricity consumption (which includes energy consumed in electricity generation and transmission) was 7.9 quadrillion Btu (Figure 5).

In 1995, the total amount of site energy consumed by commercial buildings in the United States for major energy sources (electricity, natural gas, fuel oil, and district heat) was 5.3 quadrillion Btu (Figure 5). The greatest consumption for any energy source was 2.6 quadrillion Btu for electricity, followed by 1.9 quadrillion Btu for natural gas. District heat (0.5 quadrillion Btu) and fuel oil (0.2 quadrillion Btu) were together less than half the consumption of natural gas.

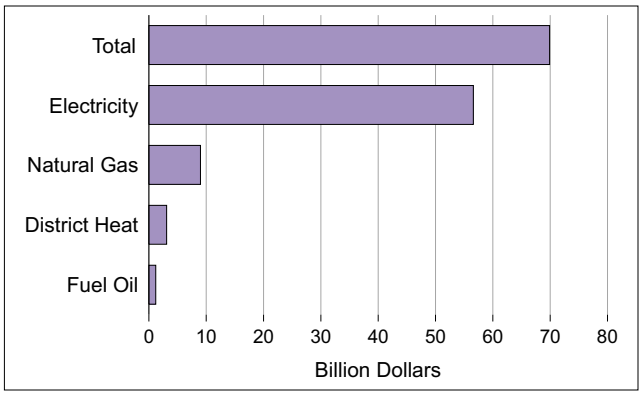
Total expenditures for major sources of energy in 1995 were 69.9 billion dollars (1995 dollars) (Figure 6). Electricity expenditures dominated, accounting for 56.6 billion dollars, or about 80 percent of the total. Total expenditures for natural gas were 9.0 billion dollars, with 3.1 billion dollars for district heat, and 1.2

Figure 5. Primary and Site Energy Consumption by Energy Source, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 6. Total Energy Expenditures by Energy Source, 1995

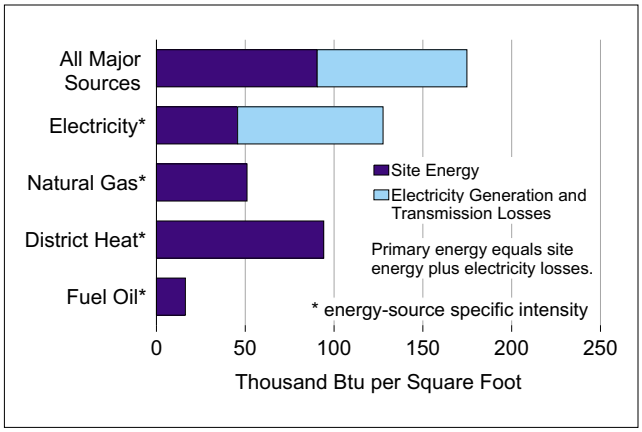


Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

billion dollars for fuel oil. Expenditures per unit of site electricity were 21.7 dollars per million Btu and expenditures per unit of primary electricity were 7.2 dollars per million Btu. For natural gas, expenditures per unit of energy were 4.6 dollars per million Btu, with 5.8 dollars per million Btu for district heat and 5.0 dollars per million Btu for fuel oil.

Energy consumption is one indicator of energy use; another is energy intensity. Energy intensity is the amount of energy consumed per unit of service or activity. For the commercial buildings sector, useful indicators of energy intensity are consumption per square foot, consumption per hour of operation, or consumption per worker. The most commonly used measure of commercial energy intensity is consumption per square foot. Two measures of floorspace can be used, total floorspace and conditional floorspace. Conditional floorspace further defines the floorspace—it may be energy-source specific (e.g., floorspace served by electricity) or end-use specific (e.g., heated floorspace). The site electricity energy intensity and natural gas intensity in 1995 were similar, 45.7 thousand Btu per square foot (for buildings that used electricity) and 51.0 thousand Btu per square foot (for buildings that used natural gas) (Figure 7).

Figure 7. Primary and Site Energy Intensity by Energy Source, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

EIA Surveys

Congress has mandated that EIA collect, analyze, and disseminate impartial, comprehensive data about energy how much is produced, who uses it, and the purposes for which it is produced. To comply with that Congressional mandate, the EIA conducts two types of surveys:

- **Supply surveys** gather information annually or more frequently from energy suppliers and marketers on the quantities and prices of specific energy sources produced or supplied to the market. The results of the supply surveys are combined and published in energy-source specific EIA publications and in the *Monthly Energy Review*.

- **Consumption surveys** gather information every four years directly from energy end users on the types of energy they use, along with information on the energy-related characteristics of households, commercial buildings, and manufacturing establishments. The results of these surveys are published in energy consumption reports, such as this report. Special analytical reports are also available on the EIA website (www.eia.doe.gov) and on EIA's *Energy InfoDisc* CD-ROM.

These surveys enable EIA to provide meaningful, objective, and accurate energy information for a wide audience that includes Congress; Federal, State and Local agencies; industry; and the general public.

The Commercial Buildings Energy Consumption Survey

Survey Methodology

The Commercial Buildings Energy Consumption Survey (CBECS) is a national sample survey of commercial buildings and their energy suppliers. The 1995 CBECS was the sixth survey in the series begun in 1979. The survey is conducted in two stages, a building characteristics survey and an energy supplier survey. The first, an in-person survey, collects information on physical characteristics of the building, building use and occupancy patterns, major equipment used, conservation practices, and types and uses of energy in the buildings. The supplier survey, a mail survey, collects information on amounts and costs of energy delivered to the building during the survey year.

The target population for the 1995 CBECS consisted of all commercial buildings in the United States with more than 1,000 square feet of floorspace. A commercial building defined by CBECS is an enclosed structure with more than 50 percent of its floorspace devoted to activities that are neither residential, industrial, nor agricultural. To cover this population, a representative sample of 6,639 buildings was chosen. Of these, building characteristics survey interviews were completed at 5,766 buildings for a response rate of 87 percent.

The sample design of CBECS is a multistage area probability cluster sample design supplemented by a list sample of "large" buildings, recently constructed buildings, and "special" buildings (Federal buildings and post offices, hospitals, colleges, and universities). The area sample portion of the design is a sample from the broad spectrum of commercial buildings. This portion uses a four-stage cluster sampling design, a method that involves sampling progressively smaller geographic areas. The supplemental list sample provides an oversample of "large" buildings and "special" buildings to ensure adequate coverage of buildings that are significant energy users. Similarly, for recently constructed buildings, the area sample is used to provide a sample from the broad spectrum of new buildings and the supplemental list sample provides an oversample of "large" new buildings.

Since the purpose of the CBECS is to publish estimates of population values, the CBECS sample is designed so that survey responses can be used to estimate characteristics of the entire stock of commercial buildings in the United States. The method of estimation is to calculate basic sampling weights (base weights) that relate the sampled buildings to the entire stock of commercial buildings. In statistical terms, a base weight is the reciprocal of the probability of selecting a building into the sample. A base weight can be explained as the number of actual buildings represented by a sampled building, e.g., a sampled building that has a base weight of 1,000 represents itself and 999 similar (but unsampled) buildings in the total stock of buildings. Thus, to reduce the bias from unit nonresponse in the survey statistics, the base weights of respondent buildings are adjusted upward, so that the respondent buildings represent not only unsampled buildings but also nonrespondent buildings.

End-Use Consumption Estimation Methodology

The energy consumption data provided by the energy suppliers are for total consumption within the commercial buildings. Estimates for major end uses can be calculated by disaggregating total energy consumption into end-use consumption by using several approaches—engineering simulations, statistical modeling, or a hybrid approach known as statistically adjusted engineering (SAE). CBECS end-use estimates were developed by using the SAE approach. The initial engineering estimates were provided by the Facility Energy Decision Screening (FEDS) system by using CBECS building characteristics data and weather data for the sampled buildings. These estimates were then statistically adjusted to match the observed CBECS consumption data.

Sampling Error, Standard Errors, and Relative Standard Errors

The 1995 Commercial Buildings Energy Consumption Survey produced estimates of numbers of buildings and floorspace for commercial buildings in the United States. Because the estimates are based on the sample selected, they are subject to sampling error. The estimates are based on reported data from representatives of a randomly chosen subset of the entire commercial building population. Consequently, the estimates always differ from the true population values. One source of the difference between the estimated values and the actual values is sampling error. Sampling error is the random difference between the survey estimate and the population value that occurs because the survey estimate is calculated from a randomly chosen subset of the entire population. The sampling error, averaged over all possible samples, would be zero, but since there is only one sample for each CBECS, the sampling error is nonzero and unknown for the particular sample chosen. However, the sample design permits sampling errors to be estimated. Because of sampling error, it is important to note that CBECS estimates should not be considered as finite point estimates, but as estimates with some associated error in each direction.

The standard error is a measure of the reliability or precision of the survey statistic. The value for the standard error can be used to construct confidence intervals and to perform hypothesis tests by standard statistical methods. Relative Standard Error (RSE) is defined as the standard error (square root of the variance) of a survey estimate, divided by the survey estimate and multiplied by 100. In this report, Text Tables 1a through 6b in Chapter 4 include the RSE for each estimate.

The 95-percent confidence range for a given survey estimate can be determined with the RSE. To calculate the 95-percent confidence range:

1. Divide the RSE by 100 and multiply by the survey estimate in the table to determine the standard error.

2. Multiply the standard error by 1.96 to determine the confidence error.

3. The survey estimate plus or minus the confidence error is the 95-percent confidence range.

For example, the estimate for total floorspace in all commercial buildings in the 1995 CBECS is 58,772 million square feet (Text Table 5b) and the estimate's RSE is 3.4 percent. The standard error is (3.4÷100)x(58,772 million square feet) or 1,998 million square feet. The 95-percent confidence error is (1.96)x(1,998 million square feet), or 3,917 million square feet. Therefore, with 95 percent confidence, the true amount of floorspace in commercial buildings in the United States in 1995 was 58,772 (3,917) million square feet or, stated another way, the range was from 54,855 to 62,689 million square feet.

Primary and Site Energy

Primary energy is the sum of the energy directly consumed by end users (site energy) and the energy consumed in the production and delivery of energy products. Electricity, of the major energy sources, has the greatest disparity between primary and site energy—a greater amount of energy is used to generate and transmit electricity than in the production and distribution of the other major sources. In 1995, steam-electric utility plants (the largest source of electricity generation) were estimated to have used 10,301 Btu of fossil-fuel energy to generate 1 kilowatthour of electricity; i.e., approximately 3.02 Btu of fossil-fuel energy were used to generate 1 Btu of electricity (3,412 Btu equals 1 kilowatthour of electricity).

The choice of expressing energy consumption data as site energy or primary energy (or site electricity or primary electricity when that energy source alone is considered) depends upon the use of the data. Site energy and site electricity reflect the amount of energy actually consumed within the building. Site energy data are most useful to building engineers, energy managers, building owners and others concerned with consumption directly related to the buildings; e.g., the energy efficiency of end-use equipment. Primary energy data are useful to policymakers and energy analysts who are concerned with environmental issues, such as carbon emissions from energy sources. See the following report for further information: Energy Information Administration. *Emissions of Greenhouse Gases in the United States 1996.* DOE/EIA-0173(96). Washington, DC, October 1997.

The consumption data presented in the 1995 and previous CBECS have been expressed as site energy and site electricity. Primary electricity data reflecting the total energy consumed in generating and transmitting electricity, are given in detailed Tables CE-1 and CE-9 for 1995.

2. Major Characteristics of Commercial Buildings

The CBECS collects statistics on a wide range of physical characteristics of buildings. For any given characteristic, buildings and floorspace (as well as energy consumed) are not evenly distributed. Three major characteristics—principal building activity, building size, and location—are particularly notable for their impact on energy use.

- The amount of energy consumed and the energy intensity vary greatly by building activity. In 1995, health care buildings had a high intensity (240.5 thousand Btu per square foot compared to 90.5 thousand for all buildings), but total energy consumption for those buildings was relatively low (only 10.5 percent of total consumption) because the total number of health care buildings was small.

- Smaller buildings and larger buildings show striking differences in the types of heating or cooling equipment used. These buildings cannot be heated or cooled effectively with the same equipment—residential-type window air conditioning units are quite satisfactory for cooling many very small commercial buildings. Large office buildings require much more complex integrated heating, cooling, and distribution systems.

- Location of buildings imposes very different heating and cooling requirements, which leads to regional differences in the energy sources and equipment used for those end uses.

In the following sections, the distribution of buildings and floorspace for major characteristics along with total site energy consumption and total intensity are discussed. The profiles of major characteristics showed no statistically significant changes from 1989 to 1992 to 1995, the years in which the last three CBECS were conducted.

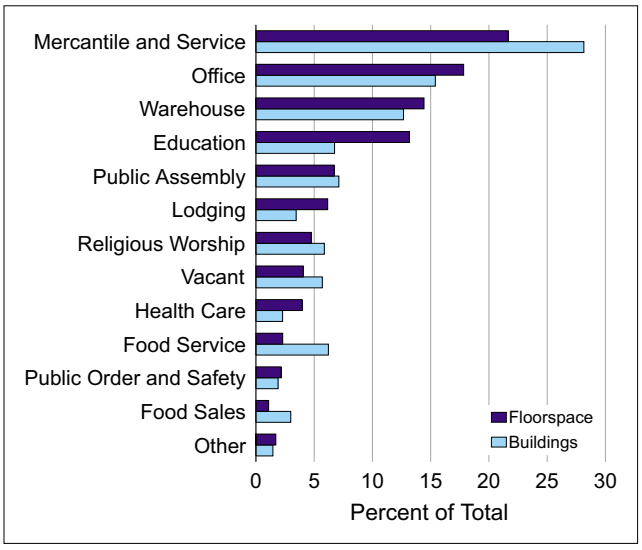
Some of the more notable findings in energy consumption in commercial buildings in 1995 are revealed at the energy source level and in differences between site and primary energy consumption. These are covered in the next chapter.

Principal Building Activities

Four types of building activity—mercantile and service, office, warehouse and storage, and education—comprised 67 percent of commercial floorspace and 63 percent of commercial buildings in 1995 (Figure 8). Mercantile and service buildings were by far the most numerous type (more than 28 percent), but they were not as dominant in floorspace (22 percent). Comparison of the percentage of floorspace and buildings for a given category gives an indication of the mean, or average, size of buildings in the category. For example, education buildings accounted for 13 percent of total floorspace and 7 percent of total buildings; i.e., those buildings were larger in average size (Figure 9). At 25,100 square feet per building, education buildings were the largest type, much larger than the average of all commercial buildings (12,800 square feet per building). Two other activities, lodging and health care (22,900 and 22,200 square feet per building, respectively), had buildings that were also larger than average.

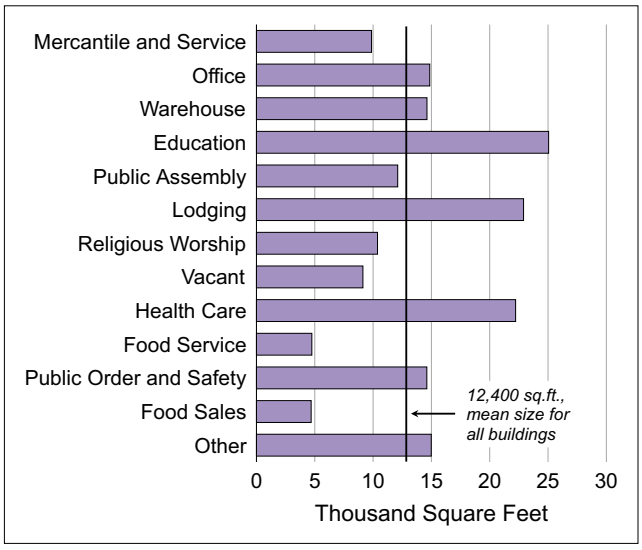
Each principal building activity category has its own set of characteristics (e.g., end-use equipment used, number of workers, hours of operation) that contribute to total energy use. Comparison of Figures 8 and 10 shows that buildings, floorspace, and total consumption are distributed differently across building activity categories. Mercantile and service buildings and office buildings accounted for the largest proportion of energy use—together they accounted for 2.0 quadrillion Btu of consumption, 37.4 percent of total consumption. Three building types—health care, food service, and food sales—each had a significantly higher energy intensity than the average of 90.5 thousand Btu per square foot for all commercial buildings (Figure 11). Warehouses, religious worship buildings, and vacant buildings had lower-than-average intensities; together they accounted for 23.2 percent of floorspace, but only 9.0 percent of total consumption.

Figure 8. Distribution of Floorspace and Buildings by Principal Building Activity, 1995



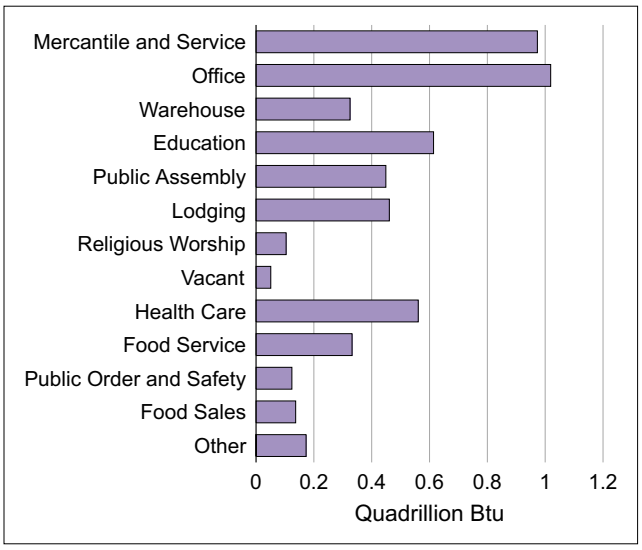
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 9. Mean Building Size by Principal Building Activity, 1995



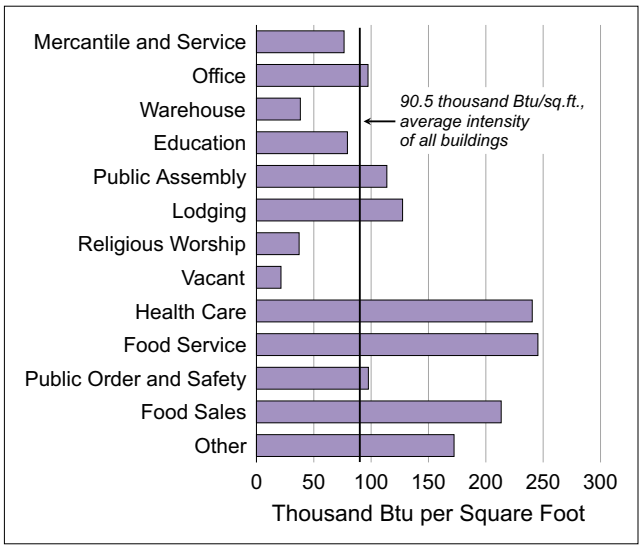
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 10. Site Energy Consumption by Principal Building Activity, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 11. Site Energy Intensity by Principal Building Activity, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

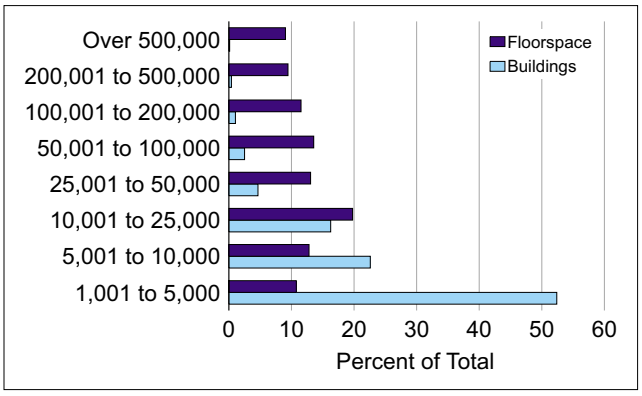
Size of Buildings

There are many more small commercial buildings than large ones. The vast majority of buildings were found in the smallest size categories, with more than half (52 percent) in the smallest category (1,001 to 5,000 square feet) and three-quarters in the two smallest categories (1,001 to 10,000 square feet) (Figure 12). Less than 5 percent of buildings (188,000 buildings) were larger than 50,000 square feet and less than 2 percent (73,000 buildings) were larger than 100,000 square feet.

The energy use characteristics of the smallest and largest commercial buildings are quite different. In smaller buildings, heating and cooling systems are employed primarily to moderate outside air temperatures (as they are in residential buildings). In large commercial buildings, outside air conditions have less impact on heating and cooling systems than do activities within the buildings—equipment used, lighting levels, number of people, and hours of operation. For example, one part of a building might need to be heated and ventilated to provide comfortable conditions for employees, while a computer room might need to be cooled because of excess heat given off by the computer equipment. Chapter 4, "End-Use Equipment and Energy Conservation," explores some of these differences in more detail.

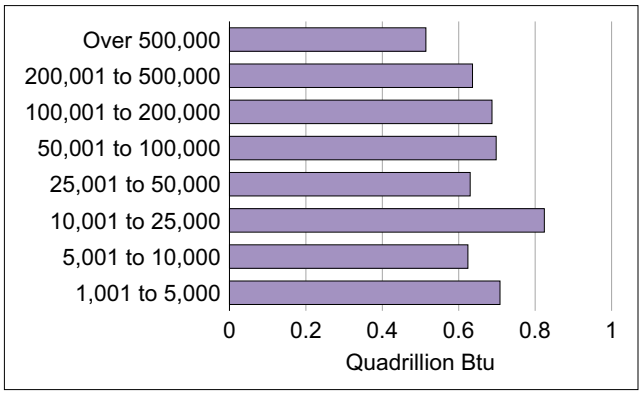
Total energy consumption was fairly evenly distributed across building size categories (the largest size category was slightly less than two categories—1,001 to 5,000 square feet and 10,001 to 25,000 square feet; other differences were not significant) (Figure 13). One category (10,001 to 25,000 square feet) had a lower energy intensity than other categories (Figure 14).

Figure 12. Distribution of Floorspace and Buildings by Size of Building, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 13. Site Energy Consumption by Size of Building, 1995

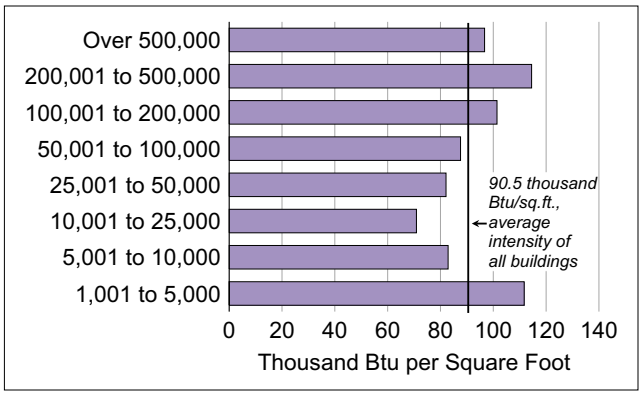


Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Examples of buildings by size category:

1,001 to 5,000: convenience store
25,001 to 50,000: 1-to-5 story office building; large supermarket
100,001 to 200,000: 3-to-8 story office building; large 2,000 student metropolitan high school
Over 500,000: 15 or more story office building; indoor football or baseball stadium

Figure 14. Site Energy Intensity by Size of Building, 1995



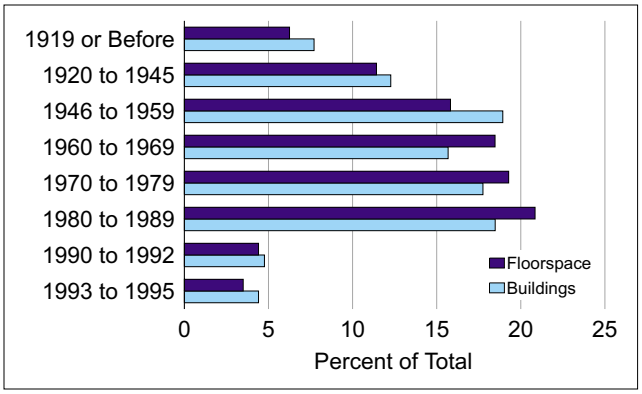
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Year Constructed

Most commercial buildings, once constructed, are expected to last for decades. Although new buildings are constructed each year and older buildings are demolished, the commercial buildings stock at any point in time is dominated by older buildings (the median age of commercial buildings in 1995 was 30.5 years). More than 70 percent of buildings and total floorspace in 1995 were constructed prior to 1980, and more than 50% of buildings and floorspace prior to 1970 (Figure 15). During the 1990's, 420,000 buildings and more than 4.6 billion square feet of floorspace were added to the commercial buildings sector, but they each represented less than 10 percent of buildings and floorspace in the 1995 buildings stock.

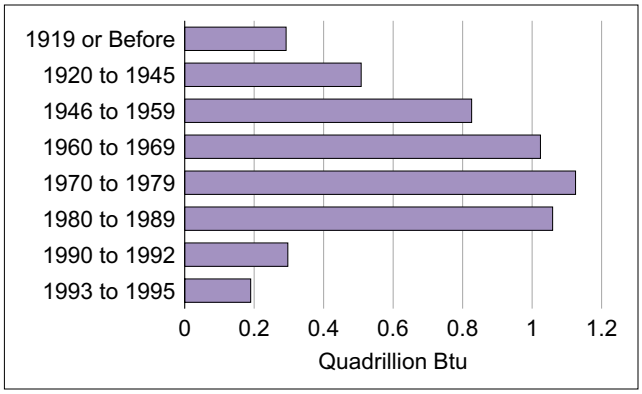
Total energy consumption was concentrated in buildings constructed in the 1960's, 1970's, and 1980's—a reflection of the greater number of buildings in those categories (Figure 16). The energy intensity by year constructed categories showed no statistically significant differences between any of the categories (Figure 17).

Figure 15.Distribution of Floorspace and Buildings by Year Constructed, 1995



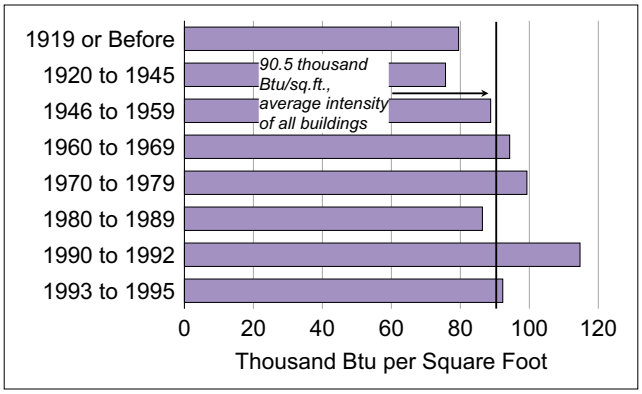
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 16. Site Energy Consumption by Year Constructed, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 17. Site Energy Intensity by Year Constructed, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

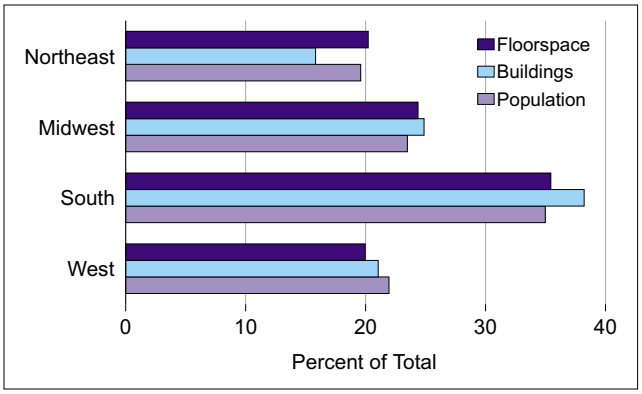
Location

Census Region

The U.S. Census Bureau divides the United States into four Census regions, each with nine to 16 States (see box on following page). For 1995, commercial buildings, floorspace, and population were distributed in a similar pattern for the four regions (Figure 18). The high correlation of buildings and floorspace with population was not surprising because commercial activity mostly entails the provision of services to people. There were slight differences in the regional distribution of buildings and floorspace. Buildings in the Northeast were larger on average (16,400 square feet per building) than those in the other three regions (11,900 to 12,600 square feet per building).

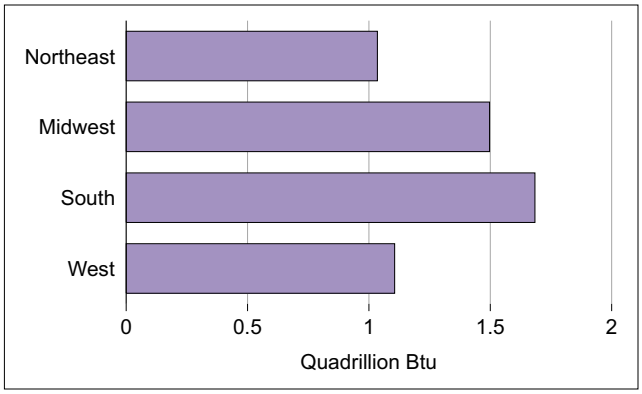
The pattern of energy consumption by Census region is similar to that of buildings and floorspace (Figure 19). Energy intensity in the Midwest region is higher than average and that in the South is lower than average (Figure 20).

Figure 18. Distribution of Floorspace and Buildings by Census Region, 1995



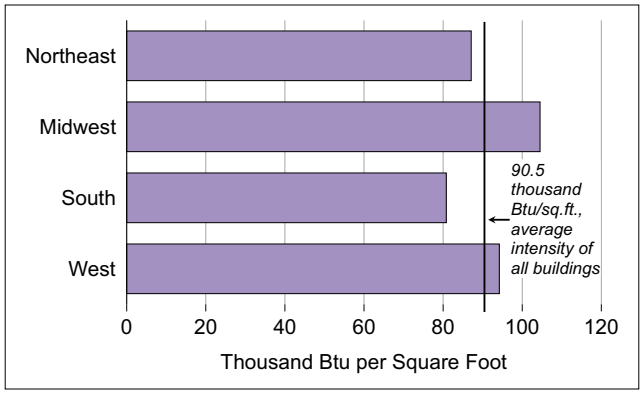
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 19. Site Energy Consumption by Census Region, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 20. Site Energy Intensity by Census Region, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Census Regions

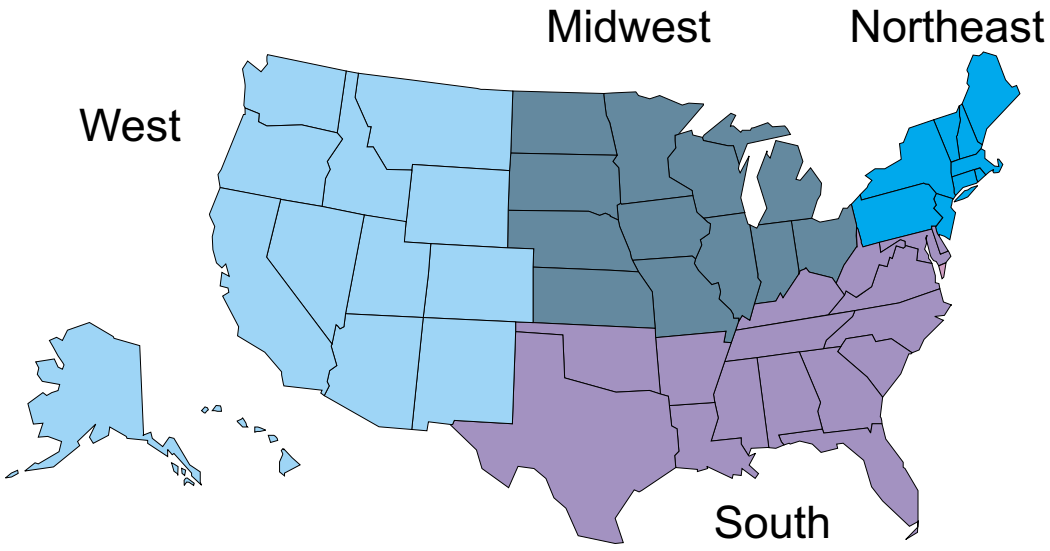
The Bureau of the Census (U.S. Department of Commerce) has divided the United States into four geographic regions, each with nine to sixteen states.

Northeast Region: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont

Midwest Region: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin

South Region: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

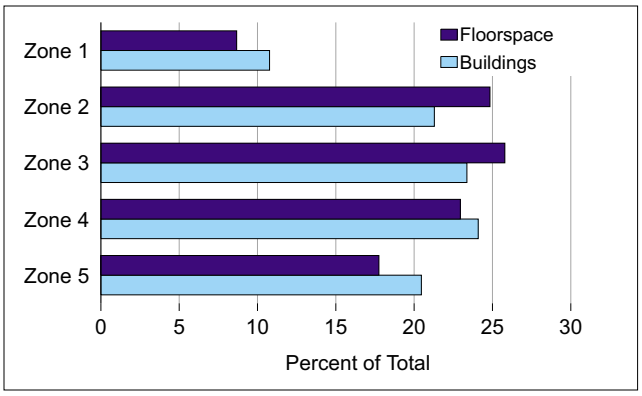
West Region: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming



Climate Zone

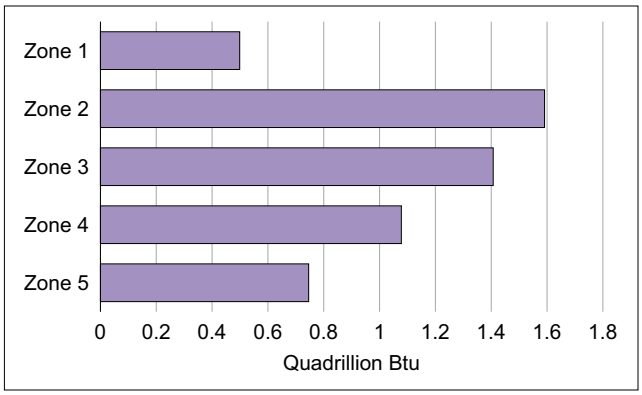
Temperature data from the National Oceanic and Atmospheric Administration were used to define five climate zones for the United States (see box on following page). The zones are oriented roughly east-west, with Zone 1 the northernmost (and coldest) and Zone 5 the southernmost (and warmest). Heating and/or cooling loads would be expected to be similar within each of the zones. Commercial buildings, floorspace, and consumption were unevenly distributed (Figures 21 and 22). Less than 10 percent of floorspace and less than 12 percent of buildings were found in Zone 1, while the other four zones each had roughly equal shares of buildings and floorspace. The average energy intensity of buildings in Zone 2 was greater than that of buildings in Zone 5 (Figure 23). All other comparisons between zones were not statistically significant.

Figure 21. Distribution of Floorspace and Buildings by Climate Zone, 1995



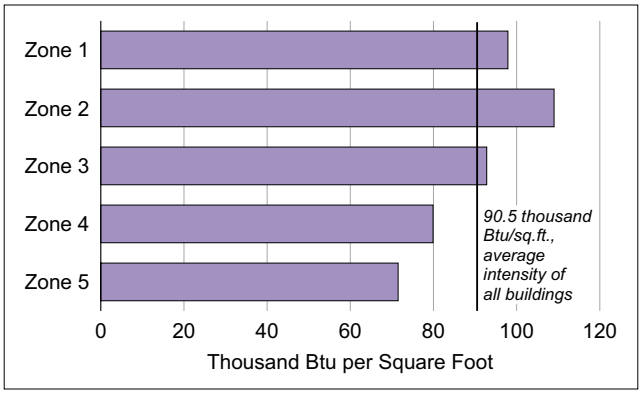
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 22. Site Energy Consumption by Climate Zone, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 23. Site Energy Intensity by Climate Zone, 1995



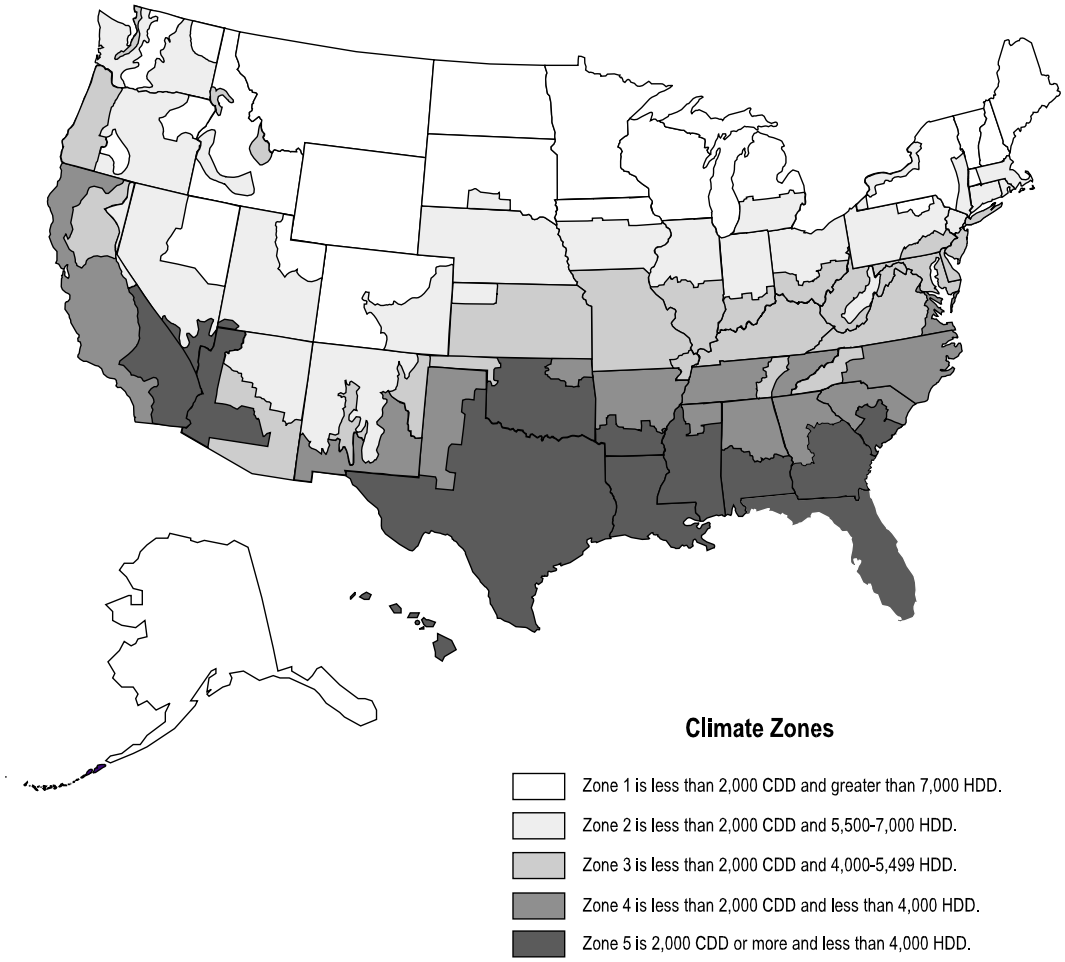
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Climate Zones

The United States is divided into five climatically distinct areas climate zones that are defined by long-term weather conditions that affect heating and cooling loads in buildings. The zones are based on the 45-year average annual number of degree-days (with a 65 degree Fahrenheit base). Annual heating degree-days (HDD) are a measure of how cold a building location is relative to the base temperature. The HDD is the numerical difference between the 45-year average temperature and 65 degrees (if less than 65; otherwise it is zero). The annual HDD is the sum of the daily HDD for the reference year. Annual cooling degree-days (CDD) are a measure of how warm a building location is relative to the base temperature. The CDD is the numerical difference between the 45-year average temperature and 65 degrees (if greater than 65; otherwise it is zero). The annual CDD is the sum of the daily CDD for the reference year.

Examples of cities in each of the climate zones:

Climate Zone 1 Billings, Montana; Minneapolis, Minnesota; Augusta, Maine
Climate Zone 2 Omaha, Nebraska; Akron, Ohio; Boston, Massachusetts
Climate Zone 3 Wichita, Kansas; Lexington, Kentucky; Baltimore, Maryland
Climate Zone 4 San Francisco, California; Memphis, Tennessee; Raleigh, North Carolina
Climate Zone 5 Honolulu, Hawaii; New Orleans, Louisiana; Miami, Florida



3. End Uses, Energy Sources, and Energy Consumption

Commercial buildings exist to house commercial establishments and provide a comfortable environment for employees and on-site customers or occupants. Energy is consumed in buildings to maintain the physical environment and to power any equipment needed to accomplish commercial activities. Important energy-related questions are—For what purposes is energy used? What sources of energy are used? How much energy is consumed? How intensely is the energy used? To answer these and related questions, the Commercial Buildings Energy Consumption Survey collects information on energy sources, the end uses of energy, and energy consumption.

- End uses are the purposes for which the energy is consumed, such as space heating, cooling, and lighting.

- Energy sources are the types of energy or fuels consumed in the building—electricity, natural gas, and district heat are examples of energy sources used in commercial buildings.

The box on the following page lists the specific end uses and energy sources that the respondents to the survey were questioned about.

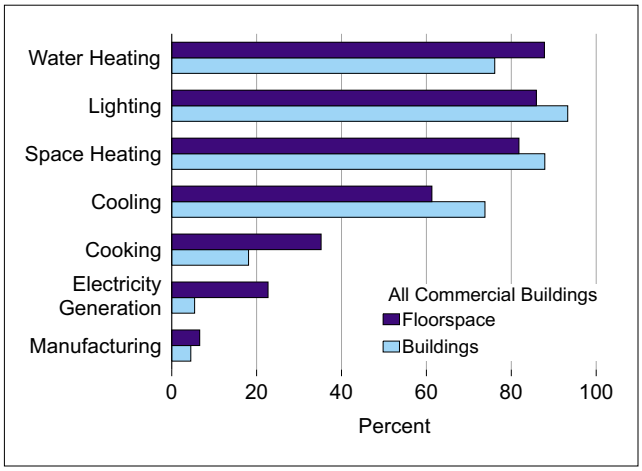
Energy End Uses

The types of activities within commercial buildings determine what specific energy-consuming services will be needed. The vast majority of commercial buildings used energy for lighting, space heating, water heating, and cooling (each of these end uses exceeded 73 percent of buildings and 60 percent of floorspace)[1] (Figure 24). The percentage of buildings and floorspace served by the major end uses showed no significant changes from the 1989 CBECS to the 1992 CBECS to the 1995 CBECS, with the exception of electricity generation. That end use increased from less than two percent of buildings and eight percent of floorspace in 1989 (see *Commercial Buildings Characteristics 1989*, DOE/EIA-246(89)) to more than five percent of buildings and 22 percent of floorspace in 1995.

Space heating had the greatest variety of energy sources; natural gas and electricity were dominant (each used for more than 39 percent of heated floorspace and more than 36 percent of heated buildings) and fuel oil, district heat, and propane were significant contributors (Figure 25). District heat was used primarily for heating in larger buildings (51,400 square feet on average) and propane was used primarily in smaller buildings (6,700 square feet on average). Use of wood for space heating in commercial buildings was very limited (only 1 percent of heated floorspace and 3 percent of heated buildings).

Natural gas and electricity were used in about equal percentages of buildings and floorspace for water heating (more than 44 percent of buildings and floorspace in buildings with water heating) (Figure 26). Fuel oil, district heat, and propane were each used for less than 8 percent of floorspace and 4 percent of buildings with water heating. District heat and propane were used for water heating in larger (72,000 square feet on average) and smaller (9,300 square feet on average) buildings, respectively.

Figure 24. End Uses in Commercial Buildings by Percent of Floorspace and Buildings, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

[1] The percentages of floorspace for lighting, heating, and cooling refer only to the portions of floorspace within the buildings that were lit, heated, or cooled, respectively. The percentage of floorspace for each of the other end uses refer to all floorspace in the buildings with that particular end use.

Energy Sources and End Uses in the 1995 CBECS

The respondent for each building in the 1995 CBECS was asked what energy sources were used to supply energy to the building and what end uses those sources were used for:

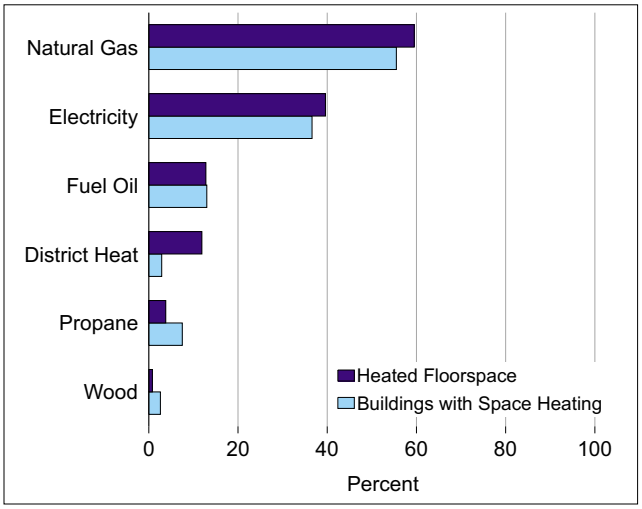
Energy Sources

electricity
natural gas
fuel oil (or diesel or kerosene)
propane (or bottled gas or LPG)
district steam or hot water piped into the building from a central plant or utility
district chilled water piped into the building from a central plant or utility
wood
coal
solar thermal panels that use sunlight to heat fluids
other
no energy used in 1995

End Uses

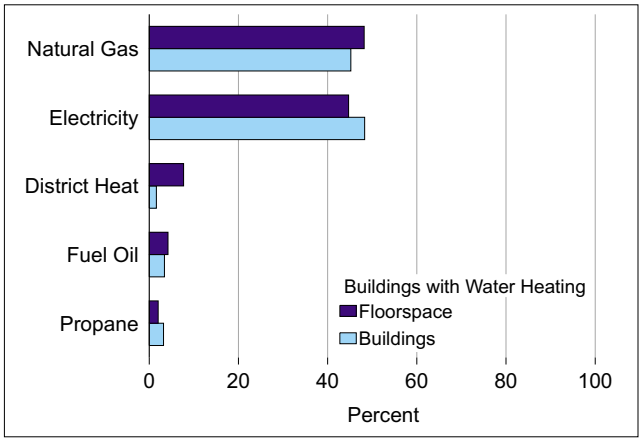
space heating (main and secondary)
air conditioning
domestic water heating
commercial or institutional cooking or food serving
manufacturing or other type of industrial activity
electricity generation, including emergency backup
lighting (electricity-only)
refrigeration (electricity-only)
personal computers and/or computer terminals (electricity-only)

Figure 25. Space Heating Energy Sources, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 26. Water Heating Energy Sources, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Electricity was the most flexible energy source in commercial buildings—a major source for the end uses shown in Figure 24, as well as the sole source for ventilation equipment, office equipment, and all other electrical equipment used in commercial buildings. Electricity was by far the dominant energy source for cooling (97.4 percent of cooled buildings and 95.0 percent of cooled floorspace). District chilled water and natural gas had limited use for cooling (each less than 7 percent of cooled floorspace and 2 percent of buildings with cooling). The former was used primarily in larger buildings (47,600 square feet on average).

Use of natural gas and electricity for cooking for commercial purposes was nearly equal (for natural gas, 54.1 percent of buildings with cooking and 63.7 percent of floorspace; for electricity, 58.1 percent of buildings and 59.1 percent of floorspace), with propane the third most used source (14.9 percent of buildings and 7.2 percent of floorspace). Commercial buildings with cooking were much larger than average, 25,000 square feet per building (compared to 12,800 square feet for all commercial buildings).

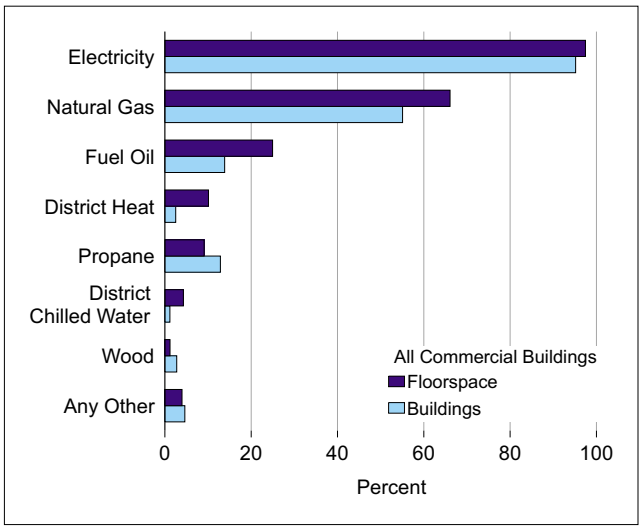
Electricity generation in commercial buildings was used predominantly for emergency back-up generation (78 percent of buildings and 88 percent of floorspace in buildings that had electricity generation). Buildings with electricity generation showed a strong bias towards larger buildings (54,100 square feet per building on average).

Energy Sources Used

Electricity and natural gas were by far the most commonly used sources of energy (for any use) in commercial buildings (Figure 27). Electricity use was nearly universal (95 percent of buildings and 97 percent of floorspace) while natural gas was used in 55 percent of buildings and 66 percent of floorspace. Fuel oil, the next most often used source, was used for 25 percent of total floorspace and 15 percent of buildings. A later section discusses the characteristics of buildings that used the four major energy sources for which CBECS collected consumption data (electricity, natural gas, fuel oil, and district heat). Commercial buildings that used propane or wood were smaller than average (9,000 square feet and 5,500 square feet for propane and wood, respectively, compared to 12,800 square feet for all buildings). The two district energy sources were used in buildings much larger than average (51,400 square feet for district heat and 47,600 square feet per building for district chilled water).

The CBECS collected information on major end uses; those that can be served by more than one type of energy source and those end uses that are exclusively sourced by electricity (e.g., lighting, office equipment, and refrigeration). The major uses of electricity that competed with other sources were cooling, space heating, water heating, and cooking[2] (Figure 28). The two dominant end uses of natural gas were space heating and water heating (Figure 29). Fuel oil and district heat (not shown), were predominantly used for space heating and water heating. Both of those energy sources, along with natural gas, served as the main space heating source when used for space heating. Electricity was more often used as a secondary space heating source than were the other three sources (32.5 percent of heated floorspace used electricity for space heating, but only 19.2 percent used electricity as the main source).

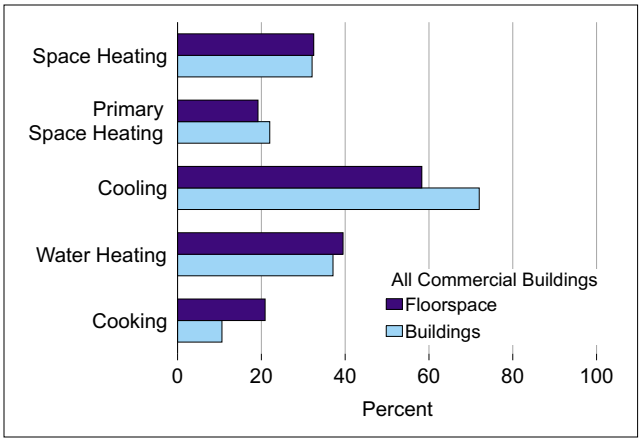
Figure 27. Energy Sources Used in Commercial Buildings, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

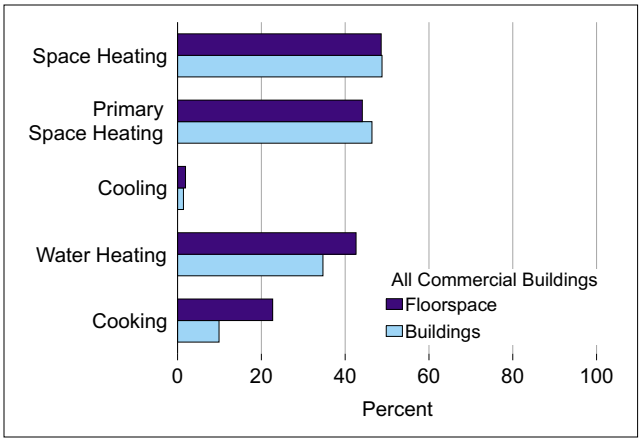
[2]The percentages of floorspace with water heating and cooking were calculated by dividing the sum of *all floorspace* in buildings with those end uses by total floorspace. The percentages of floorspace with space heating or cooling were calculated by dividing the sum of *only the heated or cooled portions of floorspace* within buildings with those end uses by total floorspace.

Figure 28. Electricity End Uses, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 29. Natural Gas End Uses, 1995



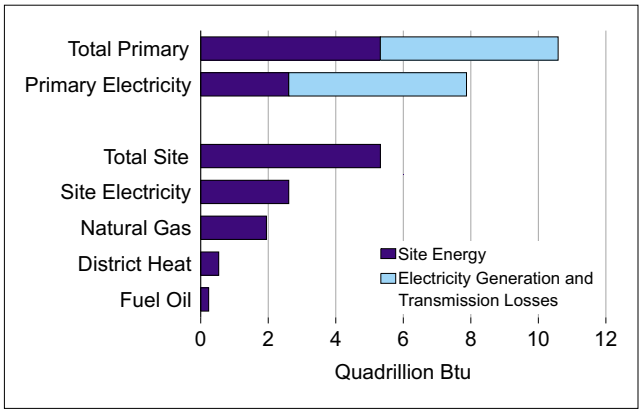
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Energy Consumption by Energy Source and End Use

In 1995, the total amount of site energy consumed by commercial buildings in the United States for major energy sources (electricity, natural gas, fuel oil, and district heat) was 5.3 quadrillion Btu (Figure 30). The greatest consumption for any energy source was 2.6 quadrillion Btu for electricity, followed by 1.9 quadrillion Btu for natural gas. District heat (0.5 quadrillion Btu) and fuel oil (0.2 quadrillion Btu) combined were less than half that of natural gas. Total *primary* energy consumption was 10.6 quadrillion Btu and primary electricity consumption was 7.9 quadrillion Btu.

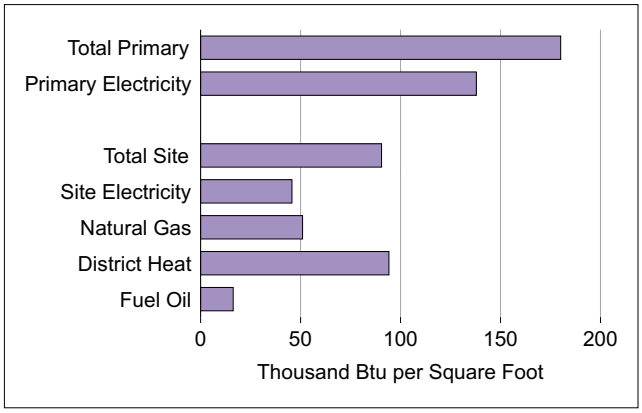
Energy consumption is one indicator of energy use; another is energy intensity, the amount of energy consumed per unit of service or activity.[3] Site electricity energy intensity and natural gas intensity in 1995 were similar, 45.7 thousand Btu per square foot for buildings that used electricity and 51.0 thousand Btu per square foot for buildings that used natural gas (Figure 31). Primary electricity intensity, at 137.9 thousand Btu per square foot, greatly exceeded natural gas intensity. There were no significant changes in energy intensities between the 1989 CBECS and the 1995 CBECS, with the exception of fuel oil intensity, which declined from

Figure 30. Site and Primary Energy Consumption by Energy Source, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 31. Site and Primary Energy Intensity by Energy Source, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

[3]For the commercial buildings sector, useful indicators of energy intensity are consumption per square foot, consumption per hour of operation, and consumption per worker. The most commonly used measure of commercial energy intensity is consumption per square foot. Two measures of floorspace can be used, total floorspace and conditional floorspace. Conditional floorspace may be energy-source specific (e.g., floorspace served by electricity) or end-use specific (e.g., heated floorspace).

27.0 thousand Btu per square foot in 1989 to 16.3 thousand Btu per square foot in 1995. All of these intensities were energy-source specific.

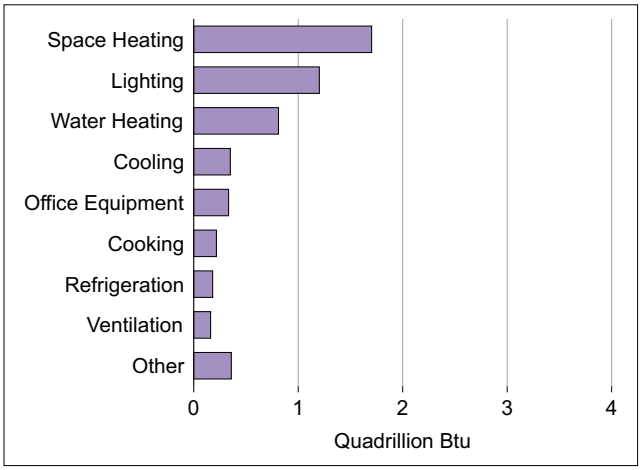
There were notable differences in site and primary end-use consumption (Figures 32 and 33):

- Space heating and lighting were the dominant end uses—combined they account for more than half of total site and primary consumption (54.6 percent of site consumption and 52.5 percent of primary consumption, respectively).

- Space heating site consumption exceeded lighting consumption (1.7 quadrillion Btu and 1.2 quadrillion, respectively) but, measured in terms of primary consumption, lighting energy requirements were nearly twice as large as those of space heating (3.6 quadrillion Btu for lighting and 1.9 quadrillion for space heating). Those differences resulted because lighting is solely electricity consumption, but space heating had only a small component of electricity consumption (Figures 34 and 35).

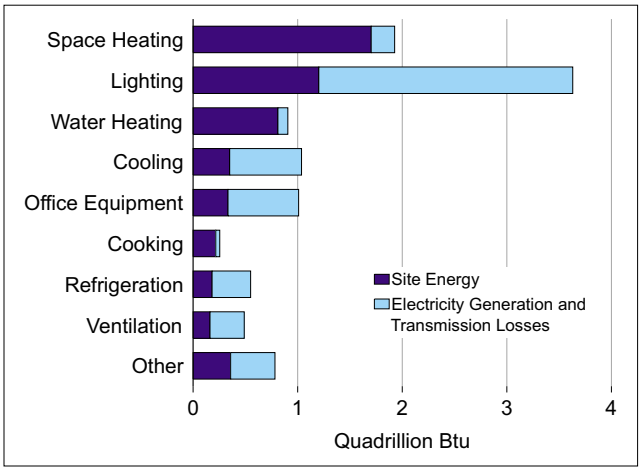
- Water heating site consumption was more than twice that of cooling or office equipment but, for primary consumption, the three end uses were nearly equal.

Figure 32. Total Site Energy Consumption by End Use, 1995



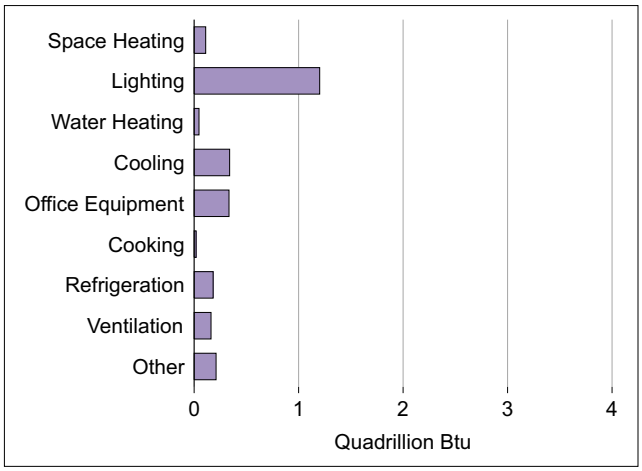
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 33. Total Primary Energy Consumption by End Use, 1995



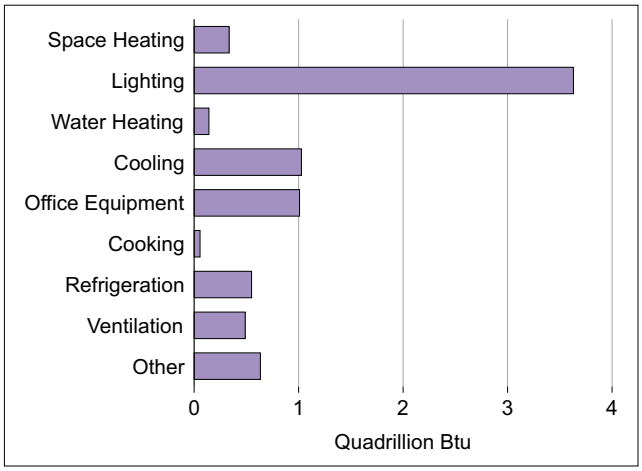
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 34. Site Electricity Consumption by End Use, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

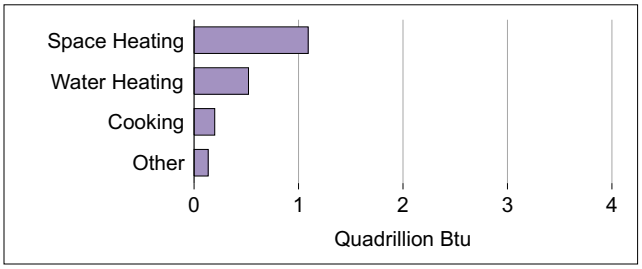
Figure 35. Primary Electricity Consumption by End Use, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Natural gas consumption was distributed mainly among three end uses—space heating, water heating, and cooking. Natural gas and electricity directly competed in those three end uses (compare Figures 34, 35, and 36). In each, natural gas consumption exceeded both site and primary electricity consumption.

Figure 36. Natural Gas Consumption by End Use, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

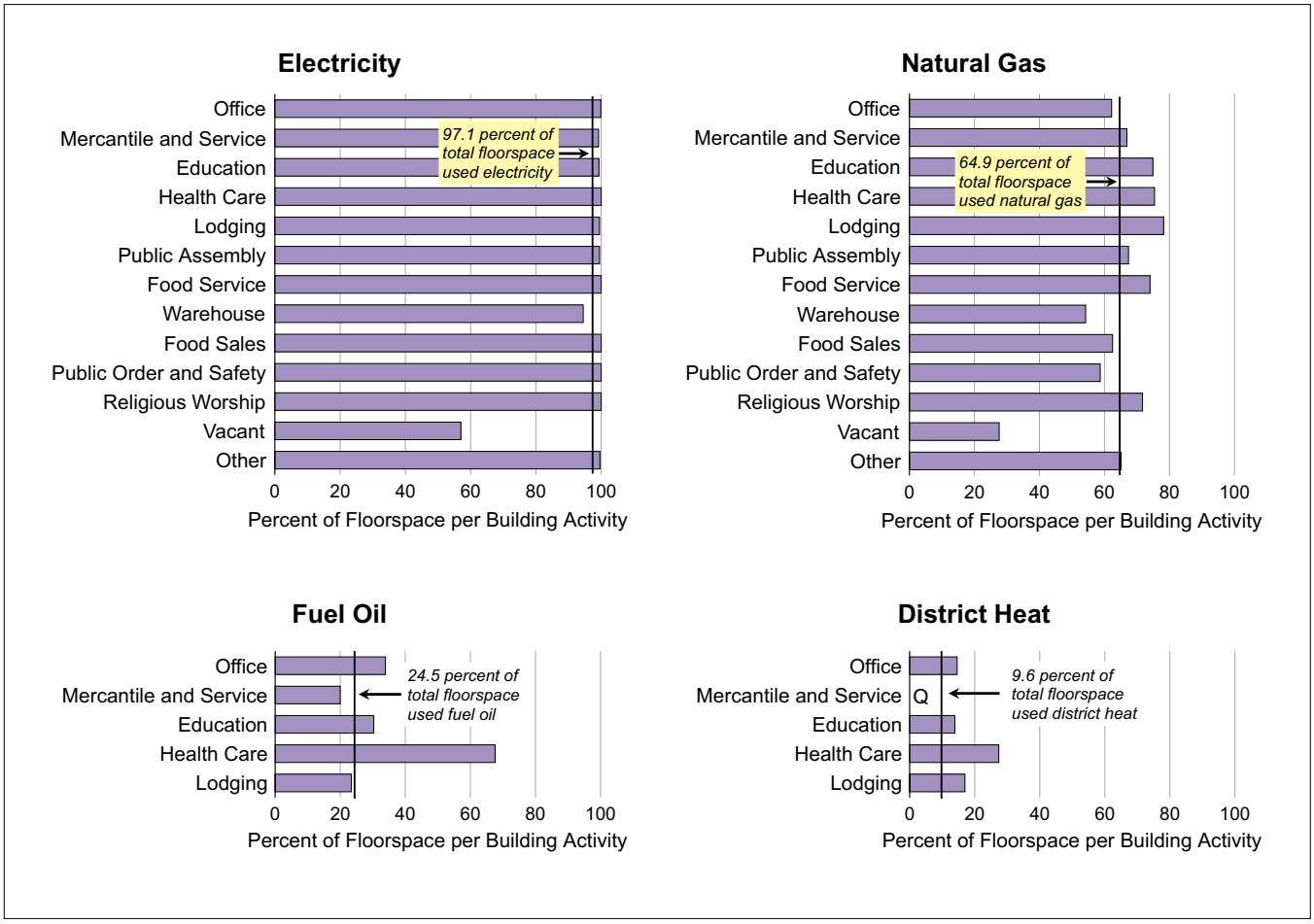
Major Energy Sources and Building Characteristics

The major energy sources used in commercial buildings and their energy intensities varied across categories of building characteristics: in particular, principal building activity, size of building, year constructed, and location.

Energy Sources and Principal Building Activity

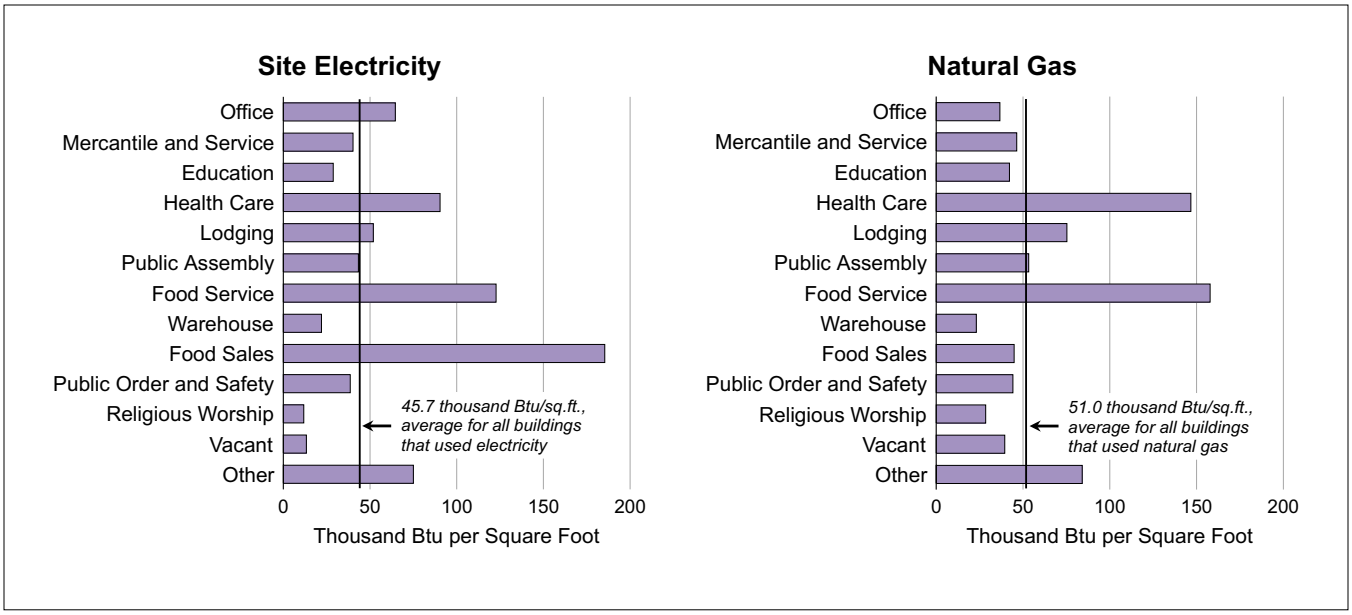
Electricity use was nearly universal in all commercial building types; the percentage of floorspace served by electricity exceeded 99 percent of total floorspace, with the exception of warehouses at 94.5 percent of floorspace and vacant buildings at 57.0 percent. The amount of floorspace that used natural gas was slightly less than two-thirds of total floorspace (64.9 percent) (Figure 37). None of the categories of principal build-

Figure 37. Percent of Floorspace That Used Major Energy Sources by Principal Building Activity, 1995



Q = Data withheld because relative standard error was greater than 50 percent, or fewer than 20 buildings were sampled.
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 38. Energy Intensities for Electricity and Natural Gas by Principal Building Activity, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

ing activity were significantly different from each other for natural gas, with the exception of vacant buildings at 27.6 percent—those buildings used natural gas significantly less than the average. The use of fuel oil and district heat by building activity is shown only for the five most common building types—the standard errors were too large or the number of cases were too few to report for the other building types.[4] The use of fuel oil (primarily for backup electricity generation) was especially high for health care buildings. More than two-thirds (67.6 percent) of those buildings used fuel oil. No other type exceeded 40 percent. The greatest use of district heat was for four building types: office, education, health care, and lodging—all exceeded 13 percent of floorspace.

The energy intensities for electricity and natural gas varied by building type (Figure 38). Electricity intensity (site electricity) was significantly higher for three building types—health care, food service, and food sales, all intensive users of electrical equipment (e.g., medical equipment, refrigerators). Three building types, warehouse, religious worship, and vacant, had lower than average intensities. Religious worship buildings were lower, in part, because of their fewer operating hours. That was reflected in their cooling, lighting, and office equipment intensities, all of which were much lower than average (Detailed Table EU-4).

Two building types had higher than average natural gas intensities, health care and food service, both more than twice the average for all buildings (146.7 thousand Btu per square foot for health care, 157.8 thousand for food service, and 51.0 thousand for all buildings). For health care buildings, space heating, cooking, and especially water heating intensities were much greater than average (Detailed Table EU-6). For food service buildings, cooking and water heating intensities were especially high. Two buildings types, warehouse and religious worship, had lower than average natural gas intensities.

There were no significant differences in either fuel oil or district heat energy intensities for the five major building activities (not shown).

Energy Sources and Size of Building, Year Constructed, and Location

Three important energy-related building characteristics are size of building, year constructed, and location (Census region and climate zone). The use of electricity was nearly universal across those four characteristics categories (Figure 39). Natural gas was used in fewer smaller buildings (53.6 percent of floorspace in the smallest size category, 67.7 percent and 70.4 percent in the two largest categories). The apparent differences in other categories were not statistically significant. There were several significant differences across categories for both fuel oil and district heat. Fuel oil and district heat were both more widely used in

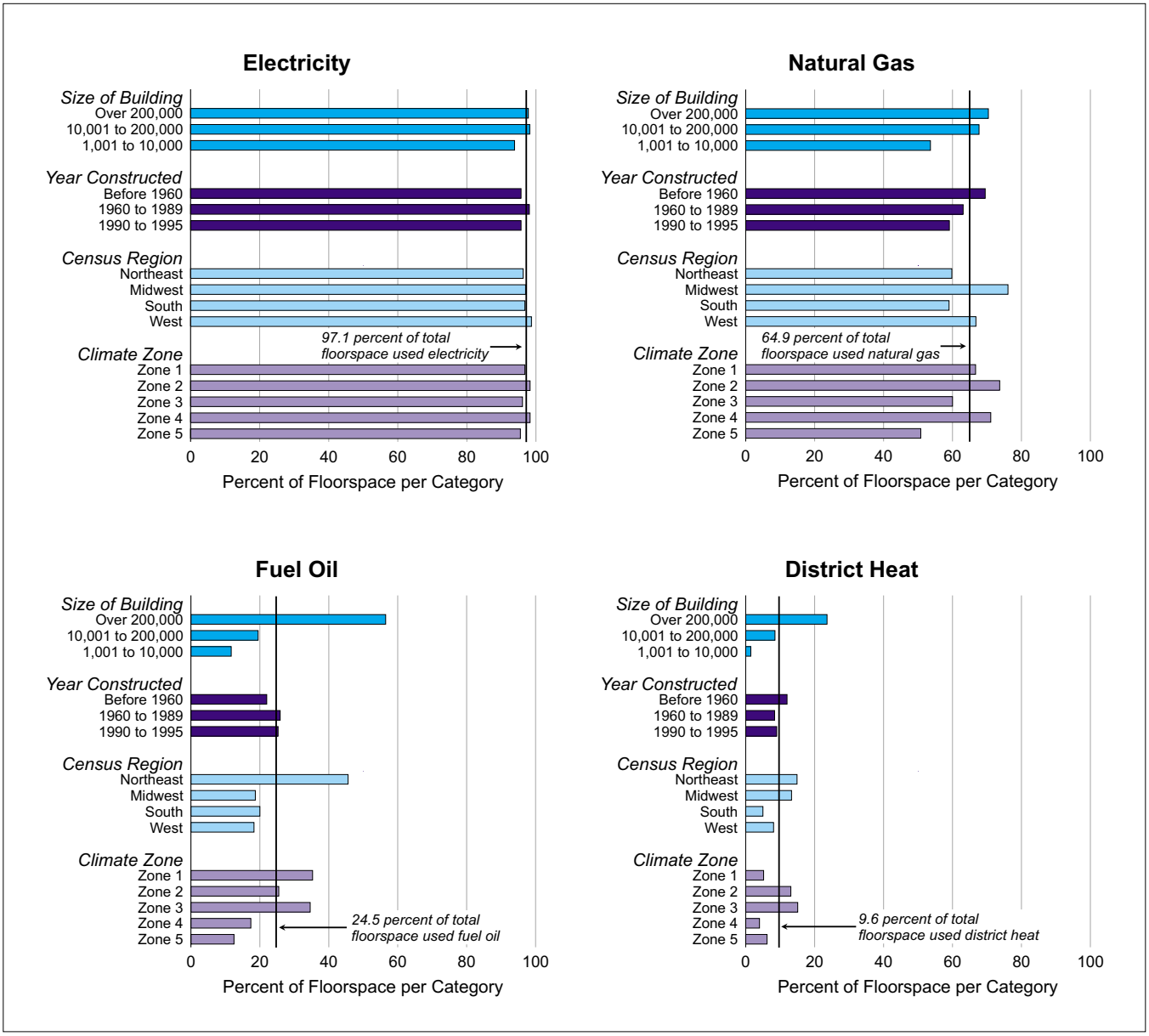
[4]Data were withheld if the relative standard error was greater than 50 percent, or fewer than 20 buildings were sampled.

larger commercial buildings. More than half (56.5 percent) of floorspace in buildings larger than 200,000 square feet used fuel oil and nearly one-fourth (23.6 percent) of floorspace of those buildings used district heat. The percent of floorspace that used fuel oil in the Northeast (45.6 percent) was more than twice that of any other Census region (each of those less than 20 percent of floorspace). The percent of floorspace that used fuel oil was lowest in climate zone 5, the warmest region. That was to be expected, since most fuel oil consumption was for space heating.

The only category that showed a significant difference in electricity intensity was year constructed—electricity intensity was greater for the most recently constructed buildings (1990 to 1995) (Figure 40). In those buildings, the electricity end uses that were more intensely used were cooling, lighting, water heating, and office equipment (Detailed Table EU-4).

Natural gas intensities were significantly greater for the smallest buildings, buildings in the Midwest, and buildings in the coldest climate zones. In smaller buildings, natural gas space heating intensity and cooking intensity were both higher than average (Detailed Ta-

Figure 39. Percent of Floorspace That Used Major Energy Sources by Size of Building, Year Constructed, Census Region, and Climate Zone, 1995

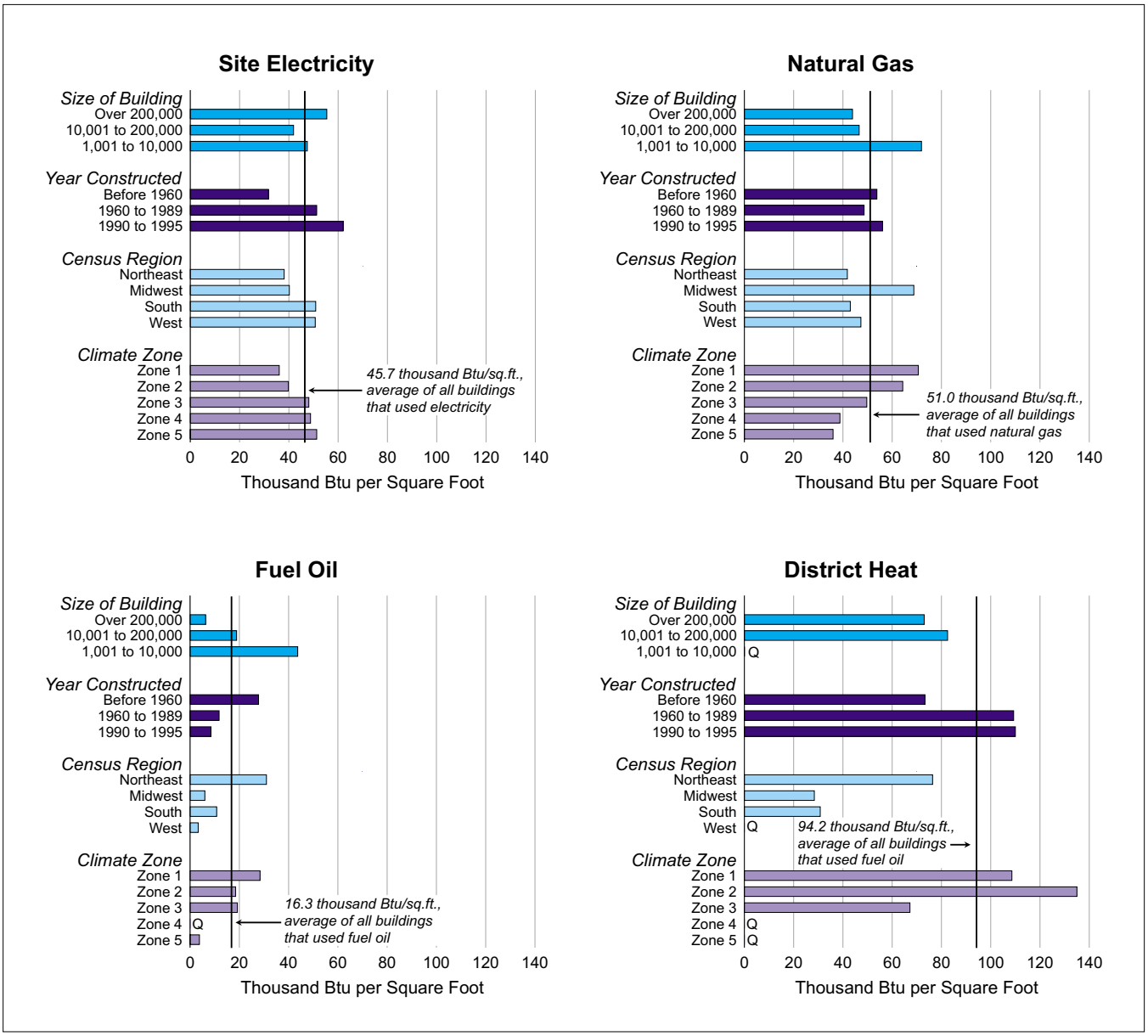


Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

ble EU-6). In the Midwest and in the colder zones, natural gas space heating intensity was much higher than average (Detailed Table EU-6).

There were significant differences for each of the four size categories for fuel oil. Fuel oil intensity was greater in smaller buildings and in older buildings in the Northeast and in colder climates. The greater intensity in the Northeast and in the cooler climate zones reflected the greater use of fuel oil for heating. There were no significant differences within any of the categories for district heat.

Figure 40. Energy Intensities for Major Energy Sources by Size of Building, Year Constructed, Census Region, and Climate Zone, 1995



Q = Data withheld because relative standard error was greater than 50 percent, or fewer than 20 buildings were sampled.
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

4. End-Use Equipment and Energy Conservation

Energy is used within buildings by end-use equipment. Commercial buildings use a variety of practices to conserve the use of energy by end-use equipment.

- End-use equipment refers to the specific type of equipment that is used to perform a given end use. Types of end-use equipment include: heat pumps, furnaces, packaged air-conditioning units, central chillers, fluorescent light fixtures, and compact fluorescent bulbs.

- Energy conservation features include those related to the building shell; the heating, ventilation, and air-conditioning systems (HVAC); and the lighting systems. Energy management practices are energy efficiency programs that are designed to reduce the energy used by specific end-use equipment.

End-Use Equipment

Space Heating Equipment

Four types of heating equipment were used extensively in commercial buildings—packaged heating units, boilers, individual space heaters, and furnaces (Figures 41 and 42; Tables 1a, 1b, and 1c; box on following page).[1] Of these four, boilers were most often the main equipment used by percentage of total heated floorspace, whereas furnaces were the main type in the largest percentage of heated buildings (compare Figures 41 and 42). All four types were used to heat about 30 percent of total heated floorspace (either main or other use), but their use as a percentage of heated buildings varied from as little as 15 percent for boilers to as much as 42 percent for furnaces. That difference reflected their use in buildings of different average sizes; that is, boilers were used in larger buildings, and furnaces were used in smaller buildings. There were no statistically significant changes in the use of the different types of heating equipment from the 1989 CBECS to the 1992 CBECS to the 1995 CBECS.

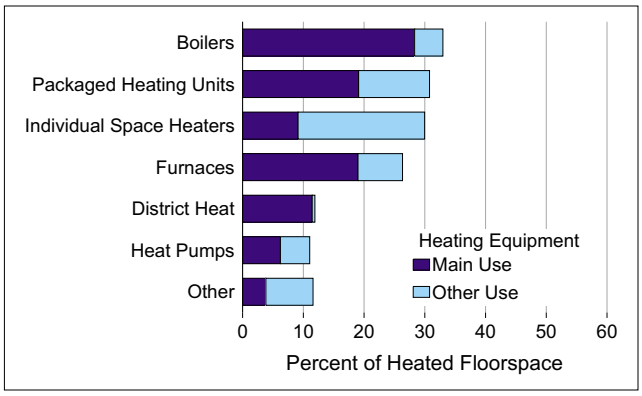
[1]Text Tables 1a through 6b are found at the end of this chapter.

- Boilers heated 45 percent of heated floorspace in the largest size category (buildings larger than 200,000 square feet) but were used for only 13 percent of heated floorspace in the smallest category (buildings 10,000 square feet or less) (Figure 43).

- District heat was used for 28 percent of heated floorspace in the largest buildings but for just 2 percent of floorspace in the smallest buildings.

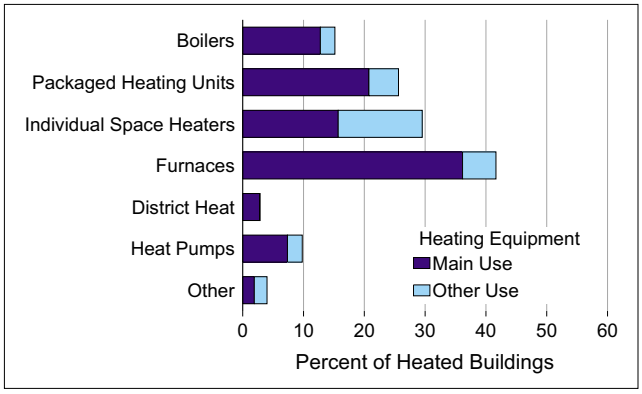
- Furnaces showed the opposite relationship—they served 47 percent of heated floorspace in the smallest buildings but only 12 percent in the largest buildings.

Figure 41. Heating Equipment Used for Main and Other Use, Percent of Heated Floorspace, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 42. Heating Equipment Used for Main and Other Use, Percent of Heated Buildings, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Space Heating and Cooling Equipment in the 1995 CBECS

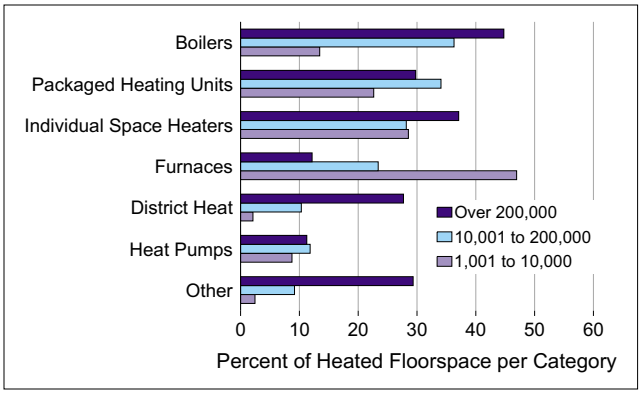
The following types of space heating equipment were included in the 1995 CBECS Building Questionnaire:

Boilers inside the building that produce steam or hot water
Packaged heating units
Individual space heaters, free-standing or mounted in walls, ceilings, or windows
Furnaces that heat air directly, without using steam or hot water
District steam or hot water piped in from outside the building
Heat pumps (other than packaged units)
Other heating equipment

The following types of cooling equipment were included in the Building Questionnaire:

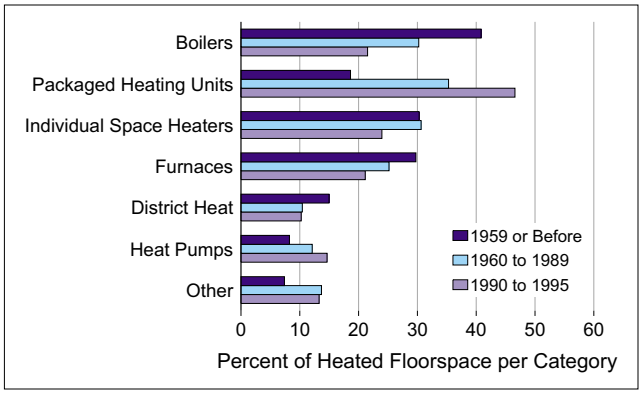
Packaged air conditioning units, often roof- or slab-mounted
Central chillers inside the building that chill water for air conditioning
Individual room air conditioners, window- or wall-mounted
Residential-type central air conditioners, other than heat pumps, that cool air directly and circulate it without chilled water
Heat pumps
District chilled water piped in from outside the building
Swamp or evaporative coolers
Other cooling equipment

Figure 43. Heating Equipment Used by Size of Building, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 44. Heating Equipment Used by Year Constructed, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Two types of heating equipment showed significant differences by the age of buildings that they were used in: boilers were used most widely in older buildings, and packaged heating units were used most widely in more recently constructed buildings (Figure 44).

- Boilers heated 41 percent of heated floorspace in older buildings (those constructed before 1960) and about half as much (22 percent) in buildings constructed in the 1990's.

- Packaged heating units were much more commonly used in the newer buildings: for 47 percent of heated floorspace in buildings constructed in the 1990's, but only 19 percent of heated floorspace in those constructed before 1960.

The four predominant types of heating equipment had the heat they produced distributed primarily via one of three types of heating distribution system (Tables 2a, 2b, and 2c). Warm air produced by packaged units and furnaces was distributed primarily by ducts or air-handling units; hot water or steam generated by boilers was transported to radiators or baseboards to heat air; and individual space heaters gave off heat directly to surrounding areas without a separate distribution system.

Cooling Equipment

Packaged air-conditioning units were by far the most widely used type of cooling equipment, both as the main equipment used and for total use (Figures 45 and 46; Tables 3a, 3b, and 3c). They cooled 55 percent of cooled floorspace and 42 percent of cooled buildings and were the main equipment for 37 percent of both cooled floorspace and buildings. Central chillers were used to cool more than a quarter of cooled floorspace (but only 3 percent of buildings), while individual (window or wall) air-conditioning units, residential-type central air-conditioning, and heat pumps were used slightly less (15 percent to 19 percent of cooled floorspace). There were no significant changes in the use of the different types of cooling equipment between the 1992 and 1995 CBECS (comparable data from 1989 are not available).

Particular types of cooling equipment showed significant differences in use by size of building (Figure 47).

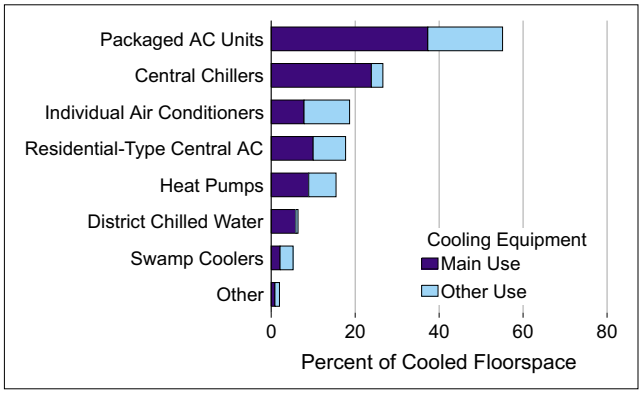
- Residential-type central air-conditioning units showed relatively greater use in the smallest buildings.

- Central chillers were used primarily in the largest buildings. That equipment type cooled 65 percent of cooled floorspace in the largest buildings but cooled only one-third as much, 22 percent, in the middle category (buildings 10,001 to 200,000 square feet in size).

The age of the building was less of a factor for type of cooling equipment than for type of heating equipment. Only buildings that used individual (window or wall) air-conditioning units showed a significant relationship (Figure 48). Those units were much more common in buildings constructed before 1960 than in buildings constructed after 1989. They cooled about one-third of the cooled floorspace in older buildings but only 6 percent in buildings constructed in the 1990's.

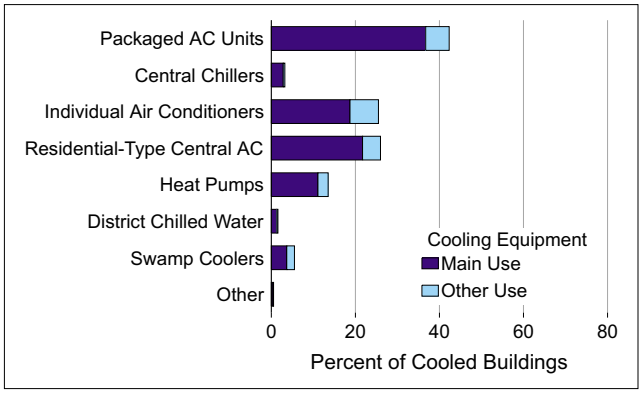
Packaged air-conditioning units, residential-type central air conditioners, and cold air produced by central chillers had the cool air distributed primarily by ducts or air-handling units (Tables 4a, 4b, and 4c). Central chillers that produced chilled water had cool air distributed via the use of fan-coil units. Individual air-conditioning units cooled air directly (without a separate system) in the room or area where they were located.

Figure 45. Cooling Equipment Used for Main and Other Use, Percent of Cooled Floorspace, 1995



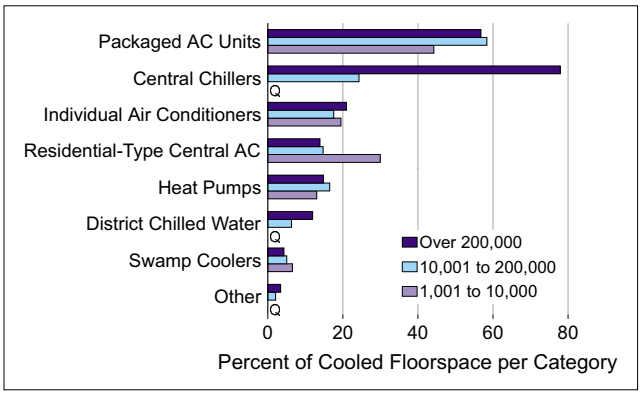
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 46. Cooling Equipment Used for Main and Other Use, Percent of Cooled Buildings, 1995



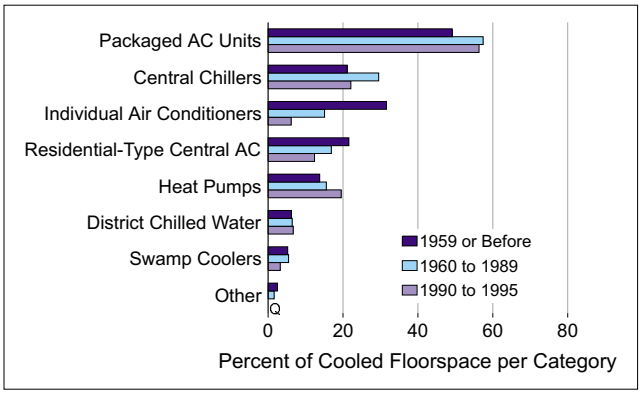
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 47. Cooling Equipment Used by Size of Building, 1995



Q=Data withheld because relative standard error was greater than 50 percent, or fewer than 20 buildings were sampled.
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 48. Cooling Equipment Used by Year Constructed, 1995



Q=Data withheld because relative standard error was greater than 50 percent, or fewer than 20 buildings were sampled.
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Lighting Equipment

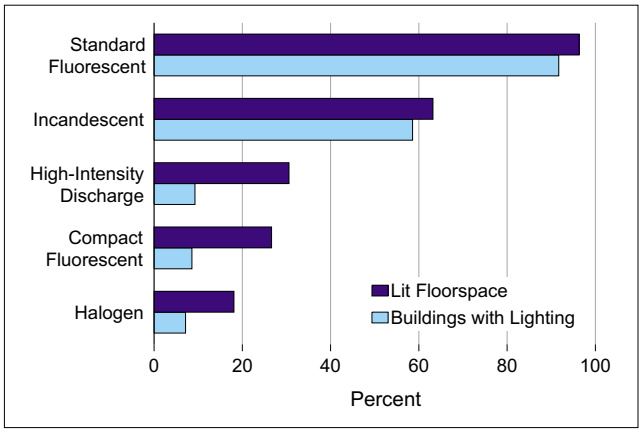
The CBECS collected information on five types of lighting systems: incandescent, standard fluorescent, compact fluorescent, high-intensity discharge, and halogen (Figure 49).

- Standard fluorescent lighting fixtures were found in nearly all buildings that had lighting equipment (more than 90 percent of lit buildings and floorspace). Incandescent light bulbs were also widely used (around 60 percent of lit buildings and floorspace).

- The three newer kinds of lighting technology—high-intensity discharge, compact fluorescent, and halogen lamps—were used in relatively few buildings (each less than ten percent of buildings). The size of commercial building that used any of the three types was much larger than average. The average size of buildings that used high-intensity discharge lamps was 41,500 square feet; the average for those that used compact fluorescent lamps was 39,400 square feet; and the average for those that used halogen lights was 32,200 square feet.

- The use of compact fluorescent lamps increased from 14 percent of lit floorspace in 1992 to 27 percent in 1995 (data were not collected in 1989).

Figure 49. Lighting Equipment Used in Commercial Buildings, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Energy Conservation Features and Practices

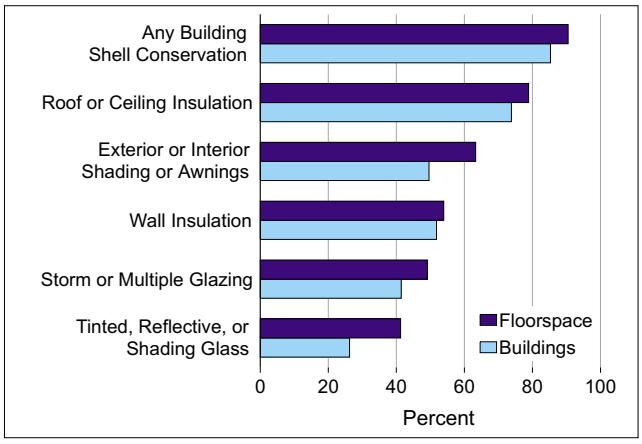
Information on specific conservation features or practices was collected for: building shells; heating, ventilation, and air-conditioning (HVAC) systems; and lighting systems. Energy conservation was widely practiced; a significant percentage had installed or employed some type of conservation feature or practice (89 percent of buildings, 94 percent of floorspace) (Tables 5a and 5b).

- Most commercial buildings had some type of building shell conservation feature (85 percent of buildings, 91 percent of floorspace) (Figure 50). The type most often found was roof or ceiling insulation (74 percent of buildings, 79 percent of floorspace). HVAC conservation features were, in general, less common than building shell features (Figure 51). HVAC maintenance, the most widely practiced of the HVAC categories, was performed in about half of buildings and three-fourths of floorspace.

- Some type of lighting conservation feature was found in 46 percent of buildings and 66 percent of floorspace. The most widely used lighting system conservation feature was the energy-efficient ballast, used in 30 percent of buildings and 48 percent of floorspace (Figure 52).

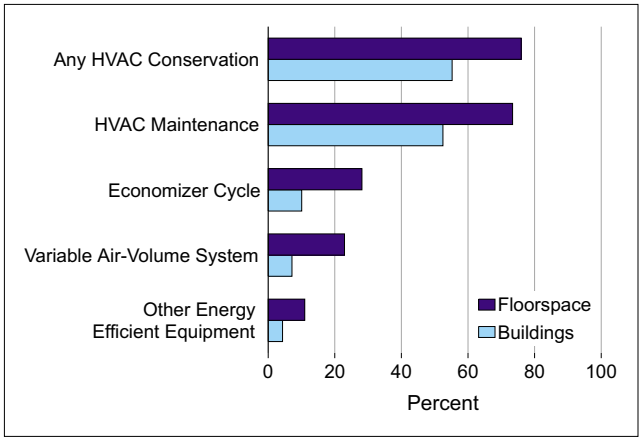
- Both HVAC and lighting system conservation features were more often found in larger than average commercial buildings. The average size for buildings with HVAC conservation features was 17,700 square feet, and it was 18,500 square feet for buildings with lighting conservation features (the average size of all commercial buildings was 12,800 square feet).

Figure 50. Building Shell Conservation Features in Commercial Buildings, 1995



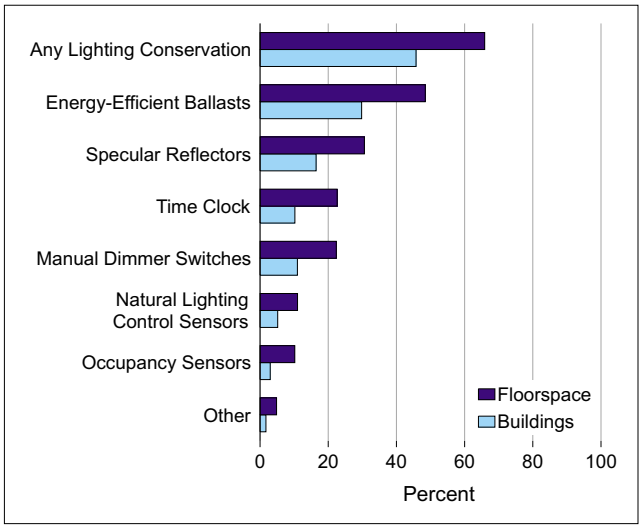
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 51. HVAC Conservation Features in Commercial Buildings, 1995



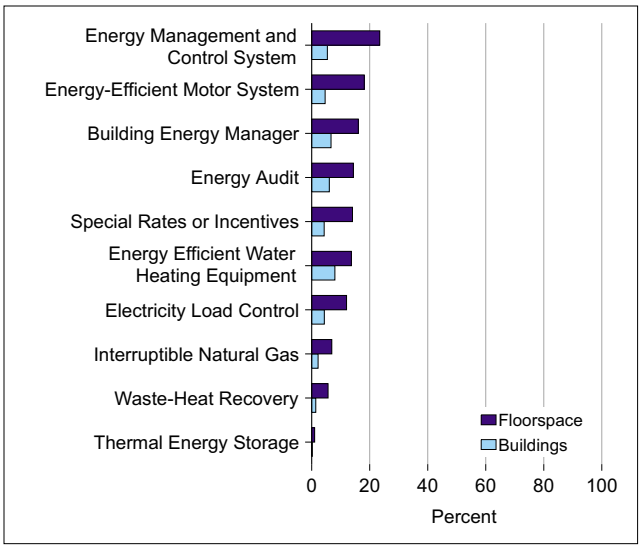
Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 52. Lighting Conservation Features in Commercial Buildings, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

Figure 53. Participation in Energy Conservation Programs, 1995



Source: Energy Information Administration, 1995 Commercial Buildings Energy Consumption Survey.

The CBECS collected information on buildings that participated in, or used, a variety of conservation programs and energy technologies (Figure 53; Tables 5a and 5b; Tables 6a and 6b). The level of participation was low for commercial buildings as a whole—the most widely used were energy management and control systems (5.4 percent of buildings and 23.5 percent of floorspace). The average size of those buildings (55,900 square feet per building) was much larger than the average of all buildings.

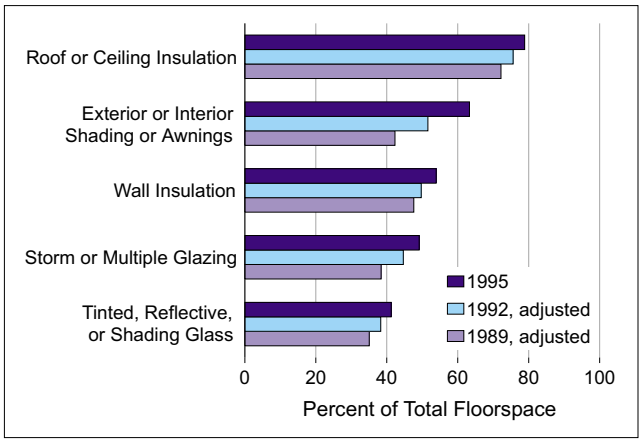
The CBECS also collected information on the use of renewable energy sources or features (besides wood). Those features were: passive solar features, photovoltaic arrays that convert sunlight directly to energy, geothermal or ground source heat pumps, wind generation, and well water used for cooling. Passive solar was the only type that was found in 20 or more buildings in the CBECS sample, the minimum number for which data can be reported. An estimated 66.9 thousand commercial buildings and 864 million square feet of floorspace used passive solar.

The use of certain energy conservation features and practices has become more common in commercial buildings in recent years (Figures 54 and 55). There were statistically significant changes in the percentage of floorspace that used several types of building shell and lighting system conservation features.

- Two building shell categories showed increases in usage—exterior or interior shading increased from 42 percent of floorspace in 1989 to 63 percent of floorspace in 1995, and use of storm or multiple glazing increased from 38 percent to 49 percent of floorspace.

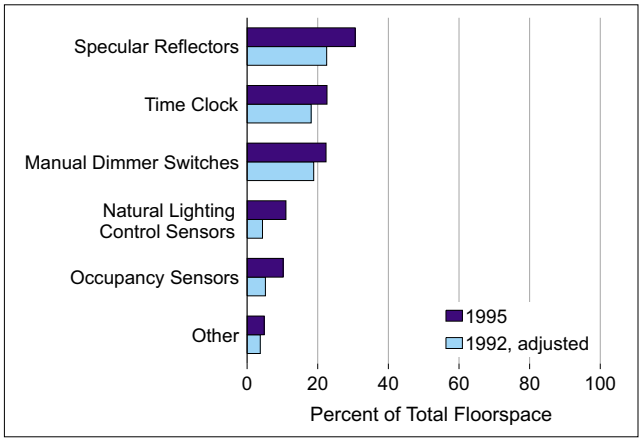
- Three categories of lighting conservation showed significant increases: specular reflectors were used for 23 percent of floorspace in 1992 and 31 percent in 1995, natural lighting control sensors increased their usage from just 4 percent to 11 percent, and occupancy sensors increased in use from 5 percent to 10 percent.

Figure 54. Changes in Building Shell Conservation Features, 1989, 1992, and 1995



Source: Energy Information Administration; 1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys.

Figure 55. Changes in Lighting Conservation Features, 1992 and 1995



Source: Energy Information Administration, 1992 and 1995 Commercial Buildings Energy Consumption Surveys.

Table 1a. Main Heating Equipment, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Space Heating	Main Heating Equipment (thousand buildings)							
		Boiler	Packaged Heating Unit	Furnace	District Heat	Individual Space Heater	Heat Pump	Other	No One Main
All Buildings	4,024	514	835	1,455	111	632	296	77	104
Primary Space-Heating Energy Source									
Electricity	1,007	11	302	123	Q	225	285	Q	26
Natural Gas	2,106	330	460	987	Q	257	Q	Q	55
Fuel Oil	439	150	Q	175	Q	Q	Q	Q	Q
District Heat	107	NC	Q	Q	105	Q	Q	NC	Q
Propane	260	Q	46	139	NC	56	Q	Q	Q
Other	61	Q	NC	Q	NC	Q	Q	Q	Q
Space-Heating Energy Sources (more than one may apply)									
Electricity	1,467	98	375	324	9	284	293	42	43
Natural Gas	2,211	335	478	1,012	6	293	14	Q	61
Fuel Oil	504	159	Q	181	Q	99	Q	Q	Q
District Heat		NC	Q	Q	106	Q	Q	Q	Q
Propane	301	26	53	152	Q	62	Q	Q	Q
Other	135	Q	Q	55	Q	Q	Q	Q	Q
	Relative Standard Errors (percent)								
All Buildings	4.0	8.9	7.3	7.1	18.3	8.5	12.5	32.2	16.3
Primary Space-Heating Energy Source									
Electricity	8.7	42.1	15.7	21.1	72.2	12.8	12.8	55.5	36.2
Natural Gas	4.7	11.2	9.8	7.8	38.8	14.1	51.1	58.6	26.9
Fuel Oil	14.1	15.8	65.0	23.3	100.0	26.1	74.2	67.9	74.8
District Heat	18.1	NC	100.6	100.0	18.7	100.6	100.0	NC	57.1
Propane	17.1	53.2	41.9	18.1	NC	34.7	100.0	69.6	64.4
Other	29.3	51.9	NC	65.5	NC	62.3	76.6	55.4	67.8
Space-Heating Energy Sources (more than one may apply)									
Electricity	6.9	18.4	12.7	13.7	21.9	11.8	12.7	47.3	25.9
Natural Gas	4.6	11.1	9.5	7.9	21.4	13.6	28.0	53.5	25.0
Fuel Oil	13.8	14.9	60.0	23.2	71.2	23.7	91.0	65.2	51.7
District Heat	17.8	NC	100.6	73.5	18.6	100.6	93.3	45.0	51.8
Propane	15.7	38.2	39.2	17.4	69.9	32.0	76.0	69.6	40.1
Other	23.9	53.2	55.6	35.0	61.7	43.4	53.1	54.8	56.3

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 1b. Main Heating Equipment, Floorspace in Heated Buildings and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Space Heating	Main Heating Equipment (million square feet)							
		Boiler	Packaged Heating Unit	Furnace	District Heat	Individual Space Heater	Heat Pump	Other	No One Main
All Buildings	54,347	14,256	10,838	10,913	5,677	5,608	3,301	2,118	1,636
Primary Space-Heating Energy Source									
Electricity	13,500	500	4,451	1,249	Q	1,985	3,134	1,650	478
Natural Gas	28,808	10,756	5,942	7,814	Q	3,013	126	195	795
Fuel Oil	4,207	2,666	Q	977	Q	Q	Q	Q	Q
District Heat	5,289	NC	Q	Q	5,145	Q	Q	NC	Q
Propane	1,545	Q	305	772	NC	278	Q	Q	Q
Other	514	Q	NC	Q	NC	Q	Q	Q	Q
Space-Heating Energy Sources (more than one may apply)									
Electricity	22,156	3,592	5,854	3,143	997	2,730	3,293	1,780	767
Natural Gas	31,535	11,021	6,542	8,188	600	3,451	472	308	954
Fuel Oil	6,606	4,014	Q	1,144	468	400	Q	Q	Q
District Heat	5,606	NC	Q	Q	5,394	Q	Q	Q	Q
Propane	2,025	355	352	832	Q	334	Q	Q	Q
Other	1,050	350	Q	223	Q	Q	Q	Q	Q

	Relative Standard Errors (percent)								
All Buildings	3.6	5.5	5.9	7.1	9.2	8.3	11.9	16.8	13.3
Primary Space-Heating Energy Source									
Electricity	7.1	22.7	11.4	19.6	57.5	11.3	11.9	19.0	23.1
Natural Gas	4.4	6.9	7.3	7.6	39.7	13.5	29.0	27.8	13.0
Fuel Oil	11.8	11.8	52.4	22.1	100.0	25.7	71.3	66.5	50.9
District Heat	8.9	NC	100.6	100.0	9.0	100.6	100.0	NC	64.9
Propane	18.5	26.5	39.9	20.6	NC	27.1	100.0	69.6	59.0
Other	23.6	41.3	NC	68.8	NC	62.4	80.5	59.8	73.0
Space-Heating Energy Sources (more than one may apply)									
Electricity	5.9	12.6	9.3	12.6	15.4	10.2	11.9	17.9	15.9
Natural Gas	4.4	6.9	7.6	7.5	19.8	12.1	20.6	20.9	14.8
Fuel Oil	10.2	10.6	38.4	19.0	31.2	25.7	77.3	56.5	43.0
District Heat	8.9	NC	100.6	85.7	9.0	100.6	71.0	30.5	60.8
Propane	16.7	21.9	36.2	19.9	60.3	24.1	49.4	69.6	44.8
Other	19.3	27.7	54.4	35.4	44.9	43.9	61.3	54.8	67.1

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 1c. Main Heating Equipment, Heated Floorspace and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Space Heating	Main Heating Equipment (million square feet)							
		Boiler	Packaged Heating Unit	Furnace	District Heat	Individual Space Heater	Heat Pump	Other	No One Main
All Buildings	48,065	13,613	9,186	9,131	5,510	4,386	2,994	1,843	1,403
Primary Space-Heating Energy Source									
Electricity	11,271	474	3,570	1,027	Q	1,400	2,847	1,480	422
Natural Gas	25,747	10,301	5,189	6,587	Q	2,539	105	170	637
Fuel Oil	3,751	2,520	Q	794	Q	Q	Q	Q	Q
District Heat	5,127	NC	Q	Q	4,988	Q	Q	NC	Q
Propane	1,366	Q	299	647	NC	233	Q	Q	Q
Other	345	Q	NC	Q	NC	Q	Q	Q	Q
Space-Heating Energy Sources (more than one may apply)									
Electricity	19,031	3,361	4,805	2,678	953	1,978	2,985	1,571	701
Natural Gas	28,177	10,611	5,742	6,924	585	2,855	398	277	783
Fuel Oil	6,047	3,853	Q	930	462	281	Q	Q	Q
District Heat	5,438	NC	Q	Q	5,236	Q	Q	Q	Q
Propane	1,812	347	341	704	Q	286	Q	Q	Q
Other	857	283	Q	202	Q	Q	Q	Q	Q

	Relative Standard Errors (percent)								
All Buildings	3.6	5.5	5.9	7.8	9.3	8.9	11.8	18.2	13.5
Primary Space-Heating Energy Source									
Electricity	6.9	23.7	10.9	19.6	56.6	13.0	11.7	20.4	22.5
Natural Gas	4.4	6.7	7.5	8.5	39.7	13.9	30.0	27.7	12.0
Fuel Oil	12.5	12.0	50.5	24.6	100.0	35.8	71.3	85.3	51.2
District Heat	9.1	NC	100.6	100.0	9.0	100.6	100.0	NC	66.6
Propane	19.6	26.5	40.6	20.2	NC	34.2	100.0	72.2	59.0
Other	30.8	45.2	NC	57.2	NC	49.8	80.5	72.0	80.5
Space-Heating Energy Sources (more than one may apply)									
Electricity	5.7	12.0	8.7	13.1	16.0	9.8	11.8	19.4	15.1
Natural Gas	4.3	6.7	7.8	8.3	20.3	12.0	20.4	20.8	13.7
Fuel Oil	10.6	10.9	35.6	21.0	31.2	30.0	77.3	69.8	44.4
District Heat	9.0	NC	100.6	83.2	9.1	100.6	71.0	29.3	62.3
Propane	17.7	21.9	37.2	19.5	60.3	29.3	49.4	72.2	42.9
Other	22.3	30.1	59.2	37.2	44.9	32.6	62.7	64.7	73.1

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 2a. Heating Distribution Equipment, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	All Heated Buildings	Type of Heating Distribution Equipment* (more than one may apply) (thousand buildings)									
		Ducts or Air Handling Units		Gives Off Heat Directly		Radiators or Baseboards		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	4,024	2,859	—	1,309	—	467	—	175	—	293	—
Heating Equipment (more than one may apply)											
Boilers	610	195	15	—	—	407	15	81	15	50	15
Packaged Heating Units	1,031	999	15	79	15	—	—	—	—	Q	15
Individual Space Heaters	1,188	—	—	1,188	—	—	—	—	—	—	—
Furnaces	1,676	1,508	18	—	—	—	—	—	—	205	18
District Heat	115	65	15	—	—	59	15	13	15	2	15
Heat Pumps	394	368	15	16	14	—	—	24	15	5	15
Other	161	14	Q	82	Q	Q	Q	62	Q	Q	Q
		Relative Standard Errors (percent)									
All Buildings	4.0	4.2	—	7.8	—	9.8	—	13.9	—	16.1	—
Heating Equipment (more than one may apply)											
Boilers	8.6	14.6	47.0	—	—	10.4	47.4	20.0	47.4	26.9	46.1
Packaged Heating Units	6.5	6.4	47.0	18.3	47.0	—	—	—	—	51.6	47.0
Individual Space Heaters	7.9	—	—	7.9	—	—	—	—	—	—	—
Furnaces	6.4	7.0	43.5	—	—	—	—	—	—	14.8	43.2
District Heat	17.5	20.3	47.5	—	—	20.3	47.5	20.4	47.5	29.8	47.5
Heat Pumps	9.1	8.4	47.2	26.4	48.8	—	—	39.6	47.2	33.8	47.2
Other	21.7	41.5	51.5	26.9	51.5	52.3	51.5	25.1	51.5	78.0	51.5

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 2b. Heating Distribution Equipment, Floorspace in Heated Buildings and Relative Standard Errors,1995

Building Characteristics	All Heated Buildings	Type of Heating Distribution Equipment* (more than one may apply) (million square feet)									
		Ducts or Air Handling Units		Gives Off Heat Directly		Radiators or Baseboards		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	54,347	40,414	—	18,982	—	12,464	—	9,145	—	4,317	—
Heating Equipment (more than one may apply)											
Boilers	16,754	9,205	203	—	—	9,314	196	3,825	196	1,131	202
Packaged Heating Units	16,893	15,905	165	2,038	165	—	—	—	—	410	165
Individual Space Heaters	16,809	—	—	16,809	—	—	—	—	—	—	—
Furnaces	14,923	13,572	140	—	—	—	—	—	—	1,969	148
District Heat	5,911	4,303	162	—	—	3,142	158	1,358	158	240	158
Heat Pumps	5,843	5,005	137	555	133	—	—	887	146	248	137
Other	6,249	1,077	115	1,868	115	618	115	4,091	115	720	115
		Relative Standard Errors (percent)									
All Buildings	3.6	3.8	—	6.7	—	5.3	—	6.9	—	8.1	—
Heating Equipment (more than one may apply)											
Boilers	4.9	8.0	22.7	—	—	5.7	23.3	10.3	23.3	11.8	22.8
Packaged Heating Units	5.1	5.4	26.2	12.8	26.2	—	—	—	—	28.0	26.2
Individual Space Heaters	7.1	—	—	7.1	—	—	—	—	—	—	—
Furnaces	5.9	6.2	23.0	—	—	—	—	—	—	12.4	24.1
District Heat	9.1	10.7	23.0	—	—	12.6	23.2	13.9	23.2	23.4	23.2
Heat Pumps	6.8	7.4	23.8	16.7	24.4	—	—	17.6	20.8	28.4	23.8
Other	9.2	14.4	26.4	17.4	26.4	14.6	26.4	12.0	26.4	36.5	26.4

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 2c. Heating Distribution Equipment, Heated Floorspace and Relative Standard Errors, 1995

Building Characteristics	All Heated Buildings	Type of Heating Distribution Equipment* (more than one may apply) (million square feet)									
		Ducts or Air Handling Units		Gives Off Heat Directly		Radiators or Baseboards		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	48,065	35,942	—	16,351	—	11,995	—	8,584	—	3,790	—
Heating Equipment (more than one may apply)											
Boilers	15,854	8,728	190	—	—	8,957	183	3,630	183	1,050	188
Packaged Heating Units	14,793	13,910	153	1,770	153	—	—	—	—	321	153
Individual Space Heaters	14,407	—	—	14,407	—	—	—	—	—	—	—
Furnaces	12,656	11,519	126	—	—	—	—	—	—	1,724	132
District Heat	5,719	4,194	146	—	—	3,047	142	1,329	142	223	142
Heat Pumps	5,312	4,515	122	511	118	—	—	826	123	236	122
Other	5,575	1,005	104	1,637	104	594	104	3,722	104	620	104
		Relative Standard Errors (percent)									
All Buildings	3.6	4.0	—	6.9	—	5.3	—	7.0	—	8.2	—
Heating Equipment (more than one may apply)											
Boilers	4.8	7.9	23.8	—	—	5.8	24.4	10.3	24.4	12.1	23.9
Packaged Heating Units	5.1	5.4	27.8	12.3	27.8	—	—	—	—	24.9	27.8
Individual Space Heaters	7.3	—	—	7.3	—	—	—	—	—	—	—
Furnaces	6.3	6.7	24.0	—	—	—	—	—	—	12.0	24.8
District Heat	9.2	11.0	24.4	—	—	12.7	24.7	14.3	24.7	22.3	24.7
Heat Pumps	6.8	7.7	25.3	15.6	25.9	—	—	17.7	24.8	28.7	25.3
Other	9.0	15.0	27.9	16.7	27.9	14.9	27.9	12.0	27.9	35.1	27.9

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 3a. Main Cooling Equipment, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Cooling	Main Cooling Equipment (thousand buildings): Packaged Air Conditioning Units	Central Chillers	Residential Type Central Air Conditioning	Heat Pumps	Individual Air Conditioners	District Chilled Water	Swamp Coolers	Other	No One Main
All Buildings	3,381	1,242	96	734	375	633	44	124	13	120
Cooling Energy Sources (more than one may apply)										
Electricity	3,293	1,207	93	718	375	633	13	124	13	120
Natural Gas	65	40	4	Q	Q	Q	Q	Q	Q	Q
District Chilled Water	53	Q	Q	Q	Q	Q	44	NC	NC	Q
		Relative Standard Errors (percent)								
All Buildings	3.8	5.9	11.5	8.9	9.4	9.0	25.9	28.1	26.8	16.4
Cooling Energy Sources (more than one may apply)										
Electricity	3.8	6.0	11.8	8.8	9.4	9.0	24.6	28.1	27.1	16.4
Natural Gas	23.9	30.6	30.6	48.2	100.1	100.0	49.8	100.0	71.8	71.1
District Chilled Water	27.2	83.6	98.9	93.3	100.0	64.4	25.9	NC	NC	53.8

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 3b. Main Cooling Equipment, Floorspace in Cooled Buildings and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Cooling	Main Cooling Equipment (million square feet)								
		Packaged Air Conditioning Units	Central Chillers	Residential Type Central Air Conditioning	Heat Pumps	Individual Air Conditioners	District Chilled Water	Swamp Coolers	Other	No One Main
All Buildings	49,935	18,746	9,802	5,543	3,985	6,339	2,295	1,143	505	1,576
Cooling Energy Sources (more than one may apply)										
Electricity	47,761	18,287	9,476	5,447	3,973	6,317	1,060	1,136	489	1,576
Natural Gas	1,314	565	456	Q	Q	Q	Q	Q	Q	Q
District Chilled Water	2,521	Q	Q	Q	Q	Q	2,295	NC	NC	Q
		Relative Standard Errors (percent)								
All Buildings	3.5	5.8	7.0	7.9	8.7	7.5	10.5	25.9	22.0	13.1
Cooling Energy Sources (more than one may apply)										
Electricity	3.5	5.8	7.3	8.0	8.7	7.6	11.1	26.1	22.3	13.1
Natural Gas	15.1	24.8	19.2	34.3	100.1	100.0	67.0	100.0	84.6	73.6
District Chilled Water	10.7	59.7	98.9	77.0	100.0	45.2	10.5	NC	NC	42.3

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 3c. Main Cooling Equipment, Cooled Floorspace and Relative Standard Errors, 1995

Building Characteristics	All Buildings with Cooling	Main Cooling Equipment (million square feet)								
		Packaged Air Conditioning Units	Central Chillers	Residential Type Central Air Conditioning	Heat Pumps	Individual Air Conditioners	District Chilled Water	Swamp Coolers	Other	No One Main
All Buildings	36,001	13,430	8,590	3,599	3,218	2,816	2,117	758	320	1,154
Cooling Energy Sources (more than one may apply)										
Electricity	34,194	13,134	8,285	3,567	3,207	2,813	981	751	303	1,153
Natural Gas	1,074	452	408	Q	Q	Q	Q	Q	Q	Q
District Chilled Water	2,302	Q	Q	Q	Q	Q	2,117	NC	NC	Q
		Relative Standard Errors (percent)								
All Buildings	3.9	5.6	7.3	9.2	9.4	10.3	10.7	29.6	19.4	14.1
Cooling Energy Sources (more than one may apply)										
Electricity	4.0	5.6	7.5	9.2	9.4	10.3	11.3	29.8	19.3	14.1
Natural Gas	16.7	29.3	19.9	31.9	100.1	100.0	67.3	100.0	84.6	74.1
District Chilled Water	10.9	60.5	98.9	72.6	100.0	47.8	10.7	NC	NC	42.1

NC = No cases in sample.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 4a. Cooling Distribution Equipment, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	All Cooled Buildings	Type of Cooling Distribution Equipment* (more than one may apply) (thousand buildings)							
		Ducts or Air Handling Units		Cools Directly		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	3,381	2,653	—	943	—	68	—	95	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	1,431	1,381	Q	90	Q	—	—	20	Q
Central Chillers	109	94	Q	—	—	27	Q	5	Q
Individual Air Conditioners	862	—	—	862	—	—	—	—	—
Residential-Type Central Air Conditioners	878	860	Q	—	—	—	—	40	Q
Heat Pumps	457	432	Q	31	Q	—	—	4	Q
District Chilled Water	53	48	Q	—	—	7	Q	Q	Q
Swamp Coolers	186	108	Q	—	—	Q	Q	40	Q
Other	18	13	Q	4	Q	Q	Q	Q	Q
		Relative Standard Errors (percent)							
All Buildings	3.8	3.5	—	7.1	—	22.6	—	23.0	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	5.4	5.2	34.8	18.8	35.4	—	—	45.2	35.4
Central Chillers	10.7	11.4	41.5	—	—	21.2	41.5	22.5	41.5
Individual Air Conditioners	6.8	—	—	6.8	—	—	—	—	—
Residential-Type Central Air Conditioners	7.7	7.9	44.3	—	—	—	—	35.0	44.3
Heat Pumps	9.1	8.9	57.1	27.6	62.0	—	—	28.7	56.8
District Chilled Water	27.2	30.4	46.6	—	—	21.1	46.6	61.7	46.6
Swamp Coolers	21.3	24.0	66.7	—	—	53.3	66.6	41.5	66.7
Other	21.5	27.7	49.5	26.4	49.5	46.0	49.5	38.4	49.5

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 4b. Cooling Distribution Equipment, Floorspace in Cooled Buildings and Relative Standard Errors, 1995

Building Characteristics	All Cooled Buildings	Type of Cooling Distribution Equipment* (more than one may apply) (million square feet)							
		Ducts or Air Handling Units		Cools Directly		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	49,935	42,803	—	14,782	—	3,527	—	2,072	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	26,628	24,550	Q	3,080	Q	—	—	566	Q
Central Chillers	11,065	10,196	Q	—	—	2,515	Q	420	Q
Individual Air Conditioners	12,494	—	—	12,494	—	—	—	—	—
Residential-Type Central Air Conditioners	9,238	8,782	Q	—	—	—	—	786	Q
Heat Pumps	6,931	6,270	Q	815	Q	—	—	188	Q
District Chilled Water	2,521	2,321	Q	—	—	478	Q	Q	Q
Swamp Coolers	2,451	1,541	Q	—	—	552	Q	432	Q
Other	949	633	Q	205	Q	Q	Q	Q	Q
		Relative Standard Errors (percent)							
All Buildings	3.5	3.8	—	5.6	—	8.1	—	9.5	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	4.9	4.9	41.2	11.6	40.2	—	—	22.3	40.2
Central Chillers	6.6	7.1	35.5	—	—	10.2	35.5	19.8	35.5
Individual Air Conditioners	5.7	—	—	5.7	—	—	—	—	—
Residential-Type Central Air Conditioners	5.4	5.6	42.1	—	—	—	—	18.5	42.1
Heat Pumps	6.6	7.0	48.6	15.9	49.3	—	—	22.0	47.9
District Chilled Water	10.7	11.9	38.4	—	—	17.6	38.4	59.8	38.4
Swamp Coolers	16.0	15.7	48.4	—	—	36.2	44.1	27.8	48.4
Other	16.2	25.6	43.3	33.9	43.3	40.8	43.3	31.4	43.3

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 4c. Cooling Distribution Equipment, Cooled Floorspace and Relative Standard Errors, 1995

Building Characteristics	All Cooled Buildings	Type of Cooling Distribution Equipment* (more than one may apply) (million square feet)							
		Ducts or Air Handling Units		Cools Directly		Fan-Coil Units without Ducts		Other	
		Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
All Buildings	36,001	32,488	—	8,455	—	3,084	—	1,597	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	19,839	18,311	Q	2,158	Q	—	—	439	Q
Central Chillers	9,576	8,768	Q	—	—	2,242	Q	349	Q
Individual Air Conditioners	6,722	—	—	6,722	—	—	—	—	—
Residential-Type Central Air Conditioners	6,379	6,087	Q	—	—	—	—	554	Q
Heat Pumps	5,557	5,006	Q	651	Q	—	—	170	Q
District Chilled Water	2,302	2,117	Q	—	—	452	Q	Q	Q
Swamp Coolers	1,874	1,144	Q	—	—	402	Q	352	Q
Other	708	462	Q	156	Q	Q	Q	Q	Q
		Relative Standard Errors (percent)							
All Buildings	3.9	4.2	—	5.5	—	8.5	—	9.5	—
Cooling Equipment (more than one may apply)									
Packaged Air-Conditioning Units	4.8	5.0	43.2	10.8	42.1	—	—	18.0	42.1
Central Chillers	6.8	7.4	41.0	—	—	10.5	41.0	17.2	41.0
Individual Air Conditioners	5.8	—	—	5.8	—	—	—	—	—
Residential-Type Central Air Conditioners	5.9	5.9	49.2	—	—	—	—	22.6	49.2
Heat Pumps	7.2	7.7	50.5	16.7	50.6	—	—	23.3	50.5
District Chilled Water	10.9	12.1	45.5	—	—	18.0	45.5	59.5	45.5
Swamp Coolers	16.4	14.8	49.7	—	—	41.8	48.9	28.1	49.7
Other	14.8	26.4	51.0	40.5	51.0	44.0	51.0	36.4	51.0

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 5a. Participation in Energy Conservation Programs, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	Number of Buildings (thousand)					Relative Standard Errors (percent)				
		Conservation Features					Conservation Features			
	All Buildings	Any Features	Building Shell	HVAC	Lighting	All Buildings	Any Features	Building Shell	HVAC	Lighting
All Buildings	4,579	4,076	3,906	2,529	2,084	3.9	3.9	4.0	4.6	5.5
Participation in Energy Conservation Programs:										
Energy Management and Control Systems	247	247	244	233	182	10.4	10.4	10.5	10.9	9.4
Energy-Efficient Motor Systems*										
Yes	212	212	211	201	166	13.8	13.9	14.0	14.4	14.1
Don't Know	40	40	40	33	25	31.1	31.1	31.2	33.8	39.6
Building Energy Manager*										
Yes	305	295	289	257	184	10.5	11.4	11.2	11.4	10.9
Don't Know	Q	Q	Q	Q	Q	91.6	91.6	91.6	91.6	96.9
Energy Audit*										
Yes	278	278	269	254	224	11.1	11.2	12.3	12.4	10.9
Don't Know	159	153	148	112	88	14.6	14.5	15.4	20.2	17.8
Special Rates or Incentives*										
Yes	197	196	194	173	137	13.8	13.8	13.9	11.6	12.8
Don't Know	89	89	85	68	50	24.3	24.3	25.0	24.2	24.9
Energy-Efficient Water Heating Equipment Installation or Retrofit*										
Yes	366	363	356	293	274	11.5	11.6	11.2	11.4	10.2
Don't Know	52	52	51	43	25	29.0	29.0	28.9	30.9	37.3
Electricity Load Control*										
Yes	198	198	197	168	142	17.4	17.4	17.5	13.5	14.7
Don't Know	48	48	48	33	32	33.3	33.3	33.3	32.8	38.4
Interruptible Natural Gas*										
Yes	101	100	99	83	96	19.7	19.8	20.0	21.2	20.2
Don't Know	34	34	34	32	21	28.4	28.4	28.4	30.9	35.9
Waste-Heat Recovery*										
Yes	64	64	64	61	61	23.8	23.9	24.1	24.8	24.9
Don't Know	25	25	25	17	13	38.5	38.5	38.5	43.5	49.9
Thermal Energy Storage*										
Yes	7	7	6	6	6	24.9	24.9	25.2	25.4	24.9
Don't Know	23	23	23	16	Q	40.4	40.4	40.4	46.1	52.9

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 5b. Participation in Energy Conservation Programs, Floorspace and Relative Standard Errors, 1995

Building Characteristics	Total Floorspace (million square feet)					Relative Standard Errors (percent)				
		Conservation Features					Conservation Features			
	All Buildings	Any Features	Building Shell	HVAC	Lighting	All Buildings	Any Features	Building Shell	HVAC	Lighting
All Buildings	58,772	55,288	53,190	44,657	38,537	3.4	3.5	3.5	3.9	3.7
Participation in Energy Conservation Programs:										
Energy Management and Control Systems	13,796	13,792	13,657	13,632	12,374	5.3	5.3	5.3	5.4	5.5
Energy-Efficient Motor Systems*										
Yes	10,650	10,630	10,574	10,447	9,989	6.0	6.0	6.0	6.1	6.1
Don't Know	605	605	597	467	406	26.7	26.7	27.0	24.4	33.9
Building Energy Manager*										
Yes	9,445	9,349	9,216	9,038	8,016	6.3	6.4	6.5	6.6	6.9
Don't Know	Q	Q	Q	Q	Q	87.9	87.9	87.9	87.9	74.0
Energy Audit*										
Yes	8,440	8,435	8,290	8,182	7,658	6.9	6.9	7.0	7.3	7.1
Don't Know	2,713	2,685	2,628	2,270	1,892	11.2	11.2	11.5	11.6	12.8
Special Rates or Incentives*										
Yes	8,263	8,242	8,111	7,935		7.1	7.2	7.3	7.1	7.0
Don't Know	1,683	1,676	1,654	1,466	7,410	16.3	16.3	16.3	18.2	16.5
Energy-Efficient Water Heating Equipment Installation or Retrofit*					1,229					
Yes	8,041	8,025	7,964	7,514	7,216	6.1	6.1	6.1	6.5	6.4
Don't Know	872	872	870	754	567	19.8	19.8	19.8	18.4	24.5
Electricity Load Control*										
Yes	6,990	6,990	6,849	6,719	6,279	7.7	7.7	7.8	7.6	7.4
Don't Know	821	815	815	710	517	24.5	24.5	24.5	27.3	26.0
Interruptible Natural Gas*										
Yes	4,071	4,060	4,043	3,960	3,809	9.6	9.7	9.7	9.9	9.2
Don't Know	695	695	695	630	442	18.5	18.5	18.5	20.3	21.7
Waste-Heat Recovery*										
Yes	3,319	3,302	3,291	3,236	3,113	10.1	10.2	10.3	10.3	10.1
Don't Know	376	376	376	304	217	28.1	28.1	28.1	32.5	33.9
Thermal Energy Storage*										
Yes	601	601	593	596	577	16.8	16.8	16.9	16.8	16.7
Don't Know	342	342	342	274	Q	30.4	30.4	30.4	35.3	38.2

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 6a. Sponsorship of Conservation Features and Conservation Programs, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	All Buildings*		Sponsor (thousand buildings) (more than one may apply)									
			Utility*		Federal Government*		Self-Sponsored*		Third Party*		Other*	
	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
Building Shell Conservation Features	3,906	—	69	Q	54	Q	3,415	Q	499	Q	67	Q
HVAC Conservation Features	2,529	—	53	Q	19	Q	603	Q	89	Q	11	Q
Lighting Conservation Features	2,084	—	295	25	27	25	1,700	25	166	25	22	25
Participation in Energy Conservation Programs:												
Energy Management and Control Systems	247	—	25	Q	7	Q	194	Q	35	Q	2	Q
Energy-Efficient Motor Systems	212	40	11	Q	3	Q	178	Q	38	Q	Q	Q
Energy Audit	278	159	136	Q	14	Q	126	Q	45	Q	Q	Q
Special Rates or Incentives	197	89	158	Q	6	Q	42	Q	3	Q	Q	Q
Energy-Efficient Water Heating Equipment Installation	366	52	36	Q	Q	Q	307	Q	45	Q	Q	Q
Electricity Load Control	198	48	85	Q	1	Q	110	Q	19	Q	Q	Q
Interruptible Natural Gas	101	34	45	Q	Q	Q	61	Q	7	Q	Q	Q
Waste Heat Recovery	64	25	Q	Q	Q	Q	55	Q	4	Q	Q	Q
Thermal Energy Storage	7	23	Q	Q	Q	Q	4	Q	Q	Q	Q	Q
	Relative Standard Errors (percent)											
Building Shell Conservation Features	4.0	—	22.6	48.1	29.2	48.1	4.7	48.1	13.9	48.1	28.7	48.1
HVAC Conservation Features	4.6	—	18.2	64.1	43.2	64.1	8.9	64.1	24.6	64.1	14.6	64.1
Lighting Conservation Features	5.5	—	12.4	35.1	35.0	35.1	6.6	35.1	17.0	35.1	47.8	35.1
Participation in Energy Conservation Programs												
Energy Management and Control Systems	10.4	—	30.7	41.1	36.6	41.1	11.6	41.1	33.6	41.1	41.1	41.1
Energy-Efficient Motor Systems	13.8	31.1	20.3	81.8	30.0	81.8	15.2	81.8	38.2	81.8	86.6	81.8
Energy Audit	11.1	14.6	16.3	73.4	48.1	73.4	15.7	73.4	32.9	73.4	38.3	73.4
Special Rates or Incentives	13.8	24.3	17.0	70.0	44.1	70.0	22.5	70.0	21.2	70.0	42.6	70.0
Energy-Efficient Water Heating Equipment Installation	11.5	29.0	32.9	80.3	72.9	80.3	12.2	80.3	30.2	80.3	47.2	80.3
Electricity Load Control	17.4	33.3	33.0	50.3	39.6	50.3	15.9	50.3	47.9	50.3	61.4	50.3
Interruptible Natural Gas	19.7	28.4	27.8	100.0	41.4	100.0	26.1	100.0	47.1	100.0	61.2	100.0
Waste Heat Recovery	23.8	38.5	74.0	100.0	44.0	100.0	25.4	100.0	25.9	100.0	70.8	100.0
Thermal Energy Storage	24.9	40.4	38.8	92.2	77.6	92.2	28.1	92.2	63.1	92.2	100.0	92.2

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

Table 6b. Sponsorship of Conservation Features and Conservation Programs, Floorspace and Relative Standard Errors, 1995

Building Characteristics	All Buildings*		Sponsor (million square feet) (more than one may apply)									
			Utility*		Federal Government*		Self-Sponsored*		Third Party*		Other*	
	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know	Yes	Don't Know
Building Shell Conservation Features	53,190	—	1,102	Q	1,422	Q	47,334	Q	6,678	Q	711	Q
HVAC Conservation Features	44,657	—	1,829	Q	1,016	Q	19,479	Q	2,911	Q	302	Q
Lighting Conservation Features	38,537	—	6,586	238	1,305	238	31,926	238	3,721	238	307	238
Participation in Energy Conservation Programs:												
Energy Management and Control Systems	13,796	—	1,113	Q	924	Q	11,659	Q	1,784	Q	166	Q
Energy-Efficient Motor Systems	10,650	605	1,257	Q	578	Q	8,893	Q	1,241	Q	Q	Q
Energy Audit	8,440	2,713	3,202	Q	396	Q	4,522	Q	1,346	Q	Q	Q
Special Rates or Incentives	8,263	1,683	6,286	Q	Q	Q	2,369	Q	379	Q	Q	Q
Energy-Efficient Water Heating Equipment Installation	8,041	872	820	Q	326	Q	7,037	Q	1,153	Q	Q	Q
Electricity Load Control	6,990	747	1,982	Q	227	Q	4,822	Q	800	Q	Q	Q
Interruptible Natural Gas	4,071	695	1,951	Q	Q	Q	2,398	Q	269	Q	Q	Q
Waste Heat Recovery	3,319	376	301	Q	Q	Q	2,812	Q	459	Q	Q	Q
Thermal Energy Storage	601	342	Q	Q	Q	Q	446	Q	Q	Q	Q	Q

Relative Standard Errors (percent)

Building Shell Conservation Features	3.5	—	15.0	35.1	26.4	35.1	4.2	35.1	11.2	35.1	23.1	35.1
HVAC Conservation Features	3.9	—	11.3	55.1	26.6	55.1	5.6	55.1	11.9	55.1	29.3	55.1
Lighting Conservation Features	3.7	—	7.5	31.0	25.6	31.0	4.4	31.0	11.5	31.0	29.3	31.0
Participation in Energy Conservation Programs:												
Energy Management and Control Systems	5.3	—	21.3	47.4	29.6	47.4	6.1	47.4	15.2	47.4	38.7	47.4
Energy-Efficient Motor Systems	6.0	26.7	12.5	79.8	34.1	79.8	6.7	79.8	16.8	79.8	53.1	79.8
Energy Audit	6.9	11.2	12.4	39.7	23.4	39.7	9.5	39.7	16.4	39.7	44.4	39.7
Special Rates or Incentives	7.1	16.3	8.3	60.3	52.0	60.3	11.0	60.3	26.7	60.3	54.0	60.3
Energy-Efficient Water Heating Equipment Installation	6.1	19.8	16.6	57.5	43.7	57.5	6.8	57.5	16.4	57.5	47.0	57.5
Electricity Load Control	7.7	21.5	13.2	51.4	44.2	51.4	8.9	51.4	22.6	51.4	53.7	51.4
Interruptible Natural Gas	9.6	18.5	11.9	100.0	39.3	100.0	12.4	100.0	21.0	100.0	44.6	100.0
Waste Heat Recovery	10.1	28.1	32.7	100.0	50.1	100.0	11.1	100.0	24.7	100.0	70.8	100.0
Thermal Energy Storage	16.8	30.4	28.6	95.9	58.7	95.9	17.4	95.9	28.4	95.9	100.0	95.9

— = Data not applicable.

* = Data elements were not statistically adjusted for nonresponse.

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.

Notes: • The Relative Standard Error (RSE) for each estimate is shown in shaded area. • See Glossary for explanation of abbreviations and definitions of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-871A, 1995 Commercial Buildings Energy Consumption Survey.

5. Detailed Tables

How to Read the Tables

This section introduces three sets of tables. The first set consists of building characteristics tables (BC-1 through BC-44), which contain the number of buildings and amount of floorspace for major building characteristics. Tables BC-1 and BC-2 of this set are summary tables. Tables BC-3 through BC-17 address location, building size, year constructed, number of workers, hours of operation, and types of occupancy. Tables BC-18 through BC-28 contain data about the energy sources used for all end uses and for specific major end uses. Tables BC-29 through BC-44 contain data about percent of floorspace heated, cooled, and lit, energy-using equipment types, and conservation measures used in the buildings.

The second set of tables consists of energy consumption and expenditures tables (CE-1 through CE-31), which present detailed energy consumption and expenditure data for buildings in the commercial sector. These tables are grouped into major fuel tables, Tables CE-1 through CE-8 and specific fuel tables. The specific fuel tables consist of Tables CE-9 through CE-19 for electricity, Tables CE-20 through CE-25 for natural gas, Tables CE-26 through CE-29 for fuel oil, and Tables CE-30 and CE-31 for district heat. The third set of tables consists of Tables EU-1 through EU-6, which contain estimates of the amount of natural gas and electricity that is consumed for nine specific end uses: space heating, cooling, ventilation, water heating, lighting, cooking, refrigeration, office equipment, and other.

This section provides assistance to those reading the tables by explaining some of the headings for categories of data. It also explains the use of the row and column factors to compute the confidence levels of the estimates given in the tables and the statistical significance of differences between the data in two or more categories. The section also includes "Quick-Reference Guides" to the statistics in the different tables.

Categories of Data in the Tables

Data in the tables are presented in column categories (at the top of each table) and row categories (in the far left column of each table).

Column Categories

The column categories most commonly classify data by building characteristics or by consumption and expenditures. The following data items, listed in alphabetical order, are explanations of some of the column categories found in the set of energy consumption and expenditures tables that may require clarification.

Conditional Energy Intensity—The amount of electricity, natural gas, fuel oil, or district heat used per square foot in buildings using the specified energy source. For example, in Table CE-11, data in the row labeled "Electricity" under "Energy Sources" and in the column labeled "Northeast" under "Electricity Energy Intensity" would read: "Buildings in the Northeast that used electricity as an energy source used 11.2 kilowatthours of electricity per square foot."

Demand-Metered Buildings—Buildings that have meters to measure peak demand (in addition to total consumption) during a billing period. Peak demand is usually metered only for electricity.

Distribution of Building-Level Intensities—The amount of energy used per square foot, divided into three percentiles: 25th, median, and 75th. In Table CE-10, for example, the row labeled "Education" under "Principal Building Activity" and in the column labeled "25th. Percentile" under "Distribution of Building-Level Intensities" would read: "In 1995, 25 percent of U.S. education buildings used 4.3 kilowatthours per square foot or less. (75 percent of the buildings used more than 4.3 kilowatthours of electricity per square foot.)"

Electricity—Site electricity. (See "site electricity" and "primary electricity" in this listing.)

Energy Intensity—Usually defined as "gross energy intensity" or "conditional energy intensity" in title of table. If table title does not specify, "energy intensity" is to be defined as "conditional energy intensity."

Floorspace—The enclosed area in a building; the sum of the floorspace in all buildings in a category.

Gross Energy Intensity—The ratio of the total amount of energy consumed by a group of buildings to the total floorspace of those buildings, including buildings and floorspace where the energy source is not used. For example, in Table CE-5, data in the row category "Education" under "Principal Building Activity" and in the column category of "Northeast" under "Energy Intensity for Sum of Major Fuels" would read: "Education buildings in the Northeast consumed 83.4 thousand Btu per square foot."

Major Fuel—Major energy sources: electricity, natural gas, fuel oil, and district heat (district steam or district hot water). Although electricity is technically not a fuel, "Major Fuel," rather than "Major Energy Source," was retained as the title of this category to facilitate comparison of previous CBECS data.

Primary Electricity—Site electricity plus the losses associated with the generation and transmission of the electricity. Most of the tables present statistics for site consumption alone, but Tables CE-1 and CE-9 also provide consumption statistics for primary electricity.

Site Electricity—The amount of electricity delivered to the commercial building. This amount excludes losses associated with the generation and transmission of the electricity. (See "primary electricity" in this listing.) Most of the tables in this section provide statistics for site electricity alone (not for primary electricity). When the term "electricity" is used, the reference is to site electricity.

Total of Major Fuels—The sum of site electricity, natural gas, fuel oil, and district heat. Statistics in this column exclude data from the column "Primary Electricity."

Row Categories

The row categories classify data by specific features, such as principal building activity or energy sources used. Data in the row categories relate to the buildings having such a feature, not to the feature. For example, in Table CE-1, the data in the "Major Fuels" column and the row category "Buildings with Cooling" is to be read as "Buildings with cooling consumed 4,923 trillion Btu of the major fuels." Tables CE-1 through CE-31 contain no data on the energy consumption for cooling specifically. Estimates of energy used for specific end uses are found in Tables EU-1 through EU-6.

The Glossary provides detailed definitions of the terms used in the tables. Below are explanations of some of the row categories found in the tables that may require clarification. These terms are listed in the order in which they occur in the tables.

All Buildings—Number of buildings, square footage, and consumption or expenditures for roofed and walled structures whose principal activities are nonresidential, nonagricultural, and nonindustrial and that are larger than 1,000 square feet (roughly twice the size of a two-car garage).

Principal Building Activity—Number of buildings, square footage, and consumption or expenditures for buildings grouped by the activity that occupies the most floorspace in the buildings. Some building types are combined in the tables. For example, inpatient and outpatient health care facilities were combined as "health care buildings," refrigerated and nonrefrigerated warehouses were combined as "warehouses," and skilled nursing care buildings were included in "lodging" See Appendix C, "Types of Buildings," for a full description of the principal building activity categories.

Climate Zone—Number of buildings, square footage, and consumption or expenditures for commercial buildings located in one of the five U.S. climate zones, based on the average number of cooling degree-days (CDD) and heating degree-days (HDD) in a 45-year period (1931-1975). See Appendix D, "U.S. Climate Zone and Census Regions and Divisions Maps," for a map showing the five U.S. climate zones.

Census Region and Division—Number of buildings, square footage, and consumption or expenditures for commercial buildings located in one of the nine divisions within the four regions as defined by the U.S. Bureau of Census. See Appendix D, "U.S. Climate Zones and Census Regions and Divisions Maps," for a map showing the four Census regions and nine Census divisions.

Energy Sources—Number of buildings, square footage, and consumption or expenditures for buildings using a specific type of energy (electricity, natural gas, fuel oil, district heat [district steam or district hot water], district chilled water, propane, and any other type of energy [wood, coal, active solar, and photovoltaic cells]). The energy consumption and expenditures tables contain consumption data based on billing information obtained from energy suppliers, for the first four sources only. Estimates of the amount of wood burned in buildings were obtained during the personal interviews with building respondents. No consumption data were collected for propane, coal, solar energy, or other renewable sources because such a collection effort would not be feasible.

Energy End Uses—Number of buildings, square footage, and consumption or expenditures in buildings that had specific end uses (heating, air-conditioning, water heating, cooking, and manufacturing), not the amount of energy consumption or expenditures for a particular end use (Tables CE-1 through CE-31). Tables EU-1 through EU-6 provide the amount of electricity or natural gas used for a particular end use.

Space-Heating Energy Sources—Number of buildings, square footage, and consumption or expenditures in buildings using at least one of the major fuels, propane, wood, or any other energy source for space heating. (In some tables, this category is subdivided into "Main and Secondary Energy Sources.") Tables CE-1 through CE-31 contain no data on the amount of energy consumption or expenditures for space heating specifically. Tables EU-1 through EU-6 provide the amount of electricity or natural gas used specifically for space heating.

Primary Space-Heating Energy Source—Number of buildings, square footage, and consumption or expenditures in buildings using a specific energy source to heat most of the square footage in the building most of the time. Tables CE-1 through CE-31 contain no specific data on the amount of energy consumption or expenditures for space heating. Tables EU-1 through EU-6 provide the amount of electricity or natural gas used specifically for space heating.

Cooling Energy Source—Number of buildings, square footage, and consumption or expenditures in buildings using electricity, natural gas, or district chilled water for cooling. Tables CE-1 through CE-31 contain no specific data on the amount of energy consumption or expenditures for cooling. Tables EU-1 through EU-6 provide the amount of electricity specifically used for cooling.

Water-Heating Energy Source—Number of buildings, square footage, and consumption or expenditures in buildings using one of the major fuels or propane for water heating. Tables CE-1 through CE-31 contain no specific data on the amount of energy consumption or expenditures for water heating. Tables EU-1 through EU-6 provide the amount of electricity or natural gas used specifically for water heating.

Cooking Energy Source—Number of buildings, square footage, and consumption or expenditures in buildings using electricity, natural gas, or propane for cooking. Tables CE-1 through CE-31 contain no data specific on the amount of energy consumption or expenditures for cooking. Tables EU-1 through EU-6 provide the amount of electricity or natural gas specifically used for cooking.

Heating Equipment—Number of buildings, square footage, and natural gas and electricity consumption (Tables EU-1 through EU-6) in buildings that had at least one type of heating equipment.

Cooling Equipment—Number of buildings, square footage, and natural gas and electricity consumption (Tables EU-1 through EU-6) in buildings that had at least one type of cooling equipment.

Lighting Equipment—Number of buildings, square footage, and natural gas and electricity consumption (Tables EU-1 through EU-6) in buildings that had at least one type of lighting equipment.

Water-Heating Equipment—Number of buildings, square footage, and natural gas and electricity consumption (Tables EU-1 through EU-6) in buildings that had at least one type of cooling equipment.

Statistical Significance of Data

Row and Column Factors

The tables provide row factors in the far right column and column factors on the top line of each table. Because the estimates in the detailed tables are based on the sample surveyed, they are subject to sampling error. The standard error is a measure of the reliability or precision of the survey statistic. The value for the standard error can be used to construct confidence intervals

and to perform hypothesis tests by standard statistical methods. Relative Standard Error (RSE) is defined as the standard error (square root of the variance) of a survey estimate, divided by the survey estimate and multiplied by 100.

An approximate RSE can be computed for each estimate in these tables via the use of row and column factors. The RSE for a given estimate is found by multiplying the RSE Row Factor (located in the last column) for the estimate by its RSE Column Factor (at the top of the column). This value is the approximate RSE, in percent. The RSE (divided by 100 and multiplied by the estimate) is the approximate standard error. (Note: Tables that contain median statistics, Tables BC-2, CE-10, CE-19 and CE-21, or contain statistics based on a model, Tables EU-1 through EU-6, do not contain row and column factors.)

The 95-percent confidence range can be determined with the approximate RSE. To calculate the 95-percent confidence range for a given estimate:

Multiply the RSE row factor by the RSE column factor to determine the approximate RSE.

Multiply the approximate RSE (divided by 100) by the estimate in the table to determine the approximate standard error.

Multiply the approximate standard error by 1.96 to determine the approximate confidence error.

The estimate plus or minus the confidence error is the 95-percent confidence range.

For example, the estimate for the amount of natural gas consumed in mercantile and service buildings is 395 trillion Btu (Figure 56), the estimate's RSE row factor is 12.33 and its RSE column factor is 1.0. The approximate RSE is (12.33)x(1.0), or 12.3 percent. The approximate standard error is (12.3/100)x(395 trillion Btu), or 48.7 trillion Btu. The 95-percent confidence error is (1.96)x(48.7 trillion Btu), or 95.5 trillion Btu. Therefore, with 95 percent confidence, the true amount of natural gas consumed in mercantile and service buildings in 1995, was 395 trillion Btu (95.5 trillion), or the range 299 to 491 trillion Btu.

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 is computed as:

$$S_{x_1\ x_2} \quad \sqrt{S_{x_1}^{\ 2} \quad S_{x_2}^{\ 2}}$$

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.

For example, in 1995, mercantile and service buildings consumed an estimated 395 trillion Btu of natural gas, while health care buildings consumed an estimated 258 trillion Btu, for an estimated difference of 137 trillion Btu. The standard error for the 395 trillion Btu estimate (x_1) is 48.70, and the standard error for the 258 trillion Btu estimate (x_2) is 35.55 and

$$S_{x_1\ x_2} \quad \sqrt{48.70^2 \quad 35.55^2}$$

$$S_{x_1\ x_2} \quad 60.30.$$

Multiplying 60.30 by 1.96 yields 118.2. Since 118.2 is less than 137, the difference between the two estimates is statistically significant.

The Quick-Reference Guides on the following pages list general topics covered by the detailed tables and the table numbers for the different types of tables. To help the reader quickly locate a particular table, the general topic class is printed along the outside edge of each table page.

Figure 56. Use of RSE Row and Column Factors

Building Characteristics	All Buildings		Total Energy Consumption (trillion Btu)						RSE Row Factor
	Number of Buildings (thousand)	Floorspace (million square feet)	Total of Major Fuels	Electricity		Natural Gas	Fuel Oil	District Heat	
				Primary	Site				
RSE Column Factor	0.7	0.6	.08	.08	.08	1.0	1.9	2.5	
All Buildings	4,579	58,772	5,321	7,873	2,608	1,946	235	533	5.74
Building Floorspace (Square Feet)									
1,001 to 5,000	2,399	6,338	708	1,148	380	264	44	Q	9.50
5,001 to 10,000	1,035	7,530	624	718	238	272	26	Q	14.90
10,001 to 25,000	745	11,617	824	1,161	384	356	45	38	12.29
25,001 to 50,000	213	7,676	630	954	316	231	28	55	9.79
50,001 to 100,000	115	7,968	698	1,097	363	243	31	60	10.41
100,001 to 200,000	48	6,776	687	1,017	337	244	21	84	11.84
200,001 to 500,000	19	5,553	636	927	307	211	25	94	13.65
Over 500,000	6	5,313	514	852	282	125	14	93	14.56
Principal Building Activity									
Education	309	7,740	614	666	221	245	57	91	10.34
Food Sales	137	642	137	358	119	18	Q	Q	20.58
Food Service	285	1,353	332	502	166	158	Q	Q	20.94
Health Care	105	2,333	561	637	211	258	21	70	13.78
Lodging	158	3,618	461	565	187	213	Q	57	13.83
Mercantile and Service	1,289	12,728	973	1,533	508	395	49	Q	12.33
Office	705	10,478	1,019	2,039	676	239	28	75	11.11
Public Assembly	326	3,948	449	514	170	142	14	Q	17.28
Public Order and Safety	87	1,271	124	148	49	33	Q	Q	30.10
Religious Worship	269	2,792	104	99	33	57	13	Q	13.80
Warehouse and Storage	580	8,481	325	531	176	106	10	Q	16.23
Other	67	1,004	173	228	75	55	Q	Q	32.41
Vacant	261	2,384	51	54	18	26	5	Q	25.95

Building Characteristics Tables Quick Reference Guide

Data Item	Number of Buildings	Floorspace
Summary Tables	BC-1 (includes means)	BC-2 (includes medians)
Location		
Census Region	BC-3	BC-3
Census Division	BC-4	BC-5
Climate Zone	BC-6	BC-6
Metropolitan Status	BC-7	BC-7
Structure		
Building Size	BC-8	BC-9
Year Constructed	BC-10	BC-11
Building Use		
Employment Size	BC-12	BC-13
Weekly Operating Hours	BC-14	BC-15
Government and Nongovernment	BC-16	BC-17
Energy Sources and End Use		
Energy Sources	BC-18	BC-19
Energy End Uses	BC-20	BC-20
Space-Heating Energy Sources	BC-21	BC-22
Primary Space-Heating Fuel	BC-23	BC-24
Cooling Energy Sources	BC-25	BC-25
Water-Heating Energy Sources	BC-26	BC-27
Cooking Energy Sources	BC-28	BC-28
End-Use Percentage		
Percent of Floorspace Heated	BC-29	BC-29
Percent of Floorspace Cooled	BC-30	BC-30
Percent of Floorspace Lit	BC-31	BC-31
Floorspace Heated, Cooled, Lit		BC-32
End-Use Equipment		
Heating	BC-33	BC-34
Cooling	BC-35	BC-36
Refrigeration	BC-37	BC-37
Water-Heating	BC-38	BC-38
Lighting	BC-39	BC-40
Conservation		
Energy Conservation Features	BC-41	BC-41
Building Shell Conservation	BC-42	BC-43
Reduction in Equipment Use	BC-44	BC-44

Energy Consumption and Expenditures Tables Quick Reference Guide

Data Item	Major Fuels	Electricity	Natural Gas	Fuel Oil	District Heat
Total Consumption	CE-1	CE-9	CE-20	CE-26	CE-30
Total Expenditures	CE-2	CE-9	CE-20	CE-26	CE-30
Consumption per Building, Square Foot, Energy Unit	CE-3	CE-10	CE-21	CE-27	CE-31
Expenditures per Building, Square Foot, Energy Unit	CE-4	CE-10	CE-21	CE-27	CE-31
Consumption and Intensity by:					
Census Region	CE-5	CE-11	CE-22	CE-28	
Building Size	CE-7	CE-13	CE-24		
Year Constructed	CE-8	CE-14	CE-25		
Building Level Intensities (percentile)		CE-10	CE-21		
Expenditures per Energy Unit and Intensity by Census Region	CE-6	CE-12	CE-23	CE-29	
Electricity Peak Demand by:					
Demand Metering and Season of Peak Demand		CE-15,16			
Peak Demand Category		CE-17,18			
Peak Demand Intensity and Load (percentile)		CE-19			
Total Energy Consumption by End Uses	EU-1	EU-3	EU-5		
Energy Consumption per Square Foot by End Uses	EU-2	EU-4	EU-6		