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Commercial Buildings Characteristics 1995

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CBECS Public Use Data will be available on the Internet at a later date. The Internet address is http://www.eia.doe.gov

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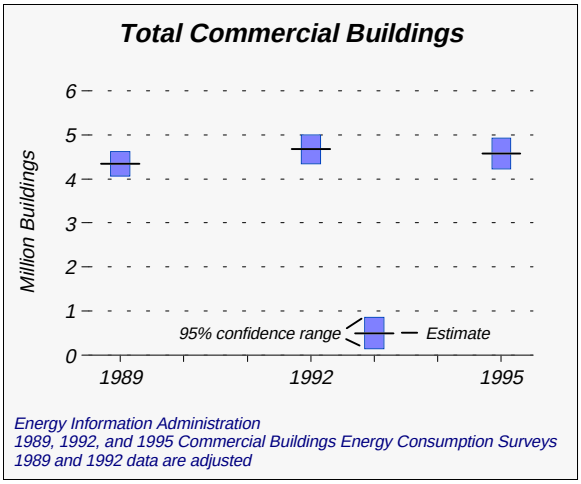
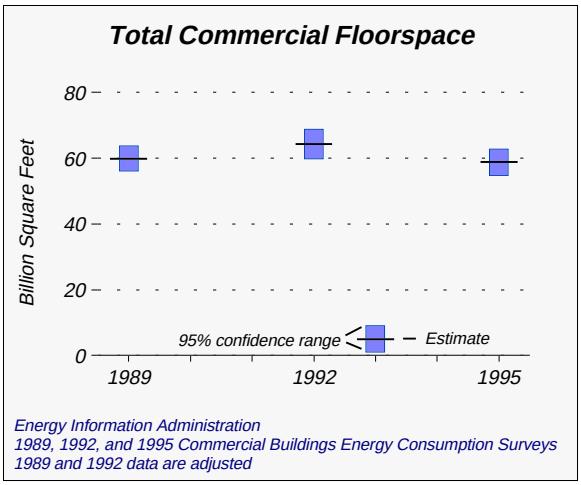
Executive Summary

The Commercial Buildings Energy Consumption Survey (CBECS) collects information on physical characteristics of commercial buildings, building use and occupancy patterns, equipment use, conservation features and practices, and types and uses of energy in buildings. The survey also collects information on the amount of energy consumed and the costs for energy in commercial buildings.

Total Commercial Buildings and Floorspace

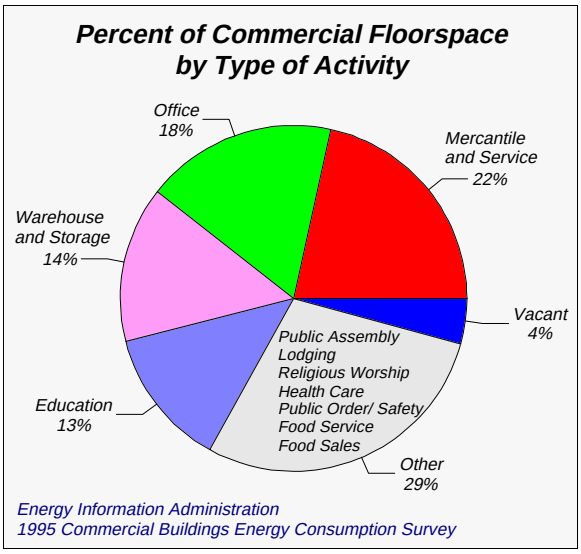
- *In 1995, there were 4.58 million commercial buildings and 58.78 billion square feet of commercial floorspace in the United States.*
- *There were no statistically significant changes in the total number of buildings or total amount of floorspace in 1995 when compared with similar buildings and floorspace data from the 1989 or 1992 CBECS. Data from 1989 and 1992 were adjusted to be consistent with the slightly different definition of commercial building population used by the 1995 CBECS.*
- *The total number of commercial buildings in 1995 was only 6 percent of total residential buildings in 1993 but had 32 percent of total residential floorspace (residential data from the 1993 Residential Energy Consumption Survey).*
- *The mean size of all commercial buildings in 1995 was 12,840 square feet. In comparison, the mean size of residential buildings in 1993 was 2,370 square feet.*





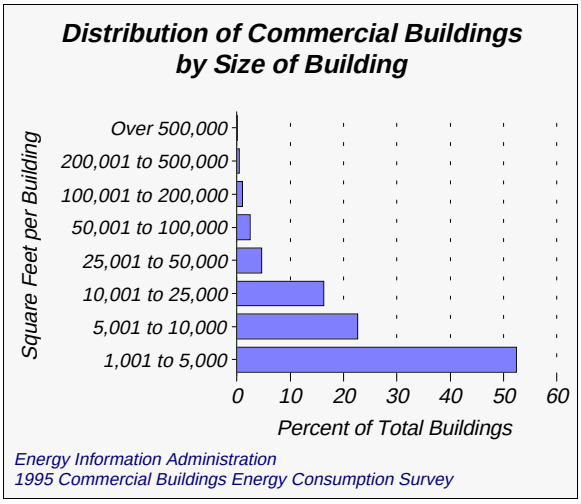
Major Activities

- *Four activities dominated commercial floorspace--mercantile and service, office, warehouse and storage, and education.*
- *Those four activities comprised 67 percent of total floorspace (and 63 percent of commercial buildings).*
- *The other principal activities, which included public assembly, lodging, health care, and food sales and service, comprised 29 percent of floorspace (and 31 percent of buildings). Vacant buildings accounted for 4 percent of floorspace (and 6 percent of buildings).*



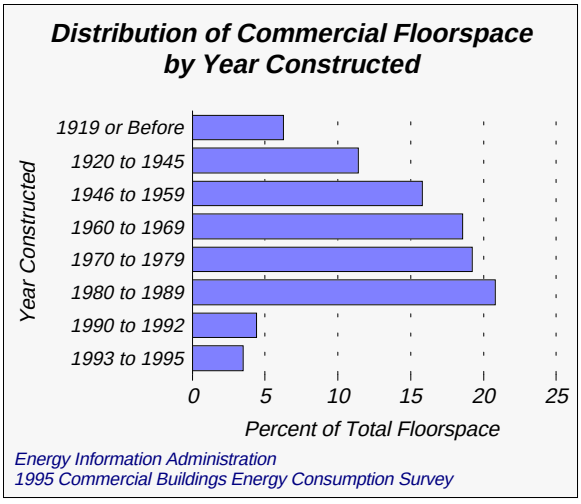
Size of Buildings

- *Most commercial buildings were found in the smaller size categories. More than half were 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).*
- *Less than 5 percent of buildings were larger than 50,000 square feet, and less than 2 percent were larger than 100,000 square feet.*
- *The mean of all commercial buildings was 12,840 square feet.*



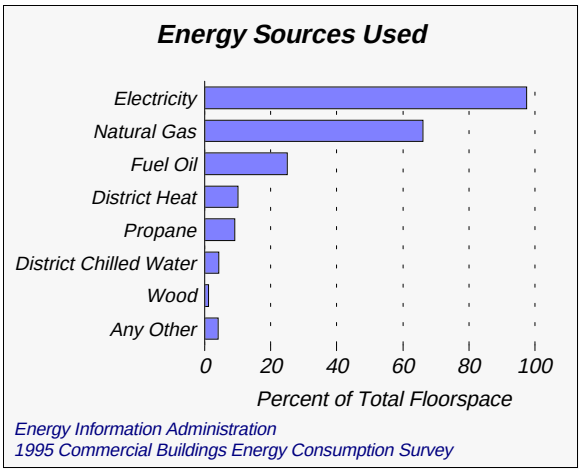
Age of Buildings

- *Less than 8 percent of commercial floorspace (and 10 percent of buildings) were constructed in the 1990's.*
- *More than 70 percent of buildings and floorspace were constructed prior to 1980 and more than 50 percent before 1970.*



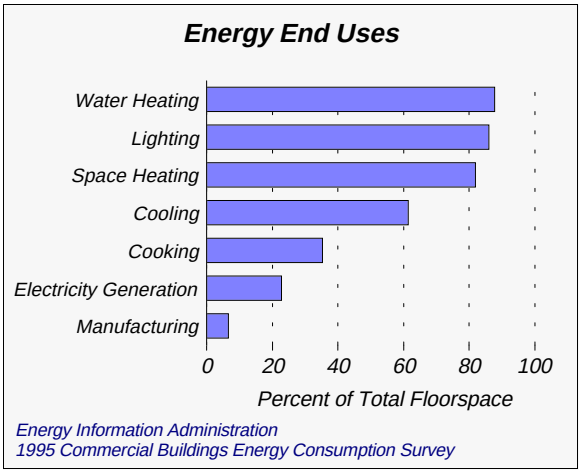
Major Energy Sources Used in Commercial Buildings

- *Electricity and natural gas were used widely in commercial buildings. Electricity use was nearly universal (97 percent of floorspace and 95 percent of buildings), while natural gas was used for about two-thirds of floorspace and 54 percent of buildings.*
- *Only fuel oil, of the other major energy sources, was used for as much as a quarter of total floorspace (but in less than 14 percent of buildings). The other sources were used for no more than 11 percent of floorspace (or in 13 percent of buildings).*
- *The relative use (both percent of floorspace and buildings) of major sources remained unchanged from use in previous CBECS.*



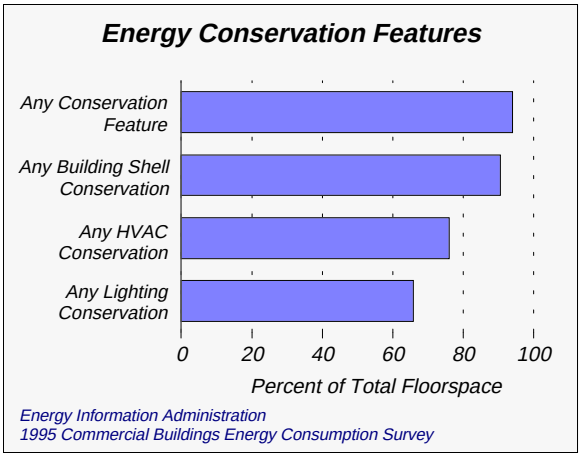
Major Uses of Energy in Commercial Buildings

- *The four dominant uses of energy in commercial buildings were water heating, lighting, space heating, and cooling. All of these uses occurred in at least 60 percent of total floorspace (and in 70 percent of buildings).*
- *The percent of total floorspace in commercial buildings that had the capability to generate electricity increased from less than 10 percent in 1989 to more than 20 percent in 1995. No other end use showed a significant change.*



Energy Conservation Features and Practices

- *Energy conservation was widely practiced in commercial buildings. An overwhelming majority had installed or employed some type of conservation feature or practice (94 percent of floorspace and 89 percent of buildings).*
- *Most commercial buildings employed some kind of building shell; heating, cooling, and ventilation (HVAC); or lighting conservation feature.*
- *Use of conservation features and practices became more common. Several specific types of building shell and lighting system conservation features showed significant increases in use from use in previous CBECS.*



Overview of the Commercial Buildings Sector

The commercial sector, defined economically, consists of establishments and operating locations that provide services. Excluded from the sector are the goods-producing industries: manufacturing, agriculture, mining, forestry and fisheries, and construction. Defined in this way, the commercial sector is extremely varied. It 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 sense, such as public schools, correctional institutions, and religious and fraternal organizations.

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 energy use. Thus, the Energy Information Administration (EIA) has chosen to survey commercial buildings in order to provide the best possible commercial energy information database. The Commercial Buildings Energy Consumption Survey (CBECS) is a national-level sample survey of commercial buildings and their energy suppliers. This quadrennial (formerly triennial) survey collects information on physical characteristics of buildings, building use and occupancy patterns, equipment use, conservation features and practices, and types and uses of energy in buildings. The survey also collects from energy suppliers amounts and costs of energy delivered to the sampled buildings. The target population for the 1995 CBECS consisted of all commercial buildings in the United States with 1,001 square feet or more of floorspace. The commercial building population sampled in 1995 differed slightly from that sampled in previous CBECS. Two types of buildings, parking garages and commercial buildings on multibuilding manufacturing facilities, previously included were excluded.

The decision makers and organizations that are concerned with the use of energy--building owners and managers; regulators, legislative bodies, and executive agencies at all government levels; equipment manufacturers and retailers; utility company managers--are confronted with a buildings sector that is complex. As noted above, the commercial sector is extremely varied and buildings are distributed unequally with respect to building characteristics. Analysis of data on major characteristics, such as building activity, age of building, size of building, and location, answer particular kinds of questions--What kinds of commercial buildings are there? How old are they? How big are they? Where are they?--that are fundamental to understand the use of energy in commercial buildings.

In 1992, the survey year of the most recent CBECS energy consumption and expenditures data, commercial buildings in the United States consumed 5,490 trillion Btu of energy. In comparison, residential households consumed 10,010 trillion Btu in 1993 and manufacturing establishments consumed 21,700 trillion Btu in 1994 (from the *1993 Residential Energy Consumption Survey* and the *1994 Manufacturing Energy Consumption Survey*, respectively). Release of energy consumption (and expenditures) data for commercial buildings in 1995 will follow completion of the CBECS supplier survey.

The following profile is a snapshot of the major characteristics of the commercial buildings sector in 1995. Succeeding sections discuss energy and energy-related characteristics--energy sources and end uses, end-use equipment, and energy conservation features and practices. The complete set of detailed tables of building characteristics data for the 1995 CBECS are available electronically in PDF format on the EIA Home Page (http://www.eia.doe.gov).

The Commercial Buildings Energy Consumption Survey

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 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 1,001 square feet of floorspace. A commercial building is defined by CBECS as 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%.

In previous years, CBECS data were published in two major data reports, one covering building characteristics and a second covering energy consumption and expenditures. Beginning with the 1995 CBECS, these data will be released in shorter reports with accompanying data tables, each covering a selected portion of CBECS data.

Interpretation of CBECS Data

The estimates in the data tables are based on the sample selected and are subject to sampling error. Variability occurs in survey statistics because the different samples that could be drawn from the population of commercial buildings would each produce different values for the survey statistics. Thus, the apparent difference between any two estimates may not be statistically significant because of the variance associated with each estimate. Care should be taken when making comparisons with the estimates presented in the data tables. See the following section for a discussion of relative standard errors (RSE) and how they can be used to construct confidence intervals for the estimates.

The commercial buildings population sampled in 1995 differed slightly from that sampled in previous CBECS. Two types of buildings, indoor parking garages and commercial buildings on multibuilding manufacturing facilities, that had previously been included were excluded. Because of this change, estimates of the number of buildings or the amount of floorspace in the 1995 CBECS cannot be compared directly with results from earlier CBECS.

Profile of Commercial Buildings in 1995

In 1995, there were 4.579 (+/- 0.350) million commercial buildings in the United States comprising 58.772 (+/-3.917) billion square feet of floorspace. That amount of commercial floorspace exceeds the total area of the State of Delaware and would amount to more than 200 square feet for every resident in the United States. The Commercial Buildings Energy Consumption Survey (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 (consumption per square foot) vary greatly by building activity (see box). In 1992, health care buildings had a high intensity (228.5 thousand Btu per square foot compared to 80.9 for all buildings), but total energy consumption for those buildings was relatively low (only 7.3 percent of total consumption) because total health care floorspace 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, with heating more important in the North and cooling more important in the South.

The commercial building population in the 1995 CBECS was defined differently from that of previous CBECS; parking garages and commercial buildings located on manufacturing facilities were excluded. Figures 1 and 2 show the 1989, 1992, and 1995 estimates for number of buildings and floorspace and the 95-percent confidence ranges for each. Because of the sampling error associated with the estimates (see box), the apparent differences between the estimates for different survey years are not statistically significant. To compare the 1995 CBECS with the 1989 and 1992 CBECS, an adjustment was made to the 1989 and 1992 estimates to match the 1995 definition. The adjustment reduced the estimate of the number of 1989 buildings from 4.528 million buildings to 4.342 million (a reduction of 4.1%) and reduced the amount of 1989 floorspace from 63.184 billion square feet to 59.915 billion (a 5.2 percent reduction). Similarly, the adjustment reduced the number of 1992 buildings from 4.806 million buildings to 4.672 million (a 2.8 percent reduction) and reduced the amount of 1992 floorspace from 67.876 billion square feet to 64.269 billion (a 5.3 percent reduction).

Figure 1. Total Commercial Buildings for 1989 (adjusted), 1992 (adjusted), and 1995

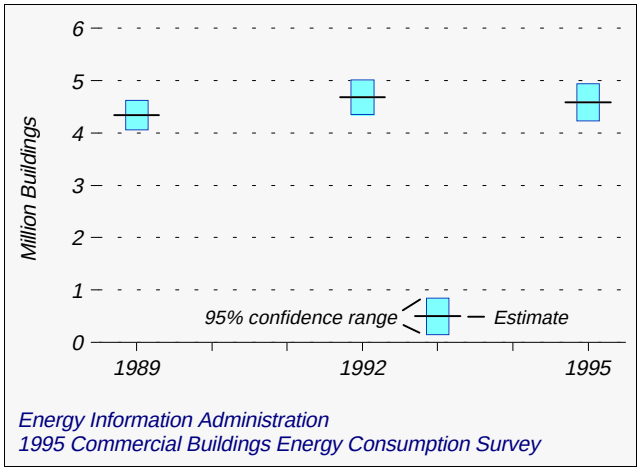
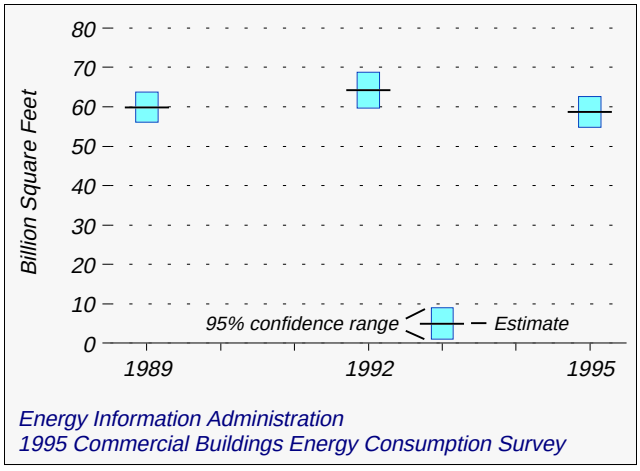


Figure 2. Total Commercial Floorspace for 1989 (adjusted), 1992 (adjusted), and 1995



In the *residential sector*, a total of 96.6 million households occupied 76.5 million residential buildings in 1993 (4.1 million buildings were multi-unit buildings). These buildings contained a total of 181.2 billion square feet of floorspace. (These data are from the *1993 Residential Energy Consumption Survey*.) The mean size of commercial buildings was 12,840 square feet, whereas the mean size of residential buildings was 2,369 square feet (and 1,875 square feet per housing unit).

In the *manufacturing sector*, the approximate enclosed floorspace of all buildings on reporting manufacturing facilities was 12.229 billion square feet in 1994. The average enclosed floorspace per establishment was 55,200 square feet. (These data are from the *1994 Manufacturing Energy Consumption Survey*.)

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 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, Tables A through J 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 (Table A.2) 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.

Energy Intensity

Energy intensity refers to the amount of energy consumed per unit of activity or service. For the commercial buildings sector, useful indicators of energy intensity are consumption per square foot, consumption per hour of operation, consumption per worker, or some combination of these. Amount of floorspace is an indicator of commercial activity. Two measures of floorspace are used; total floorspace and conditional floorspace. Conditional floorspace further defines the floorspace; it can be restricted to an energy source (e.g., floorspace served by electricity) or to an end use (e.g., heated floorspace).

A complete discussion on the use of energy intensities in the commercial buildings sector, and other sectors, can be found in the Energy Information Administration report ***Measuring Energy Efficiency in the United State's Economy: A Beginning,*** DOE/EIA-0555 (95)/2 (Washington, DC, October, 1995) and in ***Energy Efficiency and Human Activity: Past Trends, Future Prospects***, Lee Schipper and Richard B. Howarth, 1992, Cambridge University Press, Cambridge, England, 385 pages.

Major Activities in Commercial Buildings

Each principal building activity has its own set of characteristics (energy sources, equipment, number of workers, hours of operation) that contribute to total energy use. The commercial buildings sector was dominated by four types of activity: mercantile and service, office, warehouse and storage, and education (Figure 3). Together they comprised 67 percent of commercial floorspace and 63 percent of commercial buildings in 1995. 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. That meant that those buildings were larger in average size (Figure 4). At 25,100 square feet per building, education buildings were the largest type, much larger than that of all commercial buildings (12,840 square feet per building). Two other building activities, lodging and health care (22,900 and 22,200 square feet per building, respectively), were significantly larger than the average size of all buildings.

Figure 3. Distribution of Floorspace and Buildings by Principal Building Activity, 1995

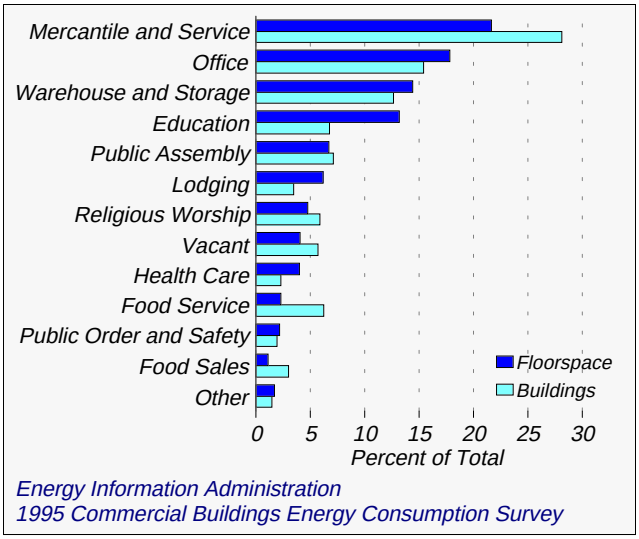
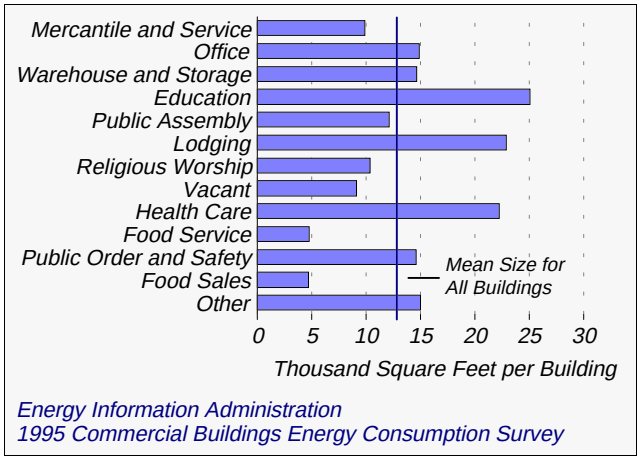


Figure 4. Mean Building Size by Principal Building Activity, 1995



Both food sales and food service buildings were significantly smaller in average size (fewer than 5,000 square feet per building). These two categories include convenience stores, retail bakeries, fast food restaurants, and bars, all typically small buildings.

Office buildings, which included some of the very largest commercial buildings in the United States, had an average size (14,900 square feet), very close to that of the building population in general. A common image of an office building is the multi-story building that dominates the skyline of the central cities. The category is actually dominated by smaller buildings, such as banks, real estate offices, and insurance offices. Collectively, they bring the overall office building average close to that of the total commercial population mean.

Building characteristics data for commercial buildings located on non-manufacturing facilities are shown in Table A.1 and Table A.2. Principal facility activities included: education (primary or secondary, college, other), government (post office, prison, other), non-manufacturing industrial, hospital or other health service, and transportation.

Size of Buildings

The vast majority of commercial buildings were found in the smallest size categories, with more than half (52 percent) in the smallest category and three quarters in the two smallest categories (Figure 5). The dominance of buildings in the smaller size categories is well illustrated in the cumulative percent graph (Figure 6).

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. However, large buildings comprised a significant percentage of total floorspace (44 percent for buildings larger than 50,000 square feet; 30 percent for buildings larger than 100,000 square feet).

Figure 5. Distribution of Floorspace and Buildings by Size of Building, 1995

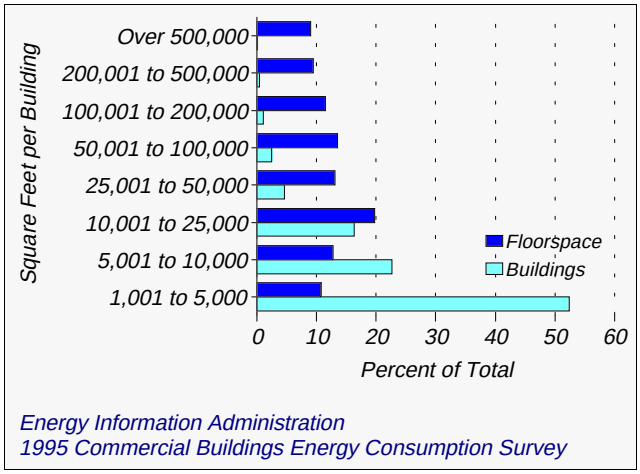
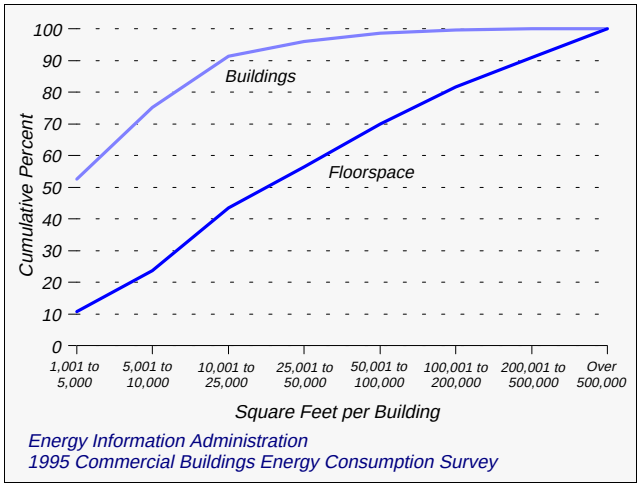


Figure 6. Cumulative Percent of Floorspace and Buildings by Size of Building, 1995



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.

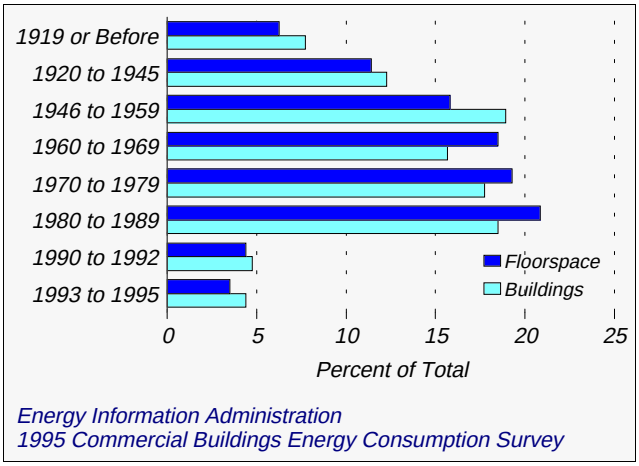
Examples of buildings by size category:

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

Year Constructed

Most commercial buildings, once constructed, are expected to last for decades or longer. New buildings are constructed each year and older buildings are demolished, but the commercial buildings stock at any point in time is dominated by older buildings. 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 7). 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 represented less than 10 percent of both buildings and floorspace in the 1995 buildings stock.

Figure 7. Distribution of Floorspace and Buildings by Year Constructed, 1995



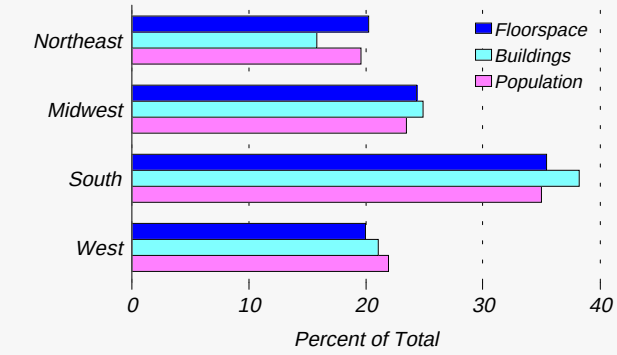
Location of Commercial Buildings

Census Region

The U.S. Census Bureau divides the United States into four Census regions, each with nine to 16 States. For 1995, commercial buildings, floorspace, and population were distributed in a similar pattern for the four regions (Figure 8). The high correlation of buildings and floorspace with population was not surprising since commercial activity is mostly 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).

Figure 8. Distribution of Floorspace, Buildings, and Population by Census Region, 1995



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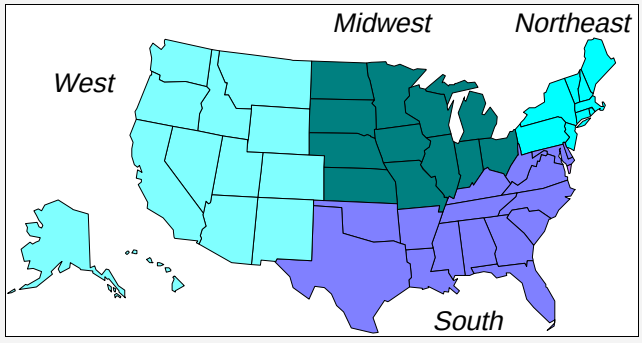
1995 Commercial Buildings Energy Consumption Survey
U. S. Bureau of Census, Statistical Abstract of the United States: 1996

Census Region

The Bureau of the Census (U.S. Department of Commerce) has divided the United States into four geographic regions, each with nine to 16 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

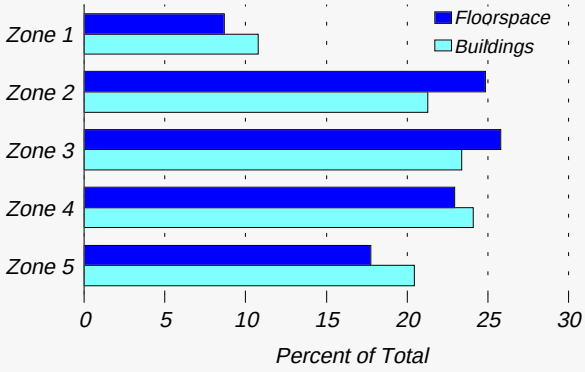
South Region: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia

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. 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. As with other characteristics, commercial buildings and floorspace were unevenly distributed by climate zone. Less than 10 percent of floorspace and less than 12 percent of buildings were found in Zone 1 (Figure 9). The other four zones had roughly equal shares of buildings and floorspace.

Figure 9. Distribution of Floorspace and Buildings by Climate Zone, 1995



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1995 Commercial Buildings Energy Consumption Survey

Climate Zone

The United States is divided into five climatically distinct areas (climate zones) that are defined by long-term weather conditions, which 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); 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); annual CDD is the sum of the daily CDD for the reference year.

	Average Annual CDD	Average Annual HDD
Climate Zone 1	Fewer than 2,000	More than 7,000
Climate Zone 2	Fewer than 2,000	5,500 to 7,000
Climate Zone 3	Fewer than 2,000	4,000 to 5,499
Climate Zone 4	Fewer than 2,000	Fewer than 4,000
Climate Zone 5	2,000 or more	Fewer than 4,000

Examples of cities in each of the five climate zones:

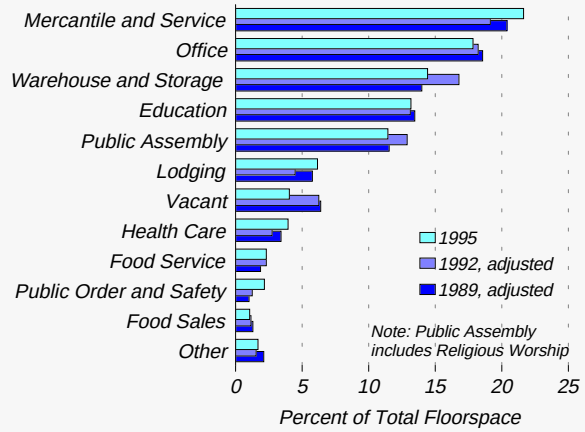
Climate Zone 1--Billings, Montana; Casper, Wyoming; Minneapolis, Minnesota; Augusta, Maine
Climate Zone 2--Reno, Nevada; Omaha, Nebraska; Des Moines, Iowa; Indianapolis, Indiana; Boston, Massachusetts
Climate Zone 3--Seattle, Washington; Albuquerque, New Mexico; Wichita, Kansas; Lexington, Kentucky; Baltimore, Maryland
Climate Zone 4--San Francisco, California; Lubbock, Texas; Memphis, Tennessee; Raleigh, North Carolina
Climate Zone 5--Honolulu, Hawaii; Las Vegas, Nevada; Dallas, Texas; New Orleans, Louisiana; Miami, Florida

Changes in Major Characteristics of Commercial Buildings from 1989 to 1995

The profiles of major characteristics of commercial buildings showed no statistically significant changes from 1989 to 1992 to 1995, the years in which the last three CBECS surveys were conducted (Figures 10, 11, and 12). The data from 1989 and 1992 were adjusted to match the definition of commercial building population used in the 1995 CBECS. There were changes in absolute numbers of buildings and floorspace within categories of the major characteristics, but when each category was expressed as a percentage of the total, no significant differences in percentages for major categories between surveys were noted.

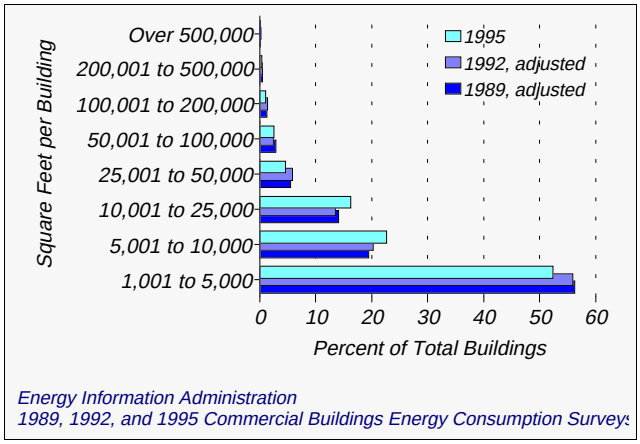
Significant changes between surveys would occur if characteristics in the newest buildings (constructed since the previous survey) were quite different, or if changes were made to buildings in the existing stock. However, each 3-year increment of new buildings and floorspace was generally small compared to all buildings and floorspace in a given category and the changes that did occur were not great enough to be statistically significant.

Figure 10. Distribution of Floorspace by Principal Building Activity, 1989, 1992, and 1995



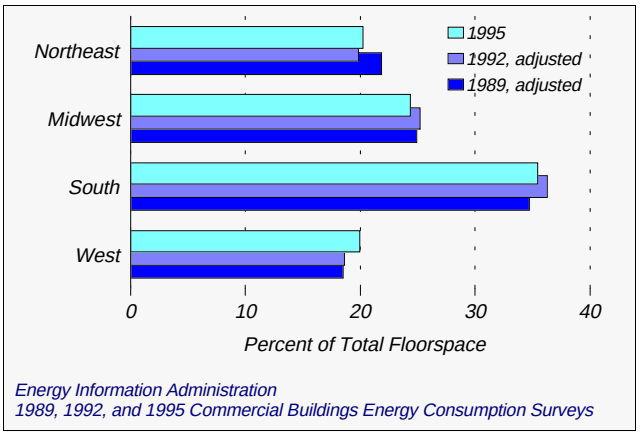
Energy Information Administration
1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys

Figure 11. Distribution of Buildings by Size of Building, 1989, 1992, and 1995



Energy Information Administration
1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys

Figure 12. Distribution of Floorspace by Census Region, 1989, 1992, and 1995



Energy Information Administration
1989, 1992, and 1995 Commercial Buildings Energy Consumption Surveys

Energy-Related Characteristics of Commercial Buildings

Commercial buildings exist to house commercial establishments and provide a comfortable environment for employees and on-site customers or clients. 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--What energy is used? For what purposes is it used? and How are these purposes accomplished? To answer these and related questions, the Commercial Buildings Energy Consumption Survey collects information on energy sources, the end uses of energy, and energy-consuming equipment.

- **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.

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

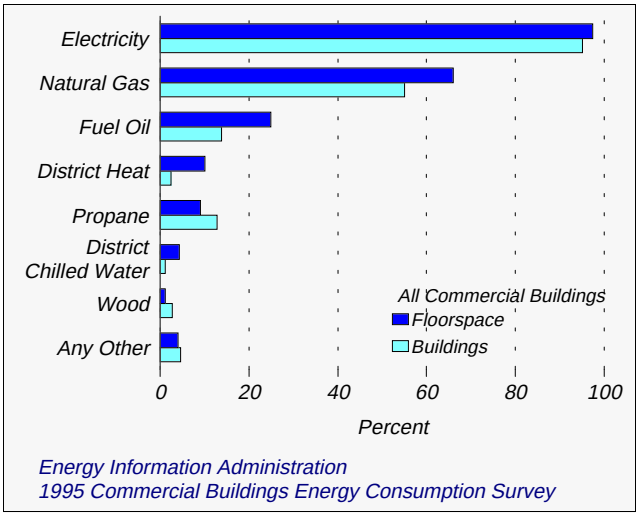
- **End-use equipment** refers to the specific type of equipment that is used to perform a given end use. Specific types of end-use equipment include the following: heat pumps, furnaces, packaged air-conditioning units, central chillers, fluorescent light fixtures, and compact fluorescent bulbs.

Each of these characteristics for the 1995 CBECS is discussed in the following sections, along with comparisons to characteristics in previous CBECS. There is also a discussion of additional energy-related data collected by CBECS, including data on energy conservation features and practices and their sponsorship, and renewable energy sources.

Energy Sources

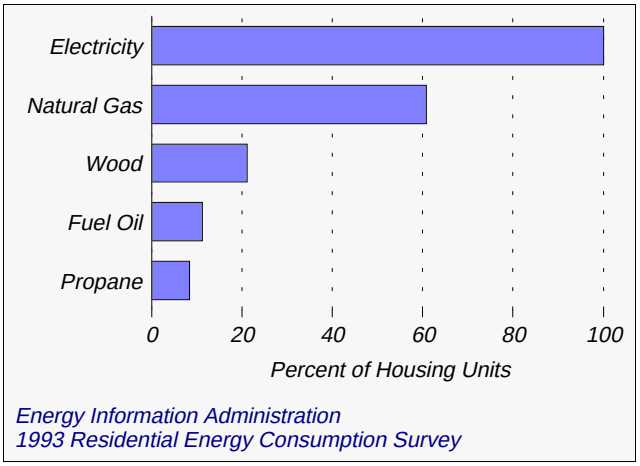
Electricity and natural gas were by far the most commonly used sources of energy in commercial buildings (Figure 13). Electricity use was nearly universal (95 percent of buildings and 97 percent of floorspace) while natural gas was used in 54 percent of buildings and 65 percent of floorspace. No energy source besides electricity and natural gas was used for more than a quarter of total floorspace or 15 percent of buildings.

Figure 13. Energy Sources Used in Commercial Buildings, 1995



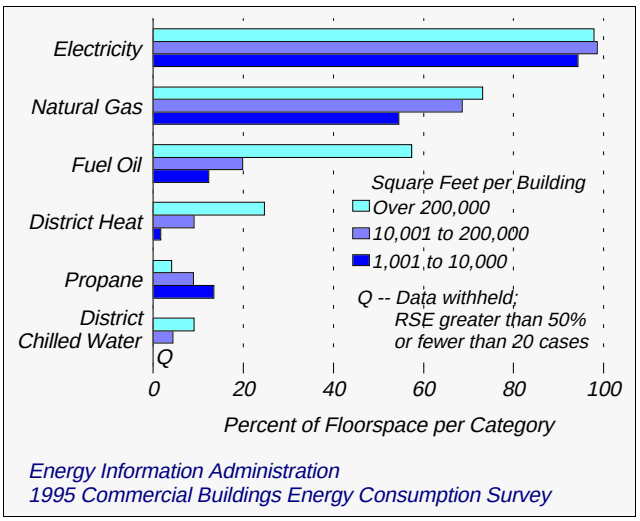
In *residential housing units*, in 1993, the two primary energy sources used were electricity and natural gas, both used about as often as in commercial buildings (99.9 percent of housing units for electricity and 61 percent of housing units for natural gas) (Figure 14, data from the *1993 Residential Energy Consumption Survey*). Two major differences between commercial buildings and residential units were the use of district energy sources (district heat and district chilled water) in commercial buildings and the much greater use of wood by residential households. A total of 21 percent of housing units used wood; in commercial buildings, its use was limited (3 percent of buildings, 1 percent of floorspace).

Figure 14. Energy Sources Used in Residential Housing Units, 1993



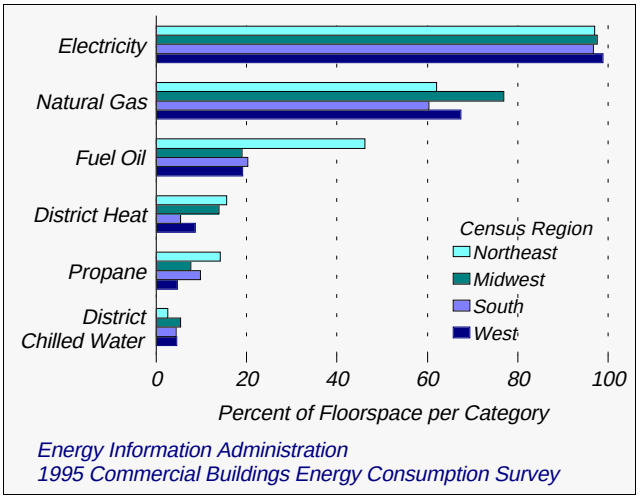
Energy use varied substantially in commercial buildings within the categories of two major characteristics, size of building and Census region. Particularly notable was the impact of the size of building on the choice of energy sources used. Four energy sources--natural gas, fuel oil, district heat, and district chilled water--were more often used in larger commercial buildings than in smaller buildings (Figure 15). One energy source, propane, was more often used in smaller buildings.

Figure 15. Energy Sources Used by Size of Building, 1995



The location of buildings by Census region was an important factor in the use of fuel oil, district heat, and propane (Figure 16). Fuel oil was used in buildings that comprised more than 46 percent of floorspace in the Northeast region--more than twice the percentage of floorspace in any other region. District heat was used less in the South than in either the Northeast or Midwest regions, and propane was used less in the West than in the Northeast. All other regional comparisons were not significantly different.

Figure 16. Energy Sources Used by Census Region, 1995



Energy Sources by End Use

Major uses of electricity were for cooling, space heating, water heating, and cooking (Figure 17). Other uses for electricity, not shown, were lighting, office equipment, ventilation equipment, and refrigeration. The percentages of floorspace with water heating or cooking were calculated by dividing the sum of *all floorspace* in buildings with these 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 these end uses by total floorspace.

The two dominant end uses of natural gas were space heating and water heating (Figure 18). Fuel oil and district heat, where used, were predominantly used for space heating and water heating (Figures 19). Both of these energy sources, along with natural gas, served as primary space heating sources, when used for space heating. Electricity was more often used as a secondary space heating source than were the other three sources.

Figure 17. Electricity End Uses, 1995

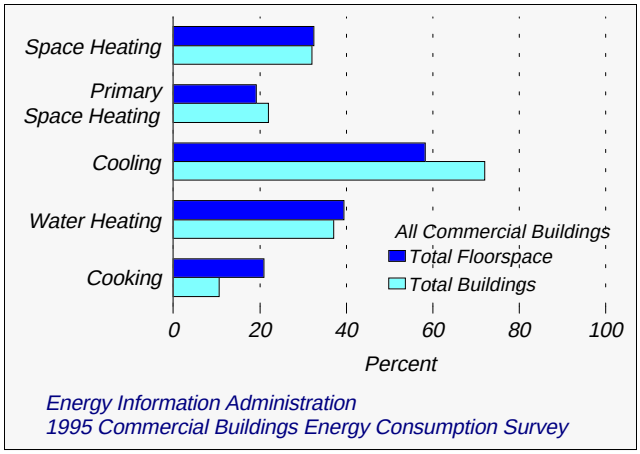


Figure 18. Natural Gas End Uses, 1995

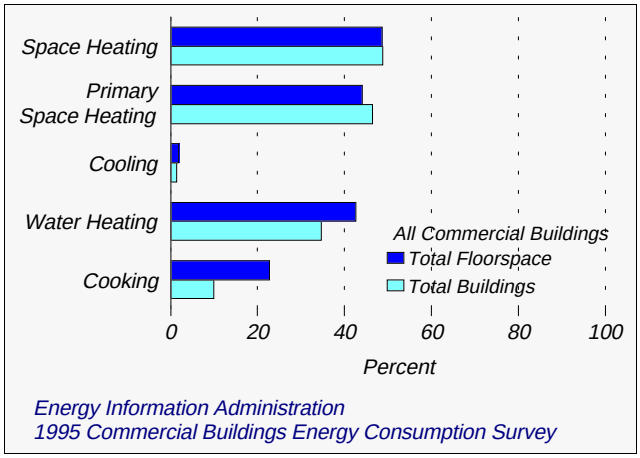
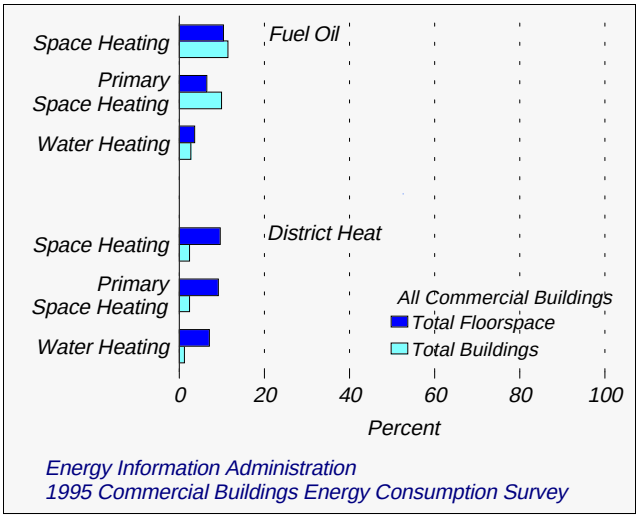


Figure 19. Fuel Oil and District Heat End Uses, 1995



Energy End Uses

The four dominant end uses in commercial buildings, both in percentage of buildings and percentage of floorspace, were water heating, lighting, space heating, and cooling (Figure 20). The percentages of floorspace for lighting, heating, and cooling refer only to the portions of floorspace within buildings that are lit, heated, and cooled, respectively. The percentages of floorspace for each of the other end uses refer to all floorspace in the buildings with that particular end use.

In *residential housing units*, three of the major end uses--lighting, water heating, and space heating--were nearly universally used (98 percent of housing units or greater) (Figure 21, data from the *1993 Residential Energy Consumption Survey*). Cooling was as widely used by households (66 percent of all housing units) as in commercial buildings.

Figure 20. End Uses in Commercial Buildings, 1995

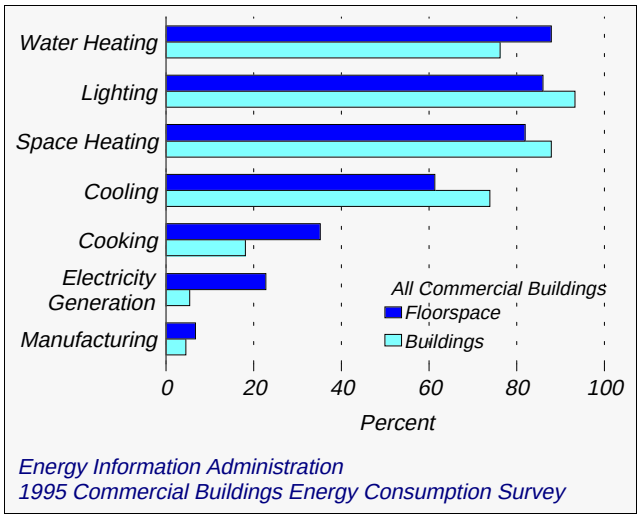
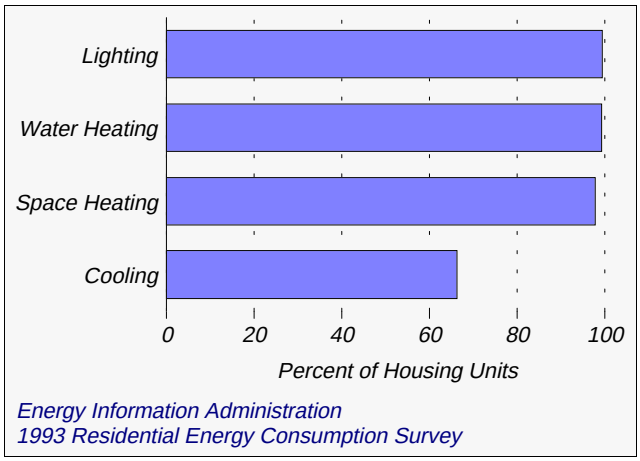
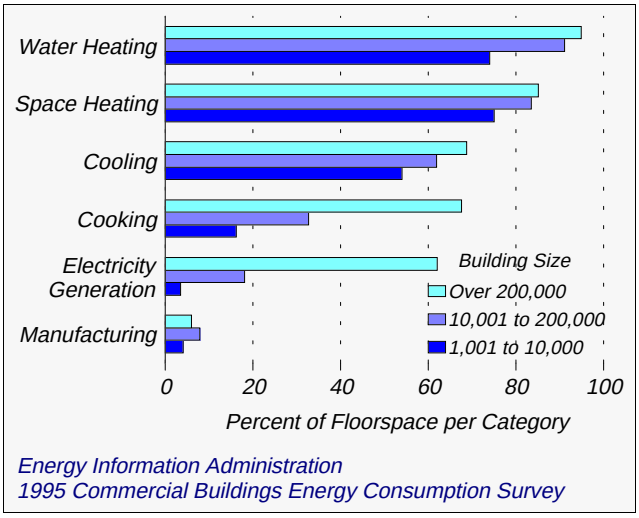


Figure 21. End Uses in Residential Housing Units, 1993



Electricity generation in commercial buildings was predominantly used for emergency back-up generation (78 percent of buildings and 88 percent of floorspace in buildings that have electricity generation). Both electricity generation and cooking showed a strong bias towards larger commercial buildings (Figure 22). In buildings larger than 200,000 square feet, both were used in buildings that accounted for a substantial majority (about two thirds) of floorspace. In the smallest buildings, those 10,000 square feet or less, they were used much less frequently (for cooking, 16 percent of floorspace; and for electricity generation, 4 percent of floorspace). Buildings with cooking and electricity generation were both dominated by the following principal activities: office, mercantile and service, education, health care, lodging, and public assembly buildings. The buildings that constitute three of these activities--education, health care, and lodging--are significantly larger than the mean size of all commercial buildings.

Figure 22. End Uses by Size of Building, 1995



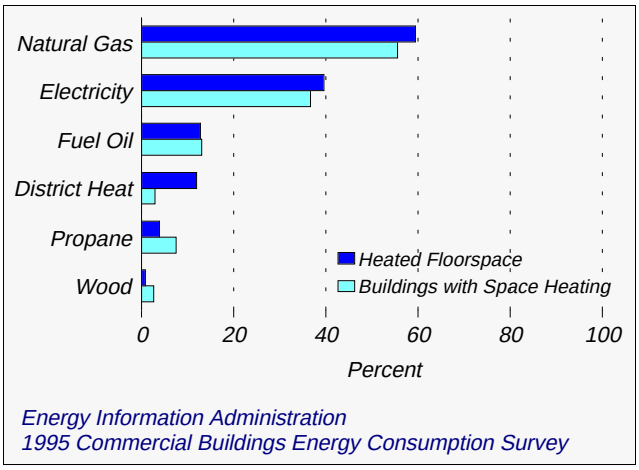
Energy Uses by Energy Source

Electricity and natural gas were the most used energy sources for the major end uses. The accompanying graphs (Figures 23, 24, 25, and 26) show use by energy source for the four end uses. In each case, the percentages of buildings and floorspace are conditional, they refer only to the buildings with the particular end use. For water heating and cooking, the percentage of floorspace refers to all buildings that have water heating or cooking. For space heating and cooling, the percentage of floorspace refers to the heated or cooled floorspace portions within heated or cooled buildings.

Electricity was the most flexible energy source in commercial buildings--a major source for the end uses shown in these figures, as well as the sole source for lighting, ventilation equipment, office equipment, and all other electrical equipment used in commercial buildings.

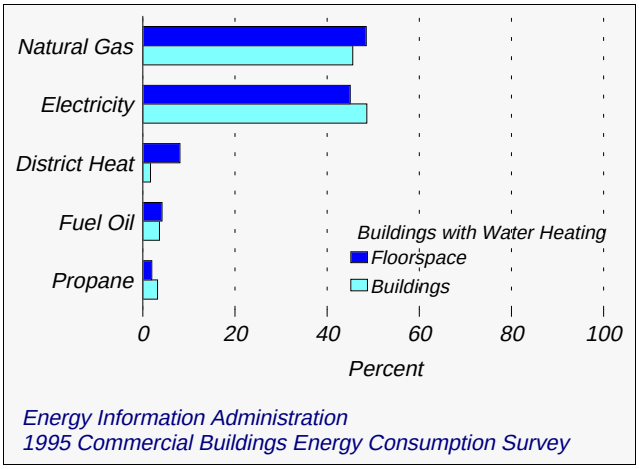
Space heating had the greatest variety of energy sources; natural gas and electricity were dominant, with fuel oil, district heat, and propane being significant contributors (Figure 23). District heat was used primarily in larger buildings (51,400 square feet per building on average) and propane in smaller buildings (6,700 square feet on average). Use of wood for space heating was limited (only 1 percent of heated floorspace and 3 percent of heated buildings).

Figure 23. Space Heating Energy Sources, 1995



Natural gas and electricity were used in about equal percentages of buildings and floorspace for water heating (Figure 24). District heat and propane were used in larger (72,000 square feet on average) and smaller (9,300 square feet on average) buildings, respectively.

Figure 24. Water Heating Energy Sources, 1995



Electricity was by far the dominant energy source for cooling in commercial buildings (Figure 25). District chilled water and natural gas had limited use (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). Natural gas and electricity use for cooking was nearly equal, with propane the third most used source (Figure 26).

Figure 25. Cooling Energy Sources, 1995

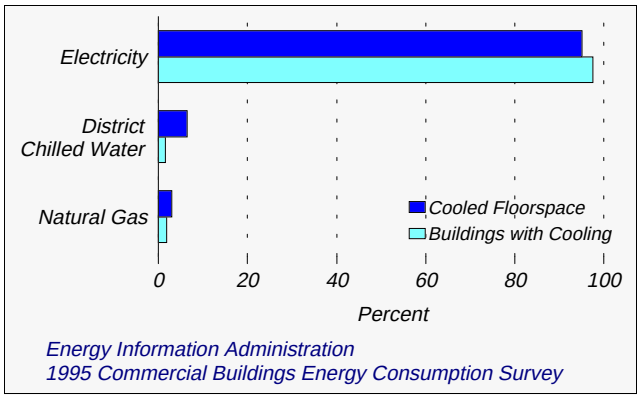
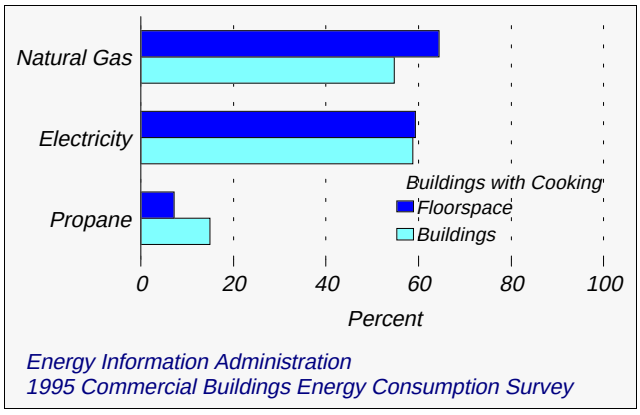


Figure 26. Cooking Energy Sources, 1995



Changes in Energy Sources and End Uses

Energy Sources

There were no significant changes from 1989 to 1992 to 1995 in the percentage of floorspace served by the major energy sources (Figure 27). The data from 1989 and 1992 were adjusted to match the definition of commercial building population used in the 1995 CBECS. Apparent increases in the percentage of floorspace that used electricity for major end uses were not statistically significant (Figure 28). Natural gas, like electricity, showed no significant changes for major end uses (Figure 29).

The percentages of floorspace with water heating or cooking were calculated by dividing the sum of *all floorspace* in buildings with these 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 these end uses by total floorspace.

Figure 27. Energy Sources Used in Commercial Buildings, 1989, 1992, and 1995

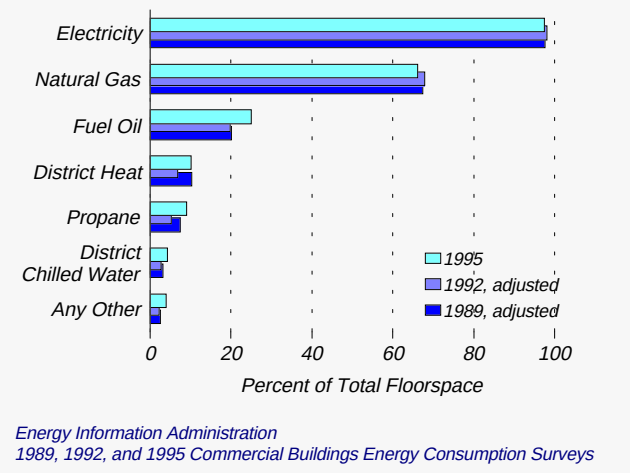


Figure 28. Electricity End Uses, 1989, 1992, and 1995

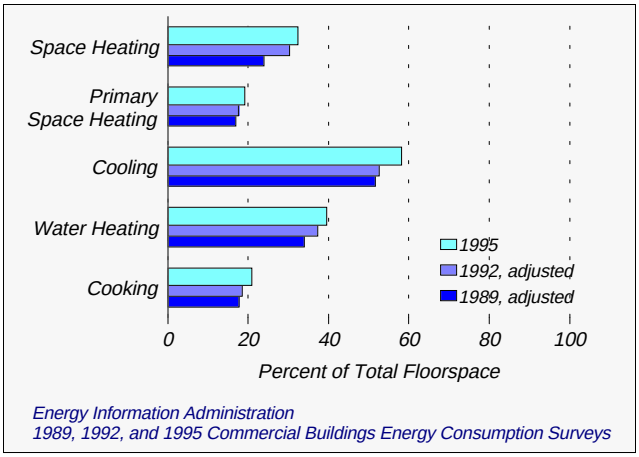
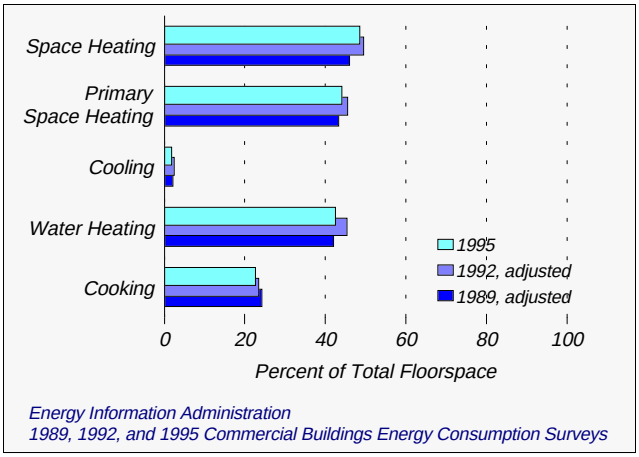


Figure 29. Natural Gas End Uses, 1989, 1992, and 1995



Energy End Uses

The amount of floorspace in buildings served by the major end uses showed no significant changes from 1989 to 1992 to 1995, with the exception of electricity generation (Figure 30). That end use increased from less than 10 percent of total floorspace in 1989 to more than 20 percent in 1995.

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

There were two significant changes in energy sources used for space heating (Figures 31). There was an increase in floorspace heated by electricity (from 30 percent of heated floorspace in 1989 to 40 percent in 1995). In contrast, the amount of heated floorspace with fuel oil space heating declined from 19 percent in 1989 to 13 percent in 1995.

The three major energy sources used for cooling--electricity, district chilled water, and natural gas--showed no significant changes in the percentage of floorspace cooled by each (Figure 32).

Figure 30. End Uses in Commercial Buildings, 1989, 1992, and 1995

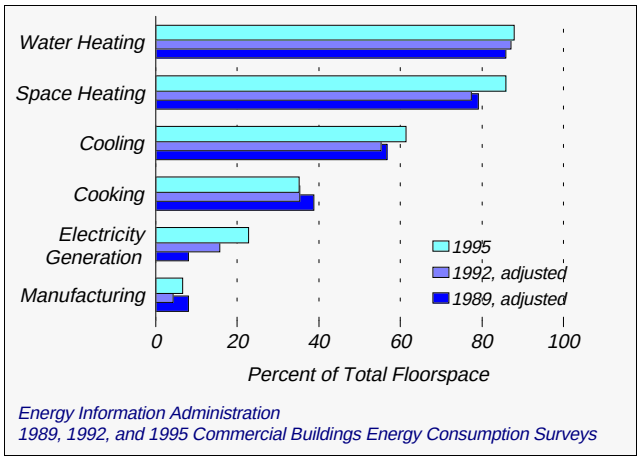


Figure 31. Space Heating Energy Sources, 1989, 1992, and 1995

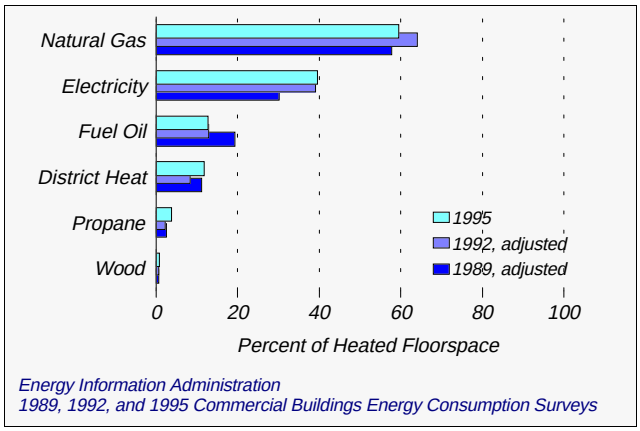
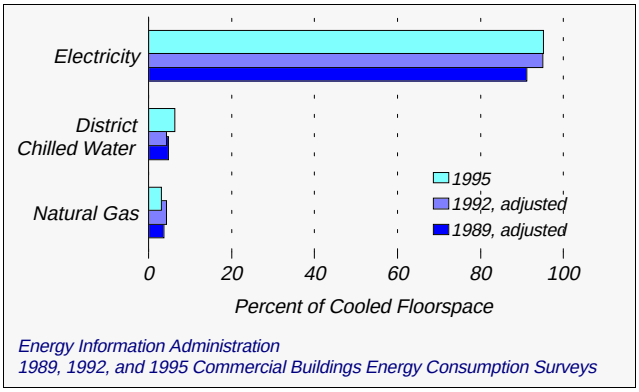


Figure 32. Cooling Energy Sources, 1989, 1992, and 1995



End-Use Equipment

Space Heating Equipment

Four types of heating equipment were used extensively--packaged heating units, boilers, individual space heaters, and furnaces (Figure 33). 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 (Figures 33 and 34; Tables B.1, B.2, and B.3). All four types were used to heat about 30 percent of total heated floorspace, 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 (see following section for more details).

Figure 33. Heating Equipment Used for Main and Other Use, Percent of Heated Floorspace, 1995

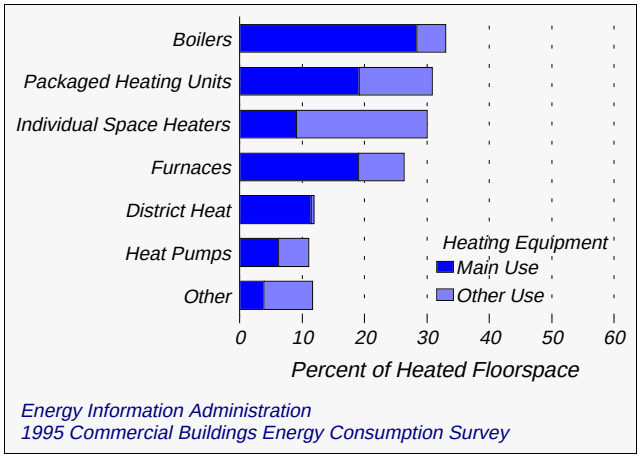
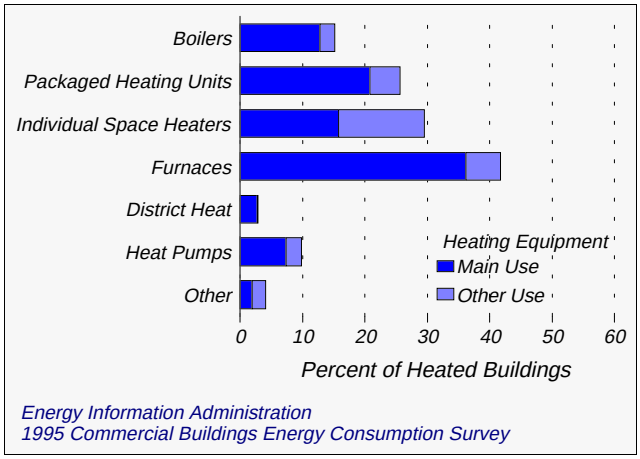


Figure 34. Heating Equipment Used for Main and Other Use, Percent of Heated Buildings, 1995

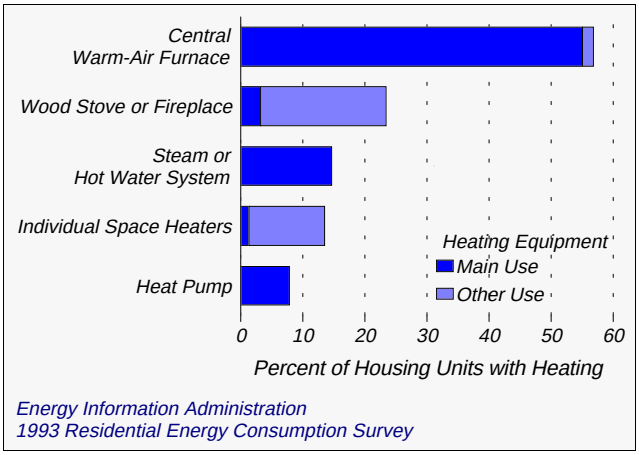


The CBECS collected information on how much of the heated floorspace within a building is served by each equipment type (Table C). Those data were aggregated into four categories: "not used," "less than 51 percent," "51 percent to 99 percent," and "100 percent;" meaning, "not used to heat the building," "used to heat half or less of the heated floorspace," "used to heat more than half of the heated floorspace," and "used to heat all of the heated floorspace." Buildings that used boilers, furnaces, and packaged heating units used these equipment types extensively, primarily for heating more than half, to all, of the heated areas. In contrast, individual space heaters were generally used to heat less than half of heated buildings; that is, they were more often used as secondary heating equipment.

The four predominant types of heating equipment had the heat they produced distributed primarily via one of three types of heating distribution system (Tables D.1, D.2, and D.3). 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. Individual space heaters gave off heat directly to surrounding areas without a separate distribution system.

Residential housing units (houses, apartments, or rooms occupied by households) were much smaller in average size than commercial buildings (1,875 square feet per housing unit versus 12,840 square feet per commercial building, residential data from the *1993 Residential Energy Consumption Survey*). Because a much smaller volume of air needs to be heated in residential units, the types of equipment used in those units differed from those used in commercial buildings (Figure 35). Residential units were dominated by a single equipment type (central warm-air furnaces), whereas commercial buildings had several types that were commonly used, a reflection of the wide range of commercial building activities and building sizes compared to those of residential buildings.

Figure 35. Heating Equipment Used for Main and Other Use, Percent of Residential Housing Units with Heating, 1993



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 (Figure 36). They cooled a total of 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 (Figures 36 and 37; Tables E.1, E.2, and E.3).

Central chillers were used for 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, for 15 percent to 19 percent of cooled floorspace.

In buildings that used central chillers, that equipment was used primarily to cool most of the cooled floorspace (Table F). Individual air conditioners were most often used to cool less than half of cooled floorspace--they were more likely to be used to supplement other cooling equipment. Both packaged air-conditioning units and residential-type central air-conditioners showed either substantial use to cool all of the cooled floorspace, or use to cool less than half of the cooled floorspace, that is, use as secondary cooling equipment.

Figure 36. Cooling Equipment Used for Main and Other Use, Percent of Cooled Floorspace, 1995

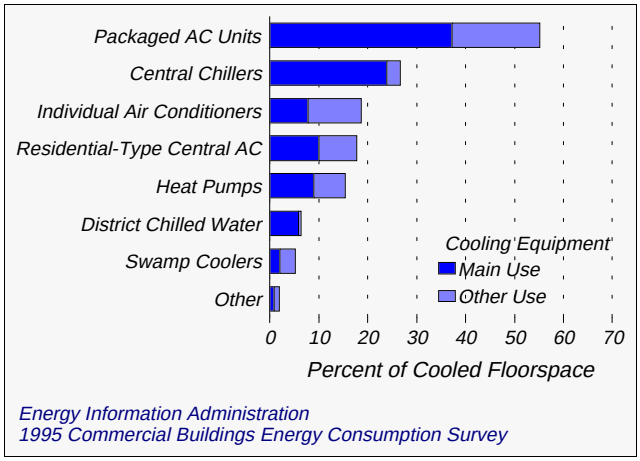
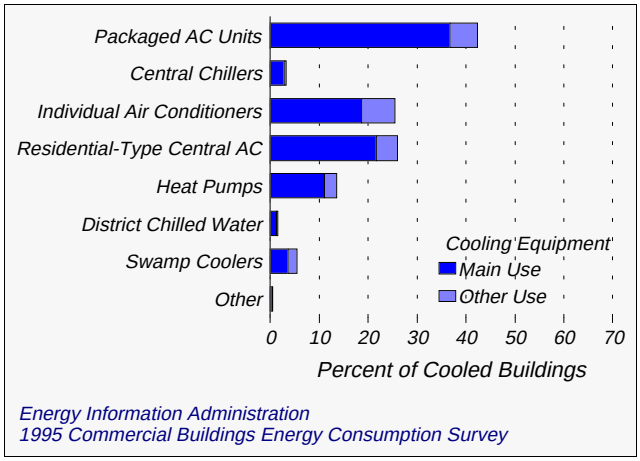


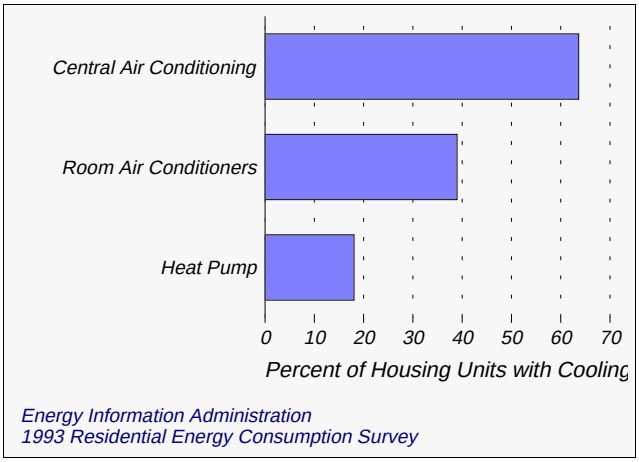
Figure 37. Cooling Equipment Used for Main and Other Use, Percent of Cooled Buildings, 1995



Packaged air-conditioning units, residential-type central air- conditioners, and cold air produced by central chillers had cool air distributed primarily by ducts or air-handling units (Tables G.1, G.2, and G.3). 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.

The three principal types of cooling equipment--central air-conditioning systems, room air-conditioners, and heat pumps--used in substantial numbers of commercial buildings were also used in *residential housing units* (Figure 38, data from the *1993 Residential Energy Consumption Survey*).

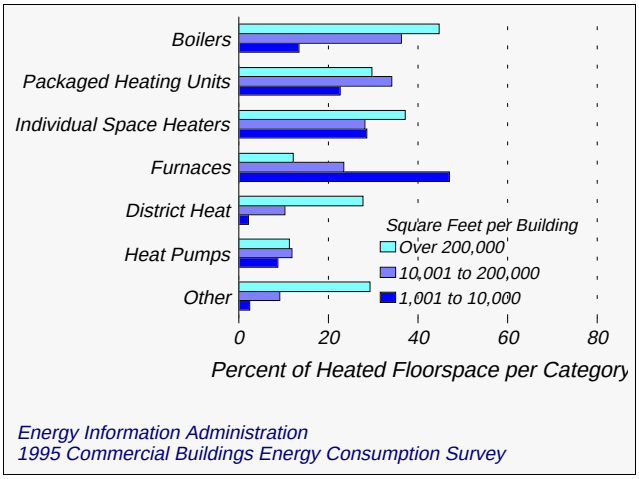
Figure 38. Cooling Equipment Used in Residential Housing Units, 1993



Use of Heating Equipment by Size and Age of Building

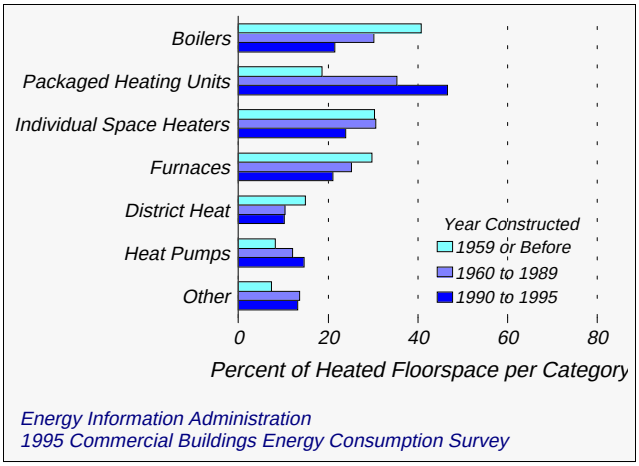
The use of certain types of heating equipment in commercial buildings was closely related to the size of building (Figure 39). Boilers and district heating were used preferentially in the largest buildings, while furnaces were more used in smaller buildings. Boilers heated 45 percent of heated floorspace in the largest size category (buildings larger than 200,000 square feet), but were used in only 13 percent in the smallest category (buildings 10,000 square feet or less). Similarly, district heat was used for 28 percent of floorspace in the larger buildings but was used in just 2 percent of floorspace in the smaller buildings. Furnaces showed the opposite relationship: they heated 47 percent of heated floorspace in the smaller buildings and 12 percent in the largest buildings.

Figure 39. Heating Equipment Used by Size of Building, 1995



Two types of heating equipment showed significant differences by the age of buildings that they were used in; boilers were used more widely in older buildings, and packaged heating units were used more widely in newer buildings (Figure 40). Boilers heated 41 percent of heated floorspace in older buildings (those constructed before 1960) and half as much (22 percent) in buildings constructed in the 1990's. Conversely, 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 floorspace in those constructed before 1960.

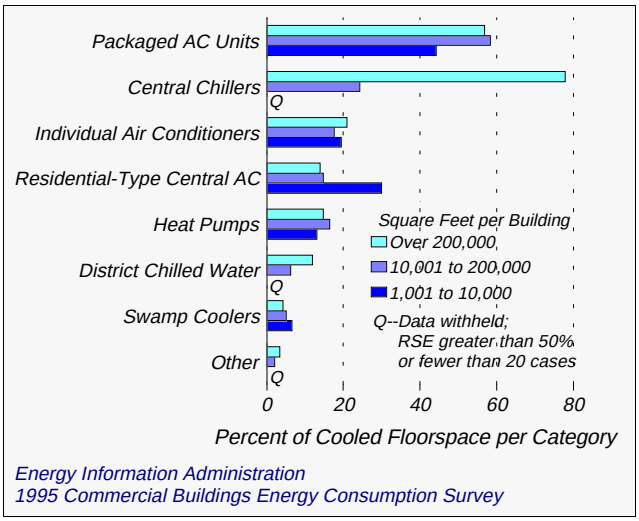
Figure 40. Heating Equipment Used by Year Constructed, 1995



Use of Cooling Equipment by Size and Age of Building

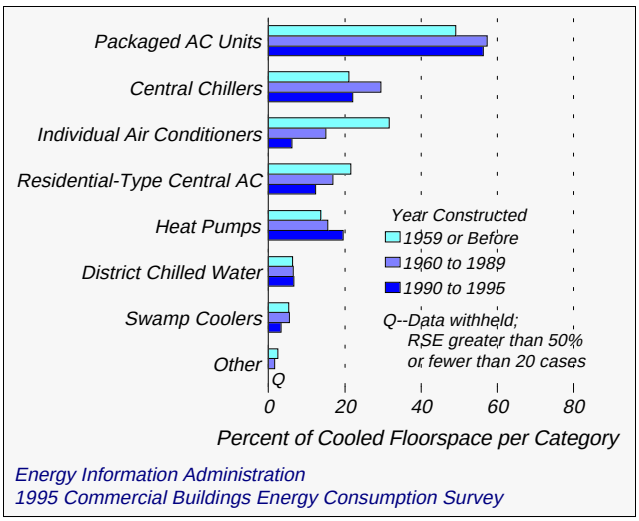
As with types of heating equipment, particular types of cooling equipment showed significant differences in use by size of building (Figure 41). Residential-type central air-conditioning units showed relatively greater use in the smallest buildings. In contrast, central chillers were used primarily in the largest buildings. That equipment type cooled 65 percent of cooled floorspace in buildings larger than 200,000 square feet but cooled only one-third as much, 22 percent, in buildings 10,001 to 200,000 square feet in size.

Figure 41. Cooling Equipment Used by Size of Building, 1995



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 42). 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 of cooled floorspace in buildings constructed in the 1990's.

Figure 42. Cooling Equipment Used by Year Constructed, 1995

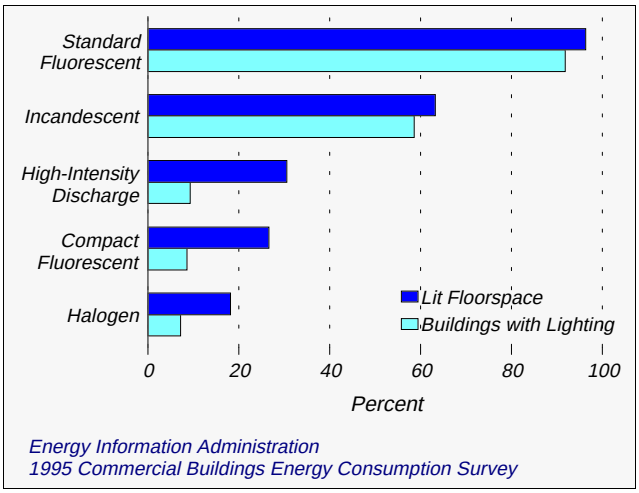


Lighting Equipment

Standard fluorescent lighting fixtures were found in nearly all buildings that had lighting equipment (more than 90 percent of lit buildings and floorspace) (Figure 43). Incandescent light bulbs were also widely used (around 60 percent of lit buildings and floorspace). Within buildings, standard fluorescent lamps were used to light most of the lit floorspace, whereas incandescent lamps were generally used to provide illumination for less than half of lit floorspace (Table H).

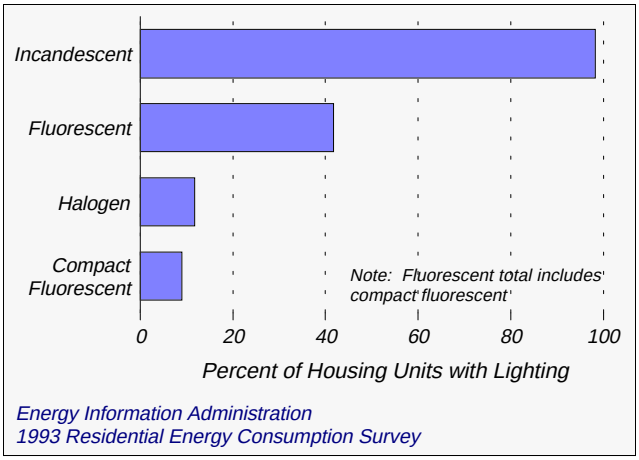
The three newer kinds of lighting technology--high-intensity discharge, compact fluorescent, and halogen lamps--were used less often. They were used most commonly in larger buildings, primarily for partial lighting (Table H). The average size of buildings that used high-intensity discharge lamps was 41,400 square feet; the average size for those that used compact fluorescent lamps was 39,200 square feet; and the average size for those that used halogen lights was 32,000 square feet.

Figure 43. Lighting Equipment Used in Commercial Buildings, 1995



Residential housing units used incandescent lights in essentially all units (Figure 44, data from the *1993 Residential Energy Consumption Survey*). Compact fluorescent and halogen lamps were used about as often in housing units as in commercial buildings.

Figure 44. Lighting Equipment Used in Residential Housing Units, 1993



Changes in End-Use Equipment

There were no significant changes in the percentage of heated floorspace served by the major types of heating equipment from 1989 to 1992 to 1995 (Figure 45). The data from 1989 and 1992 were adjusted to match the definition of commercial building population used in the 1995 CBECS.

There were no significant changes in the use of cooling equipment from 1992 to 1995 (Figure 46). Comparable cooling equipment data from the 1989 CBECS are not available.

The use of compact fluorescent lamps showed an increase in use from 1992 to 1995 (data were not collected in 1989) (Figure 47). The use of those lamps increased from 14 percent of lit floorspace in 1992 to 27 percent in 1995.

Figure 45. Heating Equipment Used in Commercial Buildings, 1989, 1992, and 1995

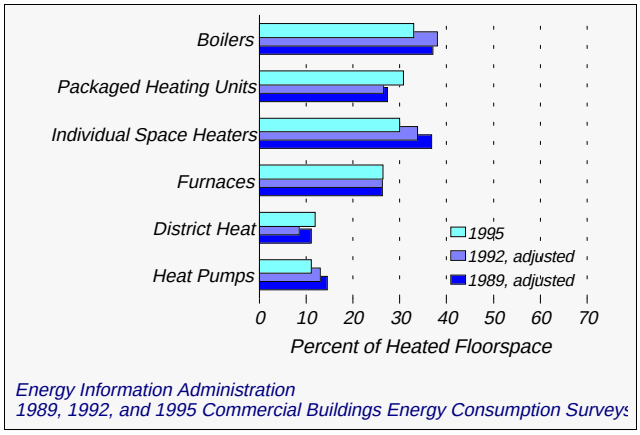


Figure 46. Cooling Equipment Used in Commercial Buildings, 1992 and 1995

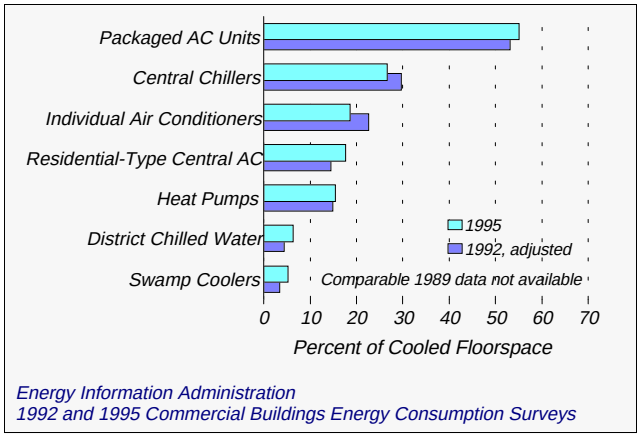
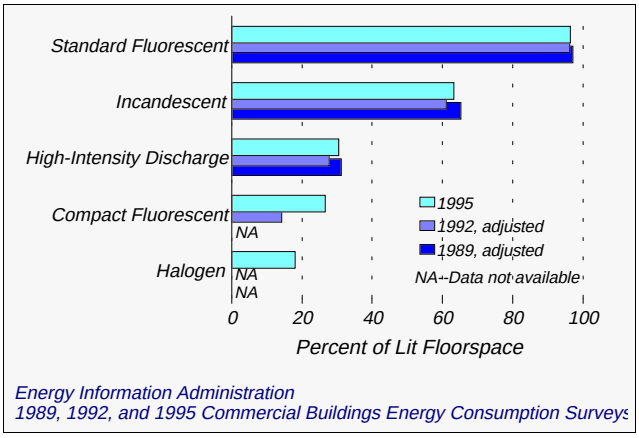


Figure 47. Lighting Equipment Used in Commercial Buildings, 1989, 1992, and 1995



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, in general, 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 I.1 and I.2).

Most commercial buildings had some type of building shell conservation feature (85 percent of buildings, 91 percent of floorspace) (Figure 48). 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 49). HVAC maintenance, the most widely practiced of the HVAC categories, was performed in about half of buildings and three-fourths of floorspace.

Figure 48. Building Shell Conservation Features in Commercial Buildings, 1995

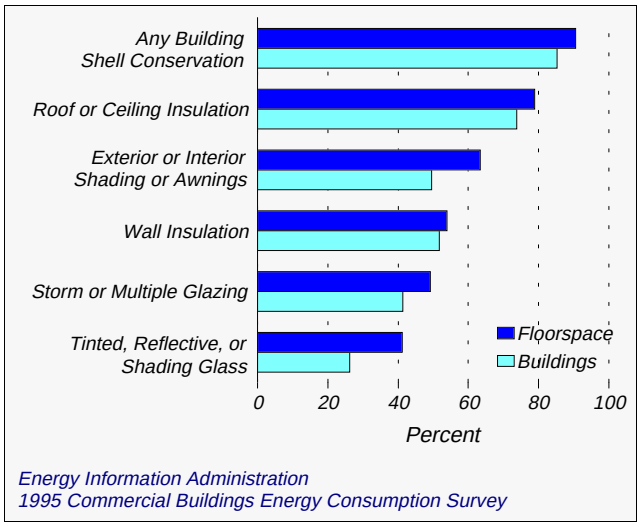
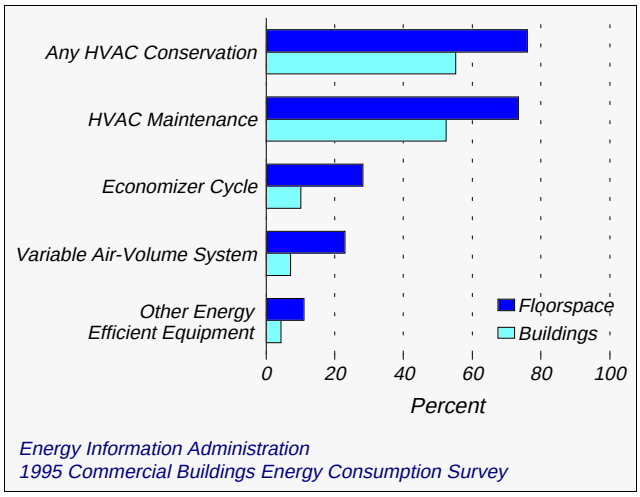


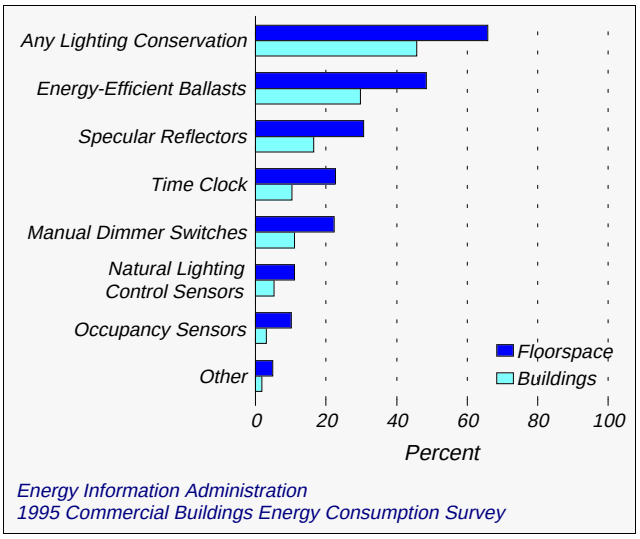
Figure 49. HVAC Conservation Features in Commercial Buildings, 1995



No single lighting system conservation feature exceeded the 30 percent of buildings and 48 percent of floorspace of energy-efficient ballasts (Figure 50). The use of any lighting conservation feature was 46 percent of buildings and 66 percent of floorspace, as compared to 55 percent of buildings and 76 percent of floorspace for any HVAC conservation feature.

Both HVAC and lighting system conservation features were more often installed or performed in larger than average commercial buildings. The average size for buildings with HVAC features was 17,700 square feet, and 18,500 square feet for buildings with lighting features, compared to the average size of all commercial buildings, which was 12,840 square feet.

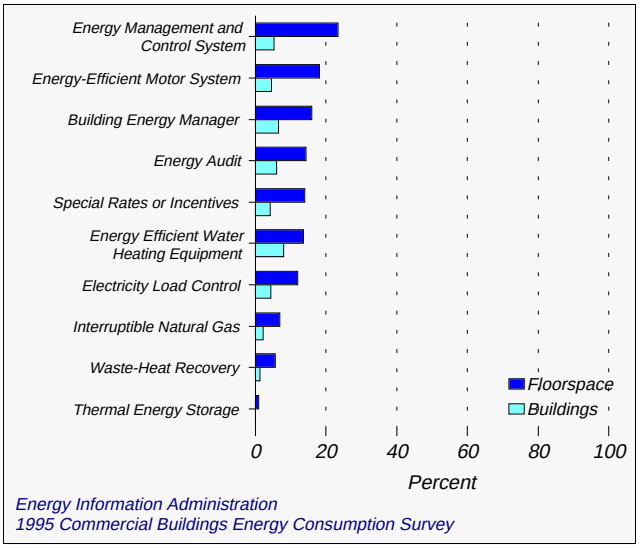
Figure 50. Lighting Conservation Features in Commercial Buildings, 1995



The CBECS collected information on buildings that participated in, or used, a variety of specific types of conservation programs and energy technologies and their sponsorship (Figure 51; Table I.1 and I.2; Tables J.1 and J.2). 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). Participation by percent of floorspace was much greater (23.5 percent) for the energy management and control systems; that is, participating buildings were much larger in size than average. The average size of buildings using energy management and control systems was 55,900 square feet.

The CBECS also collected information on the use and sponsorship 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, which is the minimum number for which data can be reported. CBECS estimated that 66.9 thousand buildings and 864 million square feet of floorspace used passive solar.

Figure 51. Participation in Energy Conservation Programs, 1995

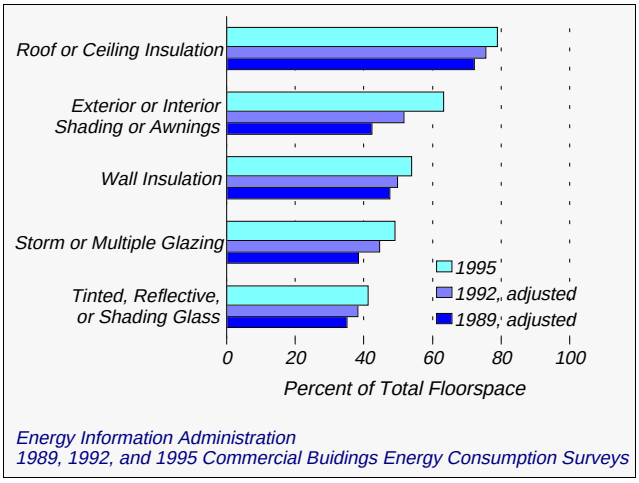


Changes in Conservation Features and Practices

The use of energy conservation features and practices has become more common in commercial buildings in recent years (Figures 52 and 53). The data from 1989 and 1992 were adjusted to match the definition of commercial building population used in the 1995 CBECS. There were significant increases in the percentage of floorspace that used two types of building shell conservation features (between 1989 and 1995) and three types of lighting system conservation features (between 1992 and 1995).

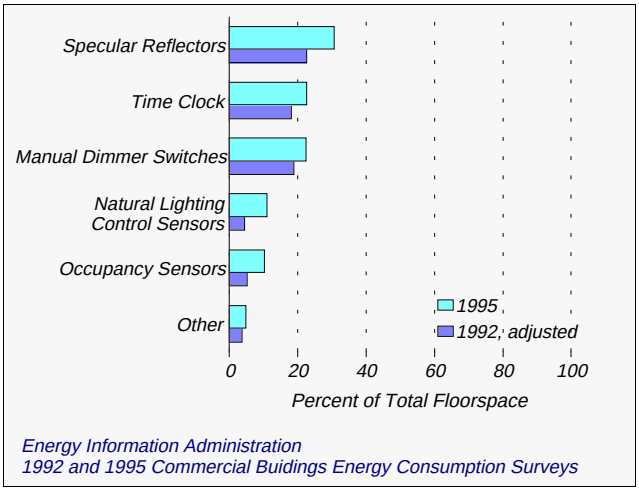
The two building shell categories that showed statistically significant increases in usage were exterior or interior shading or awnings, and storm or multiple glazing (Figure 52). Use of exterior or interior shading increased from 42 percent of floorspace in 1989 to 63 percent of floorspace in 1995, while use of storm or multiple glazing increased from 38 percent of floorspace to 49 percent.

Figure 52. Changes in Building Shell Conservation Features, 1989, 1992, and 1995



The three categories of lighting conservation that also showed significant increases were specular reflectors, natural lighting control sensors, and occupancy sensors (Figure 53). The first category, specular reflectors, was used for 23 percent of floorspace in 1992 and 30 percent in 1995. Natural lighting control sensors increased their usage from just 4 percent to 11 percent, and occupancy sensors showed an increase in use from 5 percent to 10 percent over the 3-year period.

Figure 53. Changes in Lighting Conservation Features, 1992 and 1995



Text Tables

The following tables present data cited in the text of this report. Additional data are contained in the 1995 CBECS Detailed Tables that are available electronically (in PDF format) on the EIA Home Page (http://www.eia.doe.gov/emeu/cbecs/cb951a.html). All data in these tables are from the 1995 Commercial Buildings Energy Consumption Survey.

Table A.1. Multibuilding Facility, Number of Buildings and Relative Standard Errors, 1995

Building Characteristics	Number of Buildings (thousand)			Relative Standard Errors (percent)		
	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant
All Buildings	4,579	1,480	184	3.9	5.7	13.3
Building Floorspace (square feet)						
1,001 to 5,000	2,399	635	58	5.2	10.1	30.5
5,001 to 10,000	1,035	356	26	7.3	11.1	34.2
10,001 to 25,000	745	310	45	6.8	9.3	16.4
25,001 to 50,000	213	97	26	5.7	8.2	12.0
50,001 to 100,000	115	46	12	6.4	8.3	14.5
100,001 to 200,000	48	23	11	7.3	8.9	12.3
200,001 to 500,000	19	9	4	7.8	11.4	13.5
Over 500,000	6	3	2	9.1	10.5	15.8
Principal Building Activity						
Education	309	247	65	11.0	13.1	24.7
Food Sales	137	Q	NC	14.2	49.2	NC
Food Service	285	28	Q	10.6	23.9	59.5
Health Care	105	36	11	18.6	29.5	39.5
Lodging	158	90	19	12.5	17.7	32.3
Mercantile and Service	1,289	201	Q	7.3	15.1	54.7
Office	705	197	21	7.5	14.8	33.1
Public Assembly	326	122	16	13.9	19.9	31.3
Public Order and Safety	87	26	Q	25.4	40.1	70.9
Religious Worship	269	104	Q	12.3	18.6	47.4
Warehouse and Storage	580	306	Q	11.7	13.2	70.7
Other	67	26	Q	27.9	28.5	55.2
Vacant	261	81	Q	13.9	23.5	46.3
Year Constructed						
1919 or Before	353	91	18	13.6	23.0	44.0
1920 to 1945	562	157	32	9.3	15.8	33.9
1946 to 1959	867	258	41	6.3	12.3	35.1
1960 to 1969	718	226	39	7.6	11.4	19.6
1970 to 1979	813	267	20	6.7	11.0	39.1
1980 to 1989	846	327	29	7.2	9.8	43.2
1990 to 1992	218	85	2	14.9	20.2	28.5
1993 to 1995	202	69	3	19.6	25.5	43.5
Census Region						
Northeast	725	189	27	9.5	15.5	13.5
Midwest	1,139	274	54	9.7	13.3	30.8
South	1,750	614	62	5.5	7.5	30.9
West	964	403	41	10.6	12.0	19.6
Energy Sources (more than one may apply)						
Electricity	4,343	1,347	183	3.7	5.7	13.4
Natural Gas	2,478	639	80	4.3	7.4	18.7
Fuel Oil	607	173	47	12.6	20.1	30.4
District Heat	110	95	85	17.8	19.0	19.8
District Chilled Water	53	50	49	27.2	28.5	29.1
Propane	589	164	Q	12.1	20.0	51.4
Any Other	213	88	Q	17.4	24.0	57.7
Energy End Uses (more than one may apply)						
Buildings with Heating	4,024	1,195	181	4.0	6.2	13.5
Buildings with Cooling	3,381	1,020	152	3.8	6.8	15.3
Buildings with Water Heating	3,486	1,036	170	4.3	6.1	12.9
Buildings with Cooking	828	224	34	5.6	10.4	15.9
Buildings with Manufacturing	204	64	Q	17.3	27.8	75.0
Buildings with Electricity Generation	247	91	29	12.5	17.5	25.3

Table A.1. Multibuilding Facility, Number of Buildings and Relative Standard Errors, 1995 (Continued)

Building Characteristics	Number of Buildings (thousand)			Relative Standard Errors (percent)		
	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant
Workers (main shift)						
Fewer than 5	2,505	746	57	5.5	9.2	28.7
5 to 9	798	209	32	8.3	16.1	33.6
10 to 19	625	240	25	8.0	12.6	34.7
20 to 49	400	153	25	7.4	13.6	24.1
50 to 99	138	76	25	8.4	14.5	25.9
100 to 249	71	31	9	8.5	9.7	15.1
250 or More	43	25	10	15.4	25.5	11.0
Weekly Operating Hours						
39 or Fewer	899	302	Q	8.2	13.8	50.6
40 to 48	1,257	416	57	5.9	9.8	31.0
49 to 60	969	251	37	7.8	12.8	26.3
61 to 84	567	148	23	9.0	12.2	21.1
85 to 167	420	104	14	8.4	19.9	25.7
Open Continuously	466	259	48	9.7	14.8	20.4
Ownership and Occupancy						
Nongovernment Owned	4,025	1,090	74	4.2	7.5	17.2
Owner Occupied	3,158	842	66	4.7	8.0	19.0
Nonowner Occupied	698	201	7	8.5	15.6	46.7
Unoccupied	170	47	Q	17.2	33.2	76.1
Government Owned	553	390	110	7.5	9.5	23.5
Principal Facility Activity						
Primary or Secondary Education	223	223	59	13.1	13.1	35.5
College	62	62	42	14.2	14.2	15.5
Other Education	23	23	Q	38.6	38.6	91.2
Prison	Q	Q	4	63.4	63.4	49.7
Other Government	81	81	Q	26.0	26.0	55.6
Non-Manufacturing Industrial	31	31	Q	37.3	37.3	71.4
Hospital or Other Health Service	71	71	15	25.8	25.8	41.6
Transportation	27	27	Q	41.6	41.6	48.3
Other	952	952	30	7.7	7.7	41.7
Central Plant that Produces* (more than one may apply)						
District Hot Water						
Yes	132	132	132	16.6	16.6	16.6
No	51	51	51	15.0	15.0	15.0
Don't Know	Q	Q	NC	100.0	100.0	NC
District Steam						
Yes	96	96	96	20.9	20.9	20.9
No	88	88	88	14.1	14.1	14.1
Don't Know	Q	Q	NC	100.0	100.0	NC
District Chilled Water						
Yes	70	70	70	25.3	25.3	25.3
No	114	114	114	18.0	18.0	18.0
Don't Know	Q	Q	Q	91.8	91.8	100.0
Electricity						
Yes	32	32	32	39.0	39.0	39.0
No	152	152	152	15.6	15.6	15.6
Don't Know	Q	Q	NC	100.0	100.0	NC

NC = No cases in sample.
* = 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.
Note: • The 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 A.2. Multibuilding Facility, Floorspace and Relative Standard Errors, 1995

Building Characteristics	Total Floorspace (million square feet)			Relative Standard Errors (percent)		
	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant
All Buildings	58,772	24,352	7,249	3.4	4.1	6.8
Building Floorspace (square feet)						
1,001 to 5,000	6,338	1,647	176	5.0	10.1	29.3
5,001 to 10,000	7,530	2,574	210	7.4	11.4	37.6
10,001 to 25,000	11,617	4,836	688	6.4	8.9	15.4
25,001 to 50,000	7,676	3,500	971	6.0	8.6	11.7
50,001 to 100,000	7,968	3,206	843	6.0	8.4	14.8
100,001 to 200,000	6,776	3,317	1,528	7.5	9.2	12.6
200,001 to 500,000	5,553	2,674	1,340	7.9	10.6	13.6
Over 500,000	5,313	2,598	1,493	9.5	13.5	18.8
Principal Building Activity						
Education	7,740	4,497	1,809	6.9	7.7	14.4
Food Sales	642	Q	NC	12.5	31.2	NC
Food Service	1,353	248	Q	12.5	29.1	46.2
Health Care	2,333	1,511	992	8.7	9.2	10.1
Lodging	3,618	1,645	744	9.6	13.1	23.4
Mercantile and Service	12,728	3,721	584	6.9	11.0	41.1
Office	10,478	3,927	1,125	6.2	9.5	14.2
Public Assembly	3,948	1,824	928	9.6	12.5	16.4
Public Order and Safety	1,271	571	234	17.3	28.7	32.9
Religious Worship	2,792	1,221	Q	9.7	17.8	49.3
Warehouse and Storage	8,481	3,754	330	10.1	11.6	42.0
Other	1,004	467	264	20.9	25.3	33.9
Vacant	2,384	883	Q	15.2	25.1	38.1
Year Constructed						
1919 or Before	3,673	1,141	397	10.2	17.9	29.8
1920 to 1945	6,710	2,652	760	8.7	16.4	18.3
1946 to 1959	9,298	3,914	1,193	7.4	9.9	17.3
1960 to 1969	10,858	4,691	2,106	6.0	8.1	11.1
1970 to 1979	11,333	4,859	1,444	4.9	8.1	17.5
1980 to 1989	12,252	5,258	910	6.4	10.3	12.7
1990 to 1992	2,590	1,118	229	9.7	14.3	24.3
1993 to 1995	2,059	719	210	11.7	16.5	32.1
Census Region						
Northeast	11,883	4,312	1,529	7.4	13.3	11.0
Midwest	14,322	5,355	2,121	6.0	7.1	13.2
South	20,830	9,529	2,182	5.7	6.8	13.2
West	11,736	5,156	1,416	7.6	7.6	18.3
Energy Sources (more than one may apply)						
Electricity	57,076	23,441	7,180	3.3	3.9	6.8
Natural Gas	38,145	14,397	4,323	4.1	5.7	7.7
Fuel Oil	14,421	5,977	2,902	6.0	8.3	9.0
District Heat	5,658	4,372	3,769	9.0	9.8	10.1
District Chilled Water	2,521	2,202	2,049	10.7	10.6	10.8
Propane	5,344	2,025	439	12.0	16.0	30.1
Any Other	2,336	966	318	13.5	19.7	30.2
Energy End Uses (more than one may apply)						
Buildings with Heating	54,347	21,968	7,152	3.6	4.3	7.0
Buildings with Cooling	49,935	20,116	6,427	3.5	4.1	7.0
Buildings with Water Heating	51,560	21,003	6,923	3.5	4.1	7.0
Buildings with Cooking	20,713	8,527	3,279	4.1	5.5	10.6
Buildings with Manufacturing	3,893	1,561	332	9.9	17.2	40.9
Buildings with Electricity Generation	13,366	5,932	3,059	5.6	7.7	10.9

Table A.2. Multibuilding Facility, Floorspace and Relative Standard Errors, 1995 (Continued)

Building Characteristics	Total Floorspace (million square feet)			Relative Standard Errors (percent)		
	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant	All Buildings	All Buildings in Multibuilding Facilities	Buildings in Multibuilding Facilities with Central Physical Plant
Workers (main shift)						
Fewer than 5	13,885	4,906	594	6.5	9.4	19.5
5 to 9	6,219	2,084	614	8.0	11.9	22.4
10 to 19	7,102	3,156	450	6.7	10.1	19.4
20 to 49	9,132	3,630	907	5.9	10.1	14.5
50 to 99	6,931	3,102	1,112	6.9	10.4	16.0
100 to 249	5,988	2,642	846	6.8	7.6	14.9
250 or More	9,443	4,831	2,724	6.3	8.6	11.9
Weekly Operating Hours						
39 or Fewer	6,134	2,322	Q	7.9	13.3	26.2
40 to 48	13,233	5,243	1,085	6.7	8.6	20.9
49 to 60	12,242	4,453	1,003	6.4	8.5	14.1
61 to 84	10,052	4,090	1,325	6.3	10.0	19.9
85 to 167	6,202	2,432	1,040	6.9	10.2	13.4
Open Continuously	10,908	5,811	2,668	5.9	7.8	10.6
Ownership and Occupancy						
Nongovernment Owned	46,696	16,541	3,385	3.9	5.7	11.4
Owner Occupied	35,573	12,524	3,106	3.9	6.0	12.5
Nonowner Occupied	9,697	3,510	228	8.3	10.9	23.8
Unoccupied	1,426	507	Q	22.4	39.6	73.0
Government Owned	12,076	7,811	3,864	5.2	7.0	11.6
Principal Facility Activity						
Primary or Secondary Education	3,427	3,427	1,021	10.1	10.1	24.7
College	2,758	2,758	2,263	13.4	13.4	15.7
Other Education	404	404	Q	38.0	38.0	78.7
Prison	229	229	216	46.0	46.0	48.3
Other Government	1,884	1,884	758	18.3	18.3	29.4
Non-Manufacturing Industrial	443	443	Q	26.2	26.2	63.9
Hospital or Other Health Service	2,103	2,103	1,194	10.8	10.8	9.2
Transportation	585	585	Q	26.7	26.7	44.5
Other	12,519	12,519	1,480	6.4	6.4	20.9
Central Plant that Produces* (more than one may apply)						
District Hot Water						
Yes	4,419	4,419	4,419	9.1	9.1	9.1
No	2,830	2,830	2,830	11.3	11.3	11.3
Don't Know	Q	Q	NC	100.0	100.0	NC
District Steam						
Yes	4,058	4,058	4,058	9.0	9.0	9.0
No	3,191	3,191	3,191	10.6	10.6	10.6
Don't Know	Q	Q	NC	100.0	100.0	NC
District Chilled Water						
Yes	4,292	4,292	4,292	9.3	9.3	9.3
No	2,956	2,956	2,956	11.3	11.3	11.3
Don't Know	Q	Q	Q	92.1	92.1	100.0
Electricity						
Yes	1,469	1,469	1,469	17.2	17.2	17.2
No	5,780	5,780	5,780	8.6	8.6	8.6
Don't Know	Q	Q	NC	100.0	100.0	NC

NC = No cases in sample.
* = 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.
Note: • The 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 B.1. 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	109	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 B.2. 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	10,706	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 B.3. 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 C. Percent of Heated Floorspace in Buildings by Type of Heating Equipment, Number of Buildings and Floorspace, 1995

Building Characteristics	Heated Buildings			Relative Standard Errors Heated Buildings		
	Total Buildings (thousand)	Total Floorspace (million square feet)	Heated Floorspace (million square feet)	Total Buildings (Percent)	Total Floorspace (Percent)	Heated Floorspace (Percent)
All Buildings	4,024	54,347	48,065	4.0	3.6	3.6
Percent of Floorspace Heated by:						
Boilers						
Not Used	3,414	37,593	32,212	4.2	4.3	4.4
Less than 51 percent	81	2,217	1,956	28.5	10.9	11.3
51 to 99 percent	113	4,698	4,372	15.2	9.6	9.4
100 percent	416	9,839	9,525	8.9	5.8	5.7
Packaged Heating Units						
Not Used	2,993	37,454	33,273	5.2	4.0	4.1
Less than 51 percent	186	5,972	5,500	11.7	8.2	8.4
51 to 99 percent	113	2,539	2,309	22.8	12.2	12.8
100 percent	733	8,383	6,983	8.3	6.9	6.3
Individual Space Heaters						
Not Used	2,837	37,538	33,658	4.6	3.3	3.3
Less than 51 percent	551	11,134	9,941	10.7	7.1	7.5
51 to 99 percent	119	1,936	1,674	18.6	16.3	15.0
100 percent	517	3,739	2,792	9.6	9.3	11.2
Furnaces						
Not Used	2,348	39,424	35,409	4.2	4.0	3.9
Less than 51 percent	212	3,821	3,360	12.6	8.1	7.9
51 to 99 percent	278	2,988	2,559	14.7	10.6	11.9
100 percent	1,187	8,114	6,737	7.5	7.9	8.4
District Heat						
Not Used	3,910	48,436	42,346	4.1	3.9	4.0
Less than 51 percent	Q	Q	Q	47.8	33.6	31.6
51 to 99 percent	10	1,357	1,291	14.4	15.9	16.3
100 percent	103	4,447	4,328	19.7	10.3	10.3
Heat Pumps						
Not Used	3,630	48,504	42,753	4.2	3.8	3.8
Less than 51 percent	77	2,325	2,133	20.2	9.0	8.8
51 to 99 percent	45	1,085	1,001	35.9	17.8	17.6
100 percent	272	2,433	2,179	13.6	13.0	13.1
Other						
Not Used	3,864	48,098	42,491	3.9	3.5	3.5
Less than 51 percent	64	3,852	3,478	22.0	10.5	9.7
51 to 99 percent	14	824	746	45.3	20.6	21.1
100 percent	83	1,572	1,350	31.3	20.4	22.1

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.
Notes: • The 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 D.1. 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 D.2. 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 D.3. 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 E.1. 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 E.2. 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 E.3. 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 F. Percent of Cooled Floorspace in Buildings by Type of Cooling Equipment, Number of Buildings and Floorspace, 1995

Building Characteristics	Cooled Buildings			Relative Standard Errors Cooled Buildings		
	Total Buildings (thousand)	Total Floorspace (million square feet)	Cooled Floorspace (million square feet)	Total Buildings (Percent)	Total Floorspace (Percent)	Cooled Floorspace (Percent)
All Buildings	3,381	49,435	36,001	3.8	3.5	3.9
Percent of Floorspace Cooled by:						
Packaged Air Conditioning Units						
Not Used	1,949	23,306	16,163	5.0	4.4	4.6
Less than 51 percent	151	7,794	6,284	15.5	6.3	6.8
51 to 99 percent	126	3,454	2,290	13.5	10.2	9.4
100 percent	1,155	15,381	11,265	6.6	6.2	6.1
Central Chillers						
Not Used	3,272	38,870	26,425	3.8	3.7	3.9
Less than 51 percent	11	1,227	924	15.1	15.2	14.7
51 to 99 percent	36	4,550	3,932	14.8	8.8	8.8
100 percent	62	5,288	4,720	13.7	9.5	9.7
Individual Air Conditioners						
Not Used	2,519	37,441	29,279	3.9	4.4	4.7
Less than 51 percent	216	6,202	3,903	11.1	7.9	7.4
51 to 99 percent	29	1,219	755	20.9	15.2	15.5
100 percent	617	5,073	2,065	9.3	9.2	11.8
Residential-Type Central Air Conditioners						
Not Used	2,503	40,697	29,623	4.8	4.0	4.4
Less than 51 percent	118	3,573	2,647	18.2	7.5	8.7
51 to 99 percent	91	954	572	18.8	13.5	15.2
100 percent	669	4,711	3,159	9.5	9.2	10.1
Heat Pumps						
Not Used	2,924	43,004	30,445	4.0	3.7	4.0
Less than 51 percent	63	2,863	2,260	23.6	7.8	8.3
51 to 99 percent	47	961	793	27.9	15.6	16.4
100 percent	347	3,107	2,504	11.7	9.7	10.3
District Chilled Water						
Not Used	3,328	47,414	33,699	3.9	3.6	4.0
Less than 51 percent	Q	Q	Q	53.6	32.5	34.8
51 to 99 percent	3	489	450	25.3	16.6	16.2
100 percent	41	1,828	1,688	27.9	11.8	12.0
Swamp Coolers						
Not Used	3,195	47,483	34,128	3.9	3.6	3.9
Less than 51 percent	56	1,239	1,051	22.1	14.3	14.0
51 to 99 percent	Q	479	Q	56.8	48.9	63.0
100 percent	94	733	533	29.0	23.8	24.8
Other						
Not Used	3,363	48,986	35,293	3.8	3.6	4.0
Less than 51 percent	4	395	333	27.0	17.3	17.4
51 to 99 percent	Q	Q	Q	32.9	39.9	34.5
100 percent	10	362	271	31.5	22.1	20.3

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.
Notes: • The 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 G.1. 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 G.2. 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 G.3. 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 H. Percent of Lit Floorspace in Buildings by Type of Lighting Equipment, Number of Buildings and Floorspace, 1995

Building Characteristics	Lit Buildings			Relative Standard Errors Lit Buildings		
	Total Buildings (thousand)	Total Floorspace (million square feet)	Lit Floorspace (million square feet)	Total Buildings (Percent)	Total Floorspace (Percent)	Lit Floorspace (Percent)
All Buildings	4,237	56,261	50,303	3.8	3.3	3.4
Percent of Floorspace Lit by:						
Standard Fluorescent						
Not Used	352	2,277	1,865	12.2	10.7	12.2
Less than 51 percent	662	10,889	9,394	6.1	5.8	6.2
51 to 99 percent	1,437	25,611	23,385	5.9	3.6	3.7
100 percent	1,750	17,484	15,659	5.5	5.6	5.9
Incandescent						
Not Used	1,758	20,546	18,553	5.4	5.5	5.6
Less than 51 percent	1,779	29,684	26,836	4.6	3.7	3.7
51 to 99 percent	338	3,867	3,160	8.1	8.7	8.8
100 percent	363	2,164	1,757	12.6	12.8	15.0
High-Intensity Discharge						
Not Used	3,844	40,002	34,979	4.0	3.7	3.8
Less than 51 percent	319	13,063	12,353	10.4	5.7	5.6
51 to 99 percent	61	2,873	2,656	19.2	13.7	14.1
100 percent	13	323	315	49.7	31.4	32.1
Compact Fluorescent						
Not Used	3,873	41,988	36,975	4.1	3.9	4.0
Less than 51 percent	349	13,762	12,897	9.6	6.5	6.7
51 to 99 percent	10	401	331	36.5	42.6	36.7
100 percent	Q	Q	Q	59.5	45.2	46.8
Halogen						
Not Used	3,935	46,595	41,248	4.0	3.6	3.8
Less than 51 percent	270	9,249	8,667	11.6	6.6	6.5
51 to 99 percent	25	258	238	43.5	23.8	24.1
100 percent	Q	Q	Q	84.1	69.0	72.6
Other						
Not Used	4,207	55,706	49,821	3.7	3.4	3.4
Less than 51 percent	Q	469	433	54.1	46.0	46.2
51 to 99 percent	Q	Q	Q	59.2	56.1	56.7
100 percent	Q	Q	Q	66.9	52.3	78.5

Q = Data withheld because the Relative Standard Error (RSE) was greater than 50 percent, or fewer than 20 buildings were sampled.
Notes: • The 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 I.1. 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	4,075	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 I.2. 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	7,410	7.1	7.2	7.3	7.1	7.0
Don't Know	1,683	1,676	1,654	1,466	1,229	16.3	16.3	16.3	18.2	16.5
Energy-Efficient Water Heating Equipment Installation or Retrofit*										
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 J.1. 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 J.2. 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.

Appendix A

How the Survey Was Conducted

Introduction

The Commercial Buildings Energy Consumption Survey (CBECS) is conducted by the Energy Information Administration (EIA) to provide basic statistical information on energy consumption and expenditures for U.S. commercial buildings and data on energy-related characteristics of these buildings. To obtain this information, a survey is conducted based upon a sample of commercial buildings selected according to the sample design requirements described in the "Sample Design" section of this appendix. A "building" is the basic unit for the CBECS as opposed to an "establishment" because a building is the energy-consuming unit.

This is the sixth in a series of surveys covering the commercial sector. The first survey was conducted in 1979; Surveys were then conducted on a triennial basis beginning in 1983. Future CBECS will be conducted on a quadrennial basis, with the next CBECS occurring in 1999.

The CBECS is conducted in two major data collection stages: a Building Characteristics Survey and an Energy Suppliers Survey. The first stage, the Building Characteristics Survey, collects information about selected commercial buildings through voluntary personal interviews with the buildings' owners, managers, or tenants. In 1995, the data were collected by using Computer-Assisted Personal Interviewing (CAPI) techniques. An Authorization Form signed by the respondent is used to secure the release of the building's energy consumption and expenditures records from the energy supplier. These energy consumption and expenditures data are collected during the Energy Suppliers Survey, which is the second stage.

The Energy Suppliers Survey obtains data concerning the building's actual consumption of energy and expenditures for energy from records maintained by energy suppliers. This information is obtained by means of a mail survey conducted under EIA's mandatory data collection authority. Additionally, the CBECS asked energy suppliers about any Demand-Side Management programs they may have provided to the building. Under EIA's direction, a survey research firm conducted both the personal interviews for the Building Characteristics Survey and the mail survey for the Energy Suppliers Survey.

Target Population

The target population for CBECS consisted of all commercial buildings in the United States larger than 1,000 square feet, with the exception of commercial buildings located on manufacturing sites. To be eligible for the survey, a building had to satisfy three criteria: (1) it had to meet the survey's definition of a building, (2) it had to be used primarily for some commercial purpose, and (3) it had to measure 1,001 square feet or more. A commercial building is defined by CBECS as a structure totally enclosed by walls that extend from the foundation to the roof and intended for human access. To be used primarily for some commercial purpose, the building must have more than 50 percent of its floorspace devoted to activities that are neither residential, industrial, nor agricultural. The 1995 CBECS estimated that there were 4,579 thousand buildings in the target population.

Sample Design

The sample design for the CBECS is a multistage area probability cluster sample design supplemented by a list sample of "large" buildings, recently constructed buildings, and "special" buildings (Federal Government 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. The supplemental list sample provides an oversample of "large" buildings and "special" buildings. 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.

Multistage Area Probability Sample

The area component of the CBECS sample used a four-stage cluster sampling design that selected: Primary Sampling Units (PSU's), Secondary Sampling Units (SSU's), Segments, and, ultimately, Buildings. The first three of these stages involved sampling progressively smaller geographic areas. For the 1995 CBECS, the same PSU's, SSU's, and Segments that were selected for the 1986 CBECS were reused. For the fourth stage of sampling, the 1995 selection of buildings was executed by using procedures to update the 1986 CBECS building lists to include new construction in the sampled segments.

Supplementary List Sample from Lists of Large and Specialized Buildings

To ensure adequate coverage of buildings that were significant energy users, the multistage area probability sample was supplemented within each selected PSU by a sample from a list of "large" buildings (buildings over 250,000 square feet) or facilities. In addition, to improve the precision of energy consumption estimates for certain types of buildings, a supplementary sample was drawn from several lists of special buildings. These list frame files differ from the area segment listings in that the list files are primarily facility or construction-project based as opposed to building based.

Projected Sampling Results

The goal of the 1995 CBECS sampling procedures (both the area sample and the supplemental list sample) was to achieve completed interviews for 5,500 buildings -- 4,450 buildings from the area sample and 1,050 buildings from the supplemental list sample.

Actual Sample Selected

In order to achieve the 1995 CBECS goal for number of respondents, a sample of 8,074 potential cases was selected, consisting of 6,633 buildings from the area sample frame and 1,441 buildings from the supplemental list sample frames consisting of large buildings and special buildings. Of these 8,074 buildings, 6,590 buildings were found eligible for interviewing. The three primary eligibility criteria: Building Definition, Building Use, and Building Size are described in the "Determining Building Eligibility" section of the Appendix. Other reasons for sample building listings to be classified as ineligible included duplication of buildings, demolished buildings, buildings under construction, or commercial buildings on industrial facilities.

Sampling Results

Interviews were completed for 87.5 percent, or 5,766 buildings (4,728 buildings from the area sample and 1,038 buildings from the supplemental list sample). Therefore, the 1995 CBECS sampling procedures achieved the goals for the number of completed surveys. More importantly, the 1995 CBECS adequately represents the U.S. commercial buildings population and therefore efficiently measures commercial buildings' energy consumption.

Building Characteristics Survey

Determining Building Eligibility

To be eligible for the survey, a building had to satisfy three criteria: (1) it had to meet the survey's definition of a building; (2) it had to be used primarily for some commercial purpose; and (3) it had to measure 1,001 square feet or more.

Determining building eligibility was a three-step process. The first step occurred during the development of the area and supplemental sample listings. The second step occurred when the interviewer observed the building, and the third step occurred during the interview of the building owner or manager. While criterion one, the definition of a building, can be determined during the first and second steps, criteria two and three are based more on lister or interviewer judgment and could result in exclusion of eligible buildings or the inclusion of ineligible buildings during those steps. The third step is crucial in identifying ineligible buildings. Once the interviewer begins the interview, initial screening questions instruct the interviewer to terminate the interview if criteria two or three are not met.

Criterion 1: Building Definition

The definition of a building was the same one used in previous CBECS: a structure totally enclosed by walls that extend from the foundation to the roof and intended for human access. Thus, structures such as water, radio, and television towers were excluded from the survey. Also excluded were (1) parking garages; (2) partially open structures, such as lumber yards; (3) enclosed structures that people usually do not enter, such as pumping stations and cooling towers at electric power plants; (4) enclosed structures that are not buildings, such as oil tanks, statues, and monuments; and (5) dilapidated or incomplete buildings missing a roof or a wall. There is one exception to the building definition criterion: a structure built on pillars so that the first fully enclosed level is elevated. These were included because these buildings can have energy-consuming equipment, such as heating, ventilation and air-conditioning equipment (HVAC), and lighting equipment.

Criterion 2: Building Use

The second criterion was that a building had to be used primarily for some commercial purpose; that is, more than 50 percent of the building's floorspace must have been devoted to activities that were neither residential, industrial, nor agricultural. The primary use of the sampled building governed whether the building was included in the CBECS. In 1995, there was one exception to this criterion; commercial buildings on manufacturing sites were considered out of scope. (In previous CBECS, if a commercial building, for example an office, was located on a manufacturing site, it would have been considered in scope).

Examples of nonresidential buildings that were not included in the CBECS samples are:

- Farm Buildings, such as barns, unless space is used for retail sales to the general public
- Industrial or Manufacturing Buildings that involve the processing or procurement of goods, merchandise, or food
- Buildings on most military bases
- Buildings where access is restricted for national security reasons
- Single-family detached dwellings that are primarily residential, even if the occupants use part of the dwelling for business purposes
- Mobile homes that are not placed on a permanent foundation (even if the mobile home is used for nonresidential purposes).

During the interviewing stage, interviewers were instructed not to begin interviews at buildings where they observed that 75 percent or more of the floorspace was used for residential, industrial, or agricultural purposes. Once the interview began, initial screening questions instructed the interviewer to terminate the interview if the respondent indicated that 50 percent or more of the square footage was used for residential, industrial, or agricultural purposes.

Criterion 3: Building Size

The third criterion was that a commercial building had to measure more than 1,000 square feet (about twice the size of a two-car garage) to be considered in scope for the 1995 CBECS. This building size criterion was met in two successive size cutoffs, which were evaluated during the listing and interviewing stages. Interviewers did not begin interviews when they observed a building to be 500 square feet or less. Then during the interviewing stage, interviewers asked screening questions designed to terminate the interview when the square footage was reported to be 1,000 square feet or less.

Data Collection

Data collection encompasses several phases including: (1) designing the questionnaire, (2) training supervisors and interviewers, (3) collecting data, (4) minimizing nonresponse, and (5) processing the data. A survey contractor performed the data collection under the direction of EIA.

Designing the Building Characteristics Survey Questionnaire

Questionnaire design work for the 1995 CBECS was conducted by EIA. Although a set of core questions remained the same or very similar to those used in previous surveys, the 1995 Building Questionnaire was redesigned to improve data quality and to allow the data to be collected by use of Computer-Assisted Personal Interviewing (CAPI) techniques.

Use of CAPI

Increasingly, in an effort to provide more timely data and to enhance the quality of data, surveys are conducted by using Computer Assisted Interviewing (CAI) systems. Because of the complexity of the CBECS, a personal interview with a building respondent is the most preferable method of collecting information about a particular building. Thus, using CAPI was the most logical CAI method for CBECS. Interviewers were provided laptop computers that had been preloaded with questionnaires for the buildings they were to interview.

The CBECS questionnaire requires the interviewer to ask specific follow-up questions based on the responses to previous questions. Therefore, a major benefit of converting to CAPI from a paper and pencil questionnaire was the ability to build edits into the questionnaire that would reduce the need for the interviewer to decide which of the follow-up questions to ask the respondents. This, in turn, reduced the number of skip pattern errors that needed correcting during the post-interview edit phase and the number of item nonresponses. Additionally, these built-in edits alerted the interviewer to data inconsistencies that might occur when the respondent selects an answer that is technically incorrect or incompatible with a previous answer. For example, if the respondent reports the presence of heating equipment types that are unlikely for a given energy source, CAPI will alert the interviewer to this inconsistency and provide directions, via data screen messages, on how to resolve the inconsistency. (See “CAPI Edits During Interviewing” in this Appendix for other types of edits.)

A second benefit of converting to CAPI is the ability of the interviewer to transmit the data electronically from the field to the home office for data processing, an ability which ultimately results in faster dissemination of the data to the CBECS customers.

Training Supervisors and Interviewers

The CBECS Building Questionnaire is a complex instrument designed to collect data during a personal interview at the building site. Well-trained interviewers are imperative to collecting the technical information. Training for the 1995 CBECS included three in-person training sessions: one session for the interviewer trainers, monitors and regional supervisors and two sessions for interviewers. Because the 1995 CBECS was collected for the first time by using Computer-Assisted Personal Interviewing (CAPI), all interviewers were trained on the general use of the computer and on interviewing and administering the CAPI questionnaire. Training sessions included lectures, slide presentations, and small group sessions in order to practice administering the questionnaire by using laptop computers. EIA personnel participated in all training sessions providing an overview of the CBECS and a presentation on the key 1995 CBECS energy concepts.

Prior to interviewer training, all prospective interviewers received the CBECS Training Video, CBECS Interviewers' Manual, CBECS CAPI Reference Guide, a home-study exercise to be completed prior to training, and a training agenda. The CBECS Training Video included (1) concepts of sampling, (2) the CBECS definition of a building and the eligibility criteria, (3) information on how to determine the boundaries of a building, and (4) the area sample listing materials. The video was used to familiarize the interviewer with these materials prior to the in-person interviewer training. The CBECS Interviewer's Manual included instructions for locating sampled buildings and conducting interviews, as well as describing administrative and reporting procedures. The CAPI Reference Guide described the care and operation of the computer hardware for the 1995 CBECS and the Case Management and Interviewing System that was loaded onto the laptops. Home-study exercises were related directly to materials covered in the video.

Interviewers who had not previously worked for the survey contractor received the General Interviewing Techniques Manual and Home Study Guide with exercises to be completed prior to training. Interviewers with no prior experience with CAPI participated in a 3-4 hour hands-on, self-paced instruction program on how to use the laptop computer.

During the training, all interviewers received (1) question-by-question specifications that described the intent of each question, the definitions of terms used in the survey, and how to ask each question and (2) Hand Cards that were to be used during the interview. By the conclusion of the training session, all interviewers had completed four scripted-practice interviews that covered various types of situations they might find in the field.

Because the feedback EIA received from energy suppliers indicated that the primary reason for delays in processing the Energy Suppliers Survey was missing account numbers, special emphasis was placed on obtaining account numbers. This importance was stressed along with the importance of obtaining signed Authorization Forms from the respondent. These forms are used to secure the release of the buildings' energy consumption and expenditures records from the energy supplier. With the 1995 survey, account numbers were added as a data item collected during the interview rather than in conjunction with preparing the authorization form.

The 1995 CBECS interviewing training sessions included a formalized evaluation process. Based on the results of a key concepts quiz/test and an evaluation by trainers and/or supervisors, the interviewer trainees were considered either to have successfully completed training, were placed on probation, or were released from the study.

Collecting the Data

Initial contacts with the building representatives were made through an introductory letter mailed to them at each building or facility in the survey sample. The letter, signed by a representative of EIA, was addressed to the building owner or manager. The letter explained that the building had been selected for the survey, introduced the survey contractor, assured the building manager that the data would remain confidential, and discussed the uses and needs for the CBECS data in setting national energy policies. To protect confidentiality, the letter was addressed by the survey contractor after it was signed at EIA.

A worksheet was attached to the letter that listed several pieces of information that the respondent should have ready for the interviewer. This information included square footage of the building, year constructed, energy sources used, types of heating and cooling equipment, number of workers, energy billing account numbers, and names and addresses of the energy suppliers. The worksheet alerted the respondent to questions that might be difficult to answer "on-the-spot" and which, if gathered prior to data collection, could reduce the length of the interview or the need for callbacks. Additionally, 989 buildings selected in 1995 that were from the 1992 CBECS, and 21 buildings from a 1993 Supplemental Survey of Federal Buildings were sent information that they had previously reported during those two surveys.

Data collection began August 28, 1995, and ended December 8, 1995. The data were collected by the survey contractor's field staff. This staff consisted of 149 interviewers under the supervision of seven regional supervisors and their assistants and a central office staff consisting of a project manager, a field director, and a subsampling assistant.

Interviewers

Prior to beginning the interview, the interviewer observed the outside of the building to ascertain if the structure met the size and building-use eligibility requirements of the survey. If the building failed to meet any one of the definitional criteria, the building was classified as ineligible and no interview was conducted. (See "Determining Building Eligibility" section of this Appendix for an explanation of these criteria.)

During the initial visit to the sampled buildings, the interviewers identified and attempted to schedule an interview with a knowledgeable respondent who met the survey criteria for a building representative. The respondent could be the owner of the building, a tenant, a hired building manager or engineer, or a spokesperson for a management company.

The Interview

Each interview began with a series of screening questions designed to verify the building's address and eligibility for the survey. Respondents were asked about the building as a whole rather than individual establishments located within the building. The completed building interview lasted an average of 40 minutes. This included the time for the interviewer to record the results of the screening, to ask all questions on the Building Characteristics Questionnaire, and to obtain a signed authorization form from the respondent for the release of energy billing data from the energy supplier to the building. It did not include the observation time prior to the interview to determine if the building was eligible or the time needed to obtain a signed authorization form from someone other than the building respondent, in those cases when the building respondent did not have the authority to sign the form.

The average time to obtain each completed interview, including interviewer preparation, travel, callbacks, interviewing, and transmitting the completed interviews to the home office, was 6 hours and 54 minutes. Each interviewer conducted an average of 53 interviews: 5 interviewers each completed 10 or fewer interviews, while 6 interviewers each completed more than 70.

Interviewer Supervision

Procedures were taken to ensure that the interviews were conducted as intended. Ten percent of each interviewer's cases were preselected for validation by telephone at the contractor's home office to verify that the interview had been conducted and that it had been conducted at the correct building according to specified procedures. If a disproportionate percentage of an interviewer's validation cases were classified as ineligibles or nonrespondents, additional cases were selected as needed to ensure 10 percent coverage of responding cases for each interviewer. Interviewers were informed that a sample of their work would be validated, but they were not informed which completed interviews would be checked. If a field supervisor was concerned about a particular interviewer he or she conducted discretionary validations.

Minimizing Nonresponse

Several approaches were employed in an effort to minimize nonresponse, including: advance mailings to building owners or managers (see "Data Collection " in this Appendix); in-person visits; telephone callbacks; establishment of toll-free "hot line" number to address respondents' concerns or questions; personalized letters to documented refusals; and provision of additional field staff in several Metropolitan Statistical Areas to help those who still had problem cases. These approaches dealt with the three categories of nonresponse for CBECS: (1) refusals, (2) cases where the knowledgeable respondent was located outside of the sample PSU's, and (3) cases where the respondent was unavailable during the field data collection period.

An additional type of nonresponse conversion dealt with respondents who declined to sign the authorization forms that would allow their energy suppliers to release the building's energy consumption records and information on Demand Side Management program participation. Personalized written requests for signed authorization forms were mailed for all buildings for which energy usage had been reported and a signed form had not been obtained by an interviewer. Such requests were mailed to 219 buildings interviewed by field staff. A total of 24 signed authorization forms were received by mail.

Response Rates

The total 1995 CBECS sample consisted of 8,074 buildings: 6,633 from the area sample and 1,441 from the supplemental list sample. Of these, 6,590 buildings were eligible for interviewing. Of the total number of buildings eligible, interviews were completed at 87.5 percent, or 5,766 buildings. Authorization forms were obtained for 92.6 percent of interviews completed where energy was used in the building (5,250 of 5,668 buildings).

Processing the Data

The initial processing of the CBECS data occurred at the survey contractor's home office and included receipt of the CBECS questionnaires as they were transmitted from the field, editing the questionnaires, calculating the survey weights for each building, and masking the data for confidentiality before it was transmitted to EIA. Final data preparation occurred at EIA and consisted of checking the data for internal consistency, checking the data against data from previous surveys, conducting imputation procedures for missing data, and preparing crosstabulations for release to the public.

Data Editing

Data editing for the 1995 CBECS Building Characteristics Survey occurred at several points during data collection and processing. Initial editing occurred during the Computer-Assisted Personal Interviewing (CAPI) interview. Additional editing occurred upon receipt of the questionnaire for data processing and during data entry. The final data editing occurred during review of data frequencies and crosstabulations.

CAPI Edits During Interview

Data collection using CAPI techniques allows for some data editing to occur during the interview, thus ensuring a higher quality of data as well as reducing the time required for post interview editing. Higher quality of data was achieved through building procedures to control the skip patterns and to prohibit the entry of ineligible codes directly into the CAPI questionnaire. CAPI edits that occurred during the interview included:

- Arithmetic checks for items that were required to total 100 (or more), with corrections required before the interviewer could proceed;
- Double entry of square footage and energy account numbers, with reconciliation of inconsistencies before the interviewer could proceed;
- Verification of the response when an open-ended numeric response fell outside of a preset range;
- Inter-item consistency checks that prompted interviewers to confirm that the responses were being reported and recorded as intended.

Data Editing at Home Office

Completed questionnaires were transmitted electronically to the survey contractor's home office and the hard copy materials were mailed. Clerks reviewed the hard copy materials to locate a signed Authorization Form and any hard copy listings of account numbers and Supplier Customer Lists used to supplement CAPI. Linkage of the building with the energy supplier was completed as part of the processing of building survey data.

Edits at this stage were of three types: (1) missing data checks, (2) automated logic checks that verified compliance with codes and skip patterns as specified in the codebook, and (3) inter-item consistency checks.

The survey contractor took several steps to resolve inconsistencies or ambiguities in the data. First, the contractor reviewed other parts of the questionnaire for explanations that might help solve the problem. Several open-ended questions were included in the questionnaire which allowed the respondent to either describe or include additional information about a particular item. Also, the interviewers had been asked to write comments in the "comment boxes" explaining unusual circumstances. These open-ended questions and notes were relied upon extensively in the resolution process and were very helpful in explaining some of the inconsistencies. Second, in some hard-to-resolve cases, EIA personnel provided technical guidance on how to reconcile some questionnaire responses. Finally, when these efforts failed to resolve a problem, especially when the energy sources or heating and cooling equipment were involved, the survey contractor contacted the respondent by telephone for clarification.

Overall, telephone contacts to clarify both questionable or missing information were completed for the respondents of 602 buildings, 10 percent of all completed cases. All changes made to any questionnaire response as a result of these reviews were carefully documented and explained on an error resolution sheet attached to the questionnaire.

As the last step, prior to the delivery of the draft data tape to EIA, the contractor produced data frequencies and crosstabulations. These were reviewed to search for outlying values and inconsistencies that the edits may not have identified. Inconsistencies were corrected by the contractor before data tapes were transmitted to EIA.

Based on EIA's review of the initial draft data tape, the survey contractor provided EIA with a second draft data tape that included the survey weights for each observation. These data were reviewed by EIA and provided the basis for the final masked data tape.

Final Data Preparation for Release of Data

Upon receipt of draft data tapes, EIA data analysts prepared crosstabulations to check for internal consistency of the data and compared the 1995 data with the data from previous CBECS. Questions concerning data accuracy or values were referred to the survey contractor for verification. EIA staff judgement was the final authority on some of the data items. If retrieval of missing data for one or more items failed, or if retrieval was not performed because the item was not a key data item, EIA staff imputed values for the missing data values (For a description of the imputation process, see Appendix B, "Nonsampling and Sampling Errors."). Finally, EIA began preparing the data tables and analyzing the data for public release.

Confidentiality of Information

The EIA does not receive or take possession of the names or addresses of individual respondents or any other individually identifiable energy data that could be specifically linked with a building respondent. All names and addresses are maintained by the survey contractor for survey verification purposes only. Geographic identifiers and National Oceanic and Atmospheric Administration (NOAA) Weather Division identifiers are not included on any data files delivered to EIA. Geographic location information is provided to EIA at the Census division level. In addition, building characteristics such as: number of floors, building square footage, and number of workers in the building, that could uniquely identify a particular responding building, are masked on data files provided to EIA, as well as on all public-use data files.

Appendix B

Nonsampling and Sampling Errors

Introduction

All of the statistics published in this report are estimates of population values, such as the total floorspace of commercial buildings in the United States. These estimates are based on reported data from representatives of a randomly chosen subset of the entire population of commercial buildings. As a result, the estimates always differ from the true population values.

The differences between the estimated values and the actual population values are due to two types of errors, nonsampling errors and sampling errors. Nonsampling errors are sources of variability that originate apart from the sampling process and would be expected to occur in all possible samples or in the average of all estimates from all possible samples. Sampling errors are random differences between the survey estimate and the population value that occur 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 the 1995 CBECS, the sampling error is nonzero and unknown for the particular sample chosen. However, the sample design permits sampling errors to be estimated. The section "Estimation of Standard Errors" describes how the sampling error is estimated and presented for statistics given in this report.

The two sections that follow this introduction, "Data Collection Problems" and "Nonresponse," describe some of the sources of nonsampling error, and how the survey is designed and conducted to minimize such errors. Nonsampling errors can result from: (1) inaccuracy in the data collection due to questionnaire design errors, interviewer error, respondent misunderstanding, and data processing errors; (2) nonresponse for an entire sampled building (unit nonresponse); and (3) nonresponse on a particular question from a responding building (item nonresponse). The section "Data Collection Problems" addresses some of the difficulties encountered in trying to obtain meaningful data on questionnaire items in the 1995 survey. The section "Nonresponse" presents in detail the procedures used to handle unit and item nonresponse.

Most unit nonresponse cases occurred because an appropriate respondent was unavailable or declined to participate in the survey. Item nonresponse resulted when the building respondent did not know, or, less frequently, refused to give the answer to a particular question. Unlike the sampling error, the magnitude of nonsampling error cannot easily be estimated from the sample data. For this reason, avoiding biases at the outset is a primary objective of all stages of survey design and field procedures. The wording and format of survey questionnaires, the procedures used to select and train interviewers, and the quality control built into the data collection, receipt, and processing operations were all designed to minimize these sources of error. For a discussion of the questionnaire design, interviewer training, and data control, see Appendix A, "How the Survey Was Conducted."

Data Collection Problems

Data Collection Problems

Even though the interviewer was instructed to conduct the interview with the person most knowledgeable about the building, there was a great deal of variation in how much CBECS respondents knew about their buildings. Some respondents did not know some of the information requested; some were able to provide certain information only if the questions were expressed in the particular terms they understood. This presented a special challenge to the CBECS questionnaire designers: with such a diverse population of respondents, it is difficult to construct standard wording for energy concepts that would be understood by all respondents. Additionally, even when a question is worded clearly and the respondent understands the question and has the required knowledge, simple clerical errors (possibly the fault of the questionnaire layout) can sometimes lead to inaccuracies in the data.

Following is a summary of some difficulties that EIA staff has identified with the survey responses. The extent of these comments should not be viewed as a failure of the questionnaire or the interview process; the data collection process worked well. Rather, these comments indicate areas that require further refinements to improve overall data quality.

Principal Building Activity

The principal building activity refers to the primary function or activity that occupies the most floorspace in the building sampled. In some cases, particularly if the sampled building was one of a number of buildings on a facility, the respondent reported the overall function of the facility or establishment to which the building belonged. In CBECS, for instance, a library is classified as a public assembly building, but a library on a university campus may have been reported as an education building (academic or technical instruction). To help alleviate this confusion, the 1995 CBECS asked a separate question for the overall facility activity for those buildings identified as being part of a facility. The principal activities of respondent buildings were checked against other available information, including the facility activity, interviewer observations, and the building's name, and recoded if an obvious assignment error was made.

Another difficulty with identifying principal building activities is that buildings with the same title may, in fact, have different primary functions. For example, space in a building referred to as a "courthouse" can be devoted primarily to office activities (office), to jail cells (public order and safety), or to hearing rooms (public assembly).

For some buildings, no one activity occupied 50 percent or more of the floorspace, but the activity occupying more space than any other was either industrial or residential. For example, it is possible for a building to have 30 percent of the floorspace devoted to assembly, 30 percent to food sales, and 40 percent to residential. Since more than 50 percent of the floorspace was occupied by commercial activity, these buildings were retained in the sample as commercial buildings but were included in the "Other" category.

Number of Workers

The CBECS collects data on the number of people who work in commercial buildings. Included in this number are volunteer workers, but not clients, students, or employees who work away from the building. A change in the question between the 1986 and the 1989 CBECS resulted in a somewhat smaller estimate of employment totals for 1989 than the corresponding estimates for 1986. The 1986 CBECS asked for the total number of people working in the building across all shifts. Although this was not obvious in the 1986 questionnaire, it was specified in the interviewer instructions. While it is conceivable that some respondents in 1986 may have given the number of workers for the main shift, the responses are, for the most part, consistent with the total number working across all shifts. On the other hand, the 1989 survey specifically asked for the number working during the main shift. Using the total number of people who work in the building provides a better basis for estimating floorspace by region from employment data, which tend to be more readily available from economic series. The number working during the main shift gives a more meaningful number for estimating the capacity of the building's energy-using systems. In order to compare the 1992 CBECS number of workers with the number of workers in both the 1986 and 1989 CBECS, the 1992 CBECS asked both the total number of workers across all shifts and the number of workers for the main shift. In 1995, only the number of people working during the main shift was requested.

In the 1995 CBECS, if a building was not in use during the previous 12 months it was still included in the less- than five category of number of workers.

Heating and Cooling

The phrasing of questions on heating and cooling equipment has presented difficulties in every CBECS conducted thus far and, unfortunately, illustrates difficulties both in question wording and in respondent knowledge. Commercial buildings' heating and cooling systems vary greatly in design and complexity. The CBECS questionnaire designers try to formulate a few questions that could broadly characterize a building's heating and cooling system.

In previous CBECS, some building respondents (especially those from larger buildings), found the questions to be too general to adequately describe their buildings' systems. Other building respondents lacked even the rudimentary knowledge of their buildings' systems required by the questionnaire. To alleviate some of the problems encountered in earlier CBECS in which inconsistencies appeared between types of equipment, fuel sources and the distribution system, the 1995 CBECS questionnaire limited the

respondents' choices in such a way that only answers to sensible combinations of heating or cooling equipment with distribution equipment could appear.

Additionally, a general question asked the respondent to describe the heating and cooling system. This verbatim description was not coded on the computer file but was of immeasurable value in deciphering the respondents' intentions. In particular, the question of whether the buildings uses 'heat pumps' elicited some surprising responses at some of the interviewed buildings. Several respondents indicated that they used a heat pump for heating but not cooling, or vice versa. After review of the verbatim description and callbacks to the respondents, corrections were made in cases where this information was in error. However, there were 212 cases where the heat pumps did indeed have a single use.

Gas Transported for the Account of Others

The respondents to the 1995 CBECS were asked whether the building bought or contracted for natural gas from someone other than the local distribution company and the name and address of the company or broker from whom the direct purchase gas was bought or contracted. This purchasing arrangement is known as "gas transported for the account of others." It is also known as "direct purchase gas" or "spot market gas."

This general question, plus several other specific price-related questions were first asked during the building characteristics portion of the survey in the 1992 CBECS. Prior to 1992, this information was asked only of the energy suppliers. Although suppliers could provide the volume of natural gas delivered, they could not, in many cases, report the expenditures since they did not know the purchase price of the transported gas. It was believed that the building respondent would be better able to provide information about whether they purchased natural gas under this arrangement, who the suppliers were, and what were the wellhead costs, city gate price, LDC charge, and other costs associated with gas transported for the account of others. This, however, proved to be another area where the building respondent had difficulty providing information. Therefore, based on the 1992 CBECS experience, where only 18 percent of the building respondents could report one or more of the costs associated with the purchase, the cost questions were eliminated in 1995 from the Building Characteristics questionnaire.

It appears that CBECS respondents, the people who are supposed to be most knowledgeable about the energy-using systems of the buildings, are not the most knowledgeable about billing arrangements. In future CBECS, it may be necessary to target the person most knowledgeable about billing with a separate data collection effort in order to make reliable estimates about gas transported for the account of others.

Electricity Generation or Cogeneration

A series of questions was asked about the buildings' electricity generating systems and the sources of electricity. Respondents were asked whether the building could generate electric power and, if yes, what was the primary use of the generators. Of the 5,656 buildings that use electricity, approximately 1,257 reported that they had the capability to generate electric power. Of these, 87 percent use the generators for emergency back-up use.

Respondents that reported the buildings could generate electricity but that the primary use was for something other than emergency backup were then asked whether the electric power generating system was also a cogeneration system. Because the number of sampled buildings that had a cogeneration system was less than 20, the data were not published.

Two new questions were asked in 1995 in an attempt to gather information about different purchasing arrangements of electricity. With the probability of deregulation in the electric utility sector, increasing numbers of consumers will be able to purchase their electricity from nonutility sources, similar to purchasing natural gas from independent suppliers. Respondents were asked if any of the electricity used in the building was obtained from a nonutility, non in-house source, such as an independent power producer, and if yes, how much of the electricity used was obtained from this source. While the vast majority of buildings purchased all of their electricity from a local utility, there were 26 sampled buildings that obtained some of the electricity used from a nonutility, non in-house source. After these 26 buildings were examined, it was determined that most of these buildings were on facilities with central heating plants or had the capability of generating electricity themselves. It appears that the respondents might have confused nonutility source of electricity with the ability to generate electricity on the facility or in-house.

Renewable Energy Source

The CBECS attempted to collect information on the use of renewable energy sources by including wood and solar thermal panels in the list of possible energy sources that were used to supply energy to the building. In 1995, Wood was used in about 3 percent of the buildings as an energy source. Data on the use of solar panels could not be published because either the number of buildings reporting the use was too few or the Relative Standard Error (RSE) was greater than 50 percent.

Additional questions were asked about the use of the renewable energy features and the sponsors to each one. The energy features included: passive solar features, photovoltaic (PV) arrays, geothermal or ground source heat pumps, wind generation and well water for cooling. The sponsors included: utilities, Federal Government, in-house or self-sponsored, third party, or other. With the exception of passive solar features (which included trees that could be used for shade), fewer than 20 buildings of the 5,766 sampled responded to each of the renewable energy features. Therefore, these data were not imputed or published.

Nonresponse

Unit Nonresponse

The response rate for the 1995 CBECS was 87.5 percent. That is, of the 6,590 buildings eligible for interview, 12.5 percent did not participate in the Building Characteristics Survey. Although this rate is somewhat lower than the rate for the 1992 CBECS, it still represents an extremely respectable unit-nonresponse rate for a voluntary survey of this length and complexity.

Weight adjustment was the method used to reduce unit nonresponse bias in the survey statistics. The CBECS sample was designed so that survey responses could be used to estimate characteristics of the entire stock of commercial buildings in the United States. The method of estimation used was to calculate basic sampling weights (base weights) that related 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: 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.

To reduce the bias from unit nonresponse in the survey statistics, the base weights of respondent buildings were adjusted upward, so that the respondent buildings would represent not only unsampled buildings but also nonrespondent buildings. The base weights of respondent buildings were multiplied by the Adjustment Factor A, defined as the sum of the base weights over all buildings selected for the sample divided by the corresponding sum over all respondent buildings. Respondent weights remained nonzero after weight adjustment. Nonrespondent weights were set to zero because they were accounted for by the upward adjustment of respondent weights.

Unit nonrespondents tended to fall into certain categories. For example, nonresponse tended to be lower in the Northeast than in the Midwest (11.9 percent and 14.8 percent respectively). To reduce nonresponse bias as much as possible, adjustment factors were computed independently within 38 subgroups according to characteristics known from the sampling stage for both responding and nonresponding buildings. These characteristics included the general building activity, the rough size of the building, Census region, and metropolitan versus nonmetropolitan location.

Item Nonresponse

Table B2 contains item nonresponse rates for some of the building characteristics presented in this report. "Eligible" in this context refers to interviewed buildings to which the question item applied; certain sequences of responses to previous questions would make some question items not applicable for some respondents.

Nonresponses to several items in otherwise completed questionnaires were treated by a technique known as “hot-deck imputation.” In hot-decking, when a certain response is missing for a given building, another building, called a "donor," is randomly chosen to furnish its reported value for that missing item. That value is then assigned to the building with item nonresponse (the nonrespondent, or "receiver").

To serve as a donor, a building had to be similar to the nonrespondent in characteristics correlated with the missing item. This procedure was used to reduce the bias caused by different nonresponse rates for a particular item among different types of buildings. What characteristics were used to define "similar" depended on the nature of the item to be imputed. The most frequently used characteristics were: principal building activity, floorspace category, year constructed category, and Census region. Other characteristics (such as type of heating fuel and type of heating and cooling equipment) were used for specific items. To hot-deck values for a particular item, all buildings were first grouped according to the values of the matching characteristics specified for that item. Within each group defined by the matching variables, donor buildings were assigned randomly to receiver buildings.

As was done in previous surveys, the 1995 CBECS used a vector hot-deck procedure. With this procedure, the building that donated a particular item to a receiver also donated certain related items if any of these were missing. Thus, a vector of values, rather than a single value, is copied from the donor to the receiver. This procedure helps to keep the hot-decked values internally consistent, avoiding the generation of implausible combinations of building characteristics.

Estimation of Standard Errors

Sampling error, as described in the introduction to this appendix, is the difference between the survey estimate and the true population value due to using a random sample to estimate for a population. This difference arises because a random subset, rather than the whole population, is observed. The typical magnitude of the sampling error is measured by the standard error of the estimate. The standard error is the root-mean-square difference between the estimate based on a particular sample and the value that would be obtained by averaging estimates over all possible samples.

If the estimates are unbiased, meaning there is no systematic error, this average over all possible samples is the true population value. In this case, the standard error is simply the root-mean-square difference between the survey estimate and the true population value. If systematic error is present, however, this bias is not included in the error measured by the standard error. Thus, the standard error tends to understate the total estimation error if there are non-negligible biases.

In principle, random errors can be contributed to the estimate by sources other than the sampling process. Such additional sources of random error include random errors by respondents and data entry staff and random unit nonresponse. To recognize these additional sources of variation, the definition of the sampling process can be expanded to include not just the selection of buildings but all steps required to obtain a set of responses. Under this expanded definition, all random errors can be regarded as sampling errors. The procedures designed to estimate the sampling error for CBECS incorporate all random components of the estimation process.

Jackknife Replication

Throughout this report, standard errors are given as percents of their estimated values, that is, as relative standard errors (RSE's). Computations of standard errors are more conveniently described, however, in terms of the estimation variance, which is the square of the standard error.

Table B2. Item Nonresponse Percentages for Selected Building Characteristics 1995

	Eligible Buildings	Number Missing	Percent Nonresponse
Square footage	5766	722	12.52
Square footage category	5766	9	0.16
Year construction was completed	5766	777	13.48
Year of construction category	5766	1	0.02
Multibuilding facility or complex	5766	1	0.02
Number of businesses/organizations	5766	66	1.14
Number of businesses/organizations category	5766	8	0.14
Owned by government agency	5766	7	0.12
Occupant status	5653	29	0.15
Space vacant for at least 3 months	5766	13	0.23
Months in use out of past 12 months	5766	2	0.03
Total weekly hours open	5646	127	2.25
Total weekly hours open category	5646	6	0.11
Number of workers (main shift)	5646	667	11.81
Number of workers category (main shift)	5646	42	0.74
Wall construction material	5766	2	0.03
Roof construction material	5766	53	0.92
Exterior wall insulation	5766	252	4.37
Roof or ceiling insulation	5766	164	2.84
Storm windows or doors	5766	26	0.45
Tinted or reflective glass	5766	16	0.28
Shadings or awnings	5766	8	0.14
Energy management and control system	5766	56	0.97
Variable air volume (VAV) system	5463	149	2.73
Economizer cycle	5463	71	1.30
Regular preventive maintenance program	5463	32	0.59
PCS/computer terminals in building	5766	14	0.24
Commercial refrigerator/freezer equipment present	5766	10	0.17
Percent heated in 1995	5369	46	0.86
Energy used for main heating	5766	6	0.10
Main equipment for heating	5369	339	6.31
Percent cooled in 1995	4947	29	0.59
Main cooling equipment	4947	222	4.49
Type of water heating system	5108	48	0.94
Percent lit during operating hours	5593	34	0.61
Percent lit during off-hours	4506	17	.3
Reduction in lighting off-hours	4662	352	7.55
Building uses transportation gas	3689	108	2.84

Source: Energy Information Administration, Office of Energy Markets and End Use, 1995 Commercial Buildings Energy Consumption Survey.

For some types of surveys, a convenient algebraic formula for computing variances can be obtained. The CBECS used a list-supplemented, multistage area sample design (See Appendix A, "How the Survey Was Conducted") of such complexity that it is virtually impossible to construct an exact algebraic expression for estimating variances. In particular, convenient formulas based on an assumption of simple random sampling, typical of most standard statistical packages, are entirely inappropriate for the CBECS estimates. Such formulas tend to give severely understated standard errors, making the estimates appear much more accurate than is the case.

The method used to estimate sampling variances for this survey was a jackknife replication method. The idea behind replication methods is to form several pseudoreplicates of the sample by selecting subsets of the full sample. The subsets are selected in such a way that the observed variance of estimates based on the different pseudoreplicates estimates the sampling variance in the overall estimate.

The k^{th} jackknife pseudoreplicate sample set is obtained by deleting all observations from one of the members in the k^{th} group and multiplying the weights on all cases in the other group members by 2 if there are 2 members in the group and by 1.5 if there are 3 members in the group. Observations in all other groups are unaffected. The k^{th} pseudoestimate is then obtained from this pseudoreplicate sample by following all the steps used to construct the full-sample estimate.

The variances are estimated from the pseudoestimates in the following way. Let X' be a survey estimate (based on the full sample) of characteristic X for a certain category of buildings. For example, X may be the total square footage of buildings using natural gas in the Midwest. Let X_k' be the pseudoestimate of X based on the k^{th} pseudoreplicate sample. The estimated variance of the full-sample estimate X' is then given by:

$$S_{X'}^2 = \sum_{k=1}^{44} (X_k' - X')^2 .$$

The standard error of X' is given by:

$$S_{X'} = \sqrt{S_{X'}^2} .$$

The relative standard error (percent) of X' is obtained from this standard error as:

$$RSE_{X'} = \left(\frac{S_{X'}}{X'} \right) \times 100 .$$

Generalized Variances

For every estimate in this report, the RSE was computed by the methods described above. This was the RSE used for any statistical tests or confidence intervals given in the text or to determine if the estimate had too much variation to publish (RSE greater than 50 percent).

Space limitations prevent publishing the complete set of RSE's with this document. Instead, a generalized variance technique is provided, by which the reader can compute an approximate RSE for each of the estimates in the main summary tables. For an estimate in the i^{th} row and j^{th} column of a particular table, the approximate RSE is given by the simple formula:

$$RSE_{i,j} = R_i C_j$$

where R_i is the RSE row factor given in the last column of row I, and C_j is the RSE column factor given at the top of column j.

The use of the row and column RSE factors is illustrated in Appendix A, "Detailed Tables" section.

Derivation of Row and Column Factors

The row and column factors are determined from a two-factor analysis of the table of RSE's on the basis of the model

$$\log(RSE_{i,j}) = m + a_i + b_j .$$

Least-squares estimates for this model are given by:

$$m = \overline{\log(RSE)}$$

$$a_i = \overline{\log(RSE_{i.})} - \overline{\log(RSE)}$$

$$b_j = \overline{\log(RSE_{.j})} - \overline{\log(RSE)}$$

where $\overline{\log(RSE)}$ is the mean of $\log(RSE_{i,j})$ over all rows I and columns j $\overline{\log(RSE_{i.})}$, is the mean over all columns j for a particular row I, and $\overline{\log(RSE_{j.})}$ is the mean over all rows I for a particular column j. The row and column RSE factors are then computed as

$$R_i = \log^{-1}(m + a_i) = \log^{-1}\left(\overline{\log(RSE_{i,})} \right)$$

$$C_j = \log^{-1}(b_j) = \log^{-1}\left(\overline{\log(RSE_{.j})} - \overline{\log(RSE)} \right) .$$

The RSE row factor, R_i is thus the geometric mean of the RSE's in row I, and the RSE column factor, C_j, is an adjustment factor with geometric mean equal to 1.0.

For a few table cells, there were no sample cases, hence, no estimate and no RSE. As a result, some of the arrays of direct estimates $RSE_{i,j}$ had a few missing values. In such cases, the formulas given above for row and column factors still apply, but only after appropriate estimates have been substituted for the missing values. In cases where a statistic was not publishable because of a high RSE or small cell sample size, the value of $RSE_{i,j}$ was set to missing and an appropriate estimate substituted so that the computed row and column factors are based only on statistics where the RSE is low enough to allow publication. Additionally, RSE column factors are not included for the median statistics found in Table 2 of the "Detailed Tables."

Appendix C

Description of Building Types

In the Commercial Buildings Energy Consumption Survey (CBECS), buildings were classified according to principal activity, which was the primary business, commerce, or function carried on within each building. Buildings used for more than one of the activities described below were assigned to the activity occupying the most floorspace at the time of the interview. Thus, a building assigned to a particular principal activity category may have been used for other activities in a portion of its space or at some time during the year.

Each of the principal activity categories is listed alphabetically and described below. Lists of specific types of buildings included in each category are presented for clarification but are not intended to be exhaustive.

1. **Agricultural:** See **Other**.

2. **Education:** refers to buildings used for academic or technical *classroom* instruction. This category includes the following:

   Schools:
   - Preschool
   - Elementary
   - Junior high
   - Senior high
   - College or university classrooms/Laboratories
   - Vocational school

   Other activities that occur on school campuses are reported separately:
   - Administration (see Office/Professional)
   - Auditorium (see Public Assembly)
   - Dormitory (see Lodging)
   - Gymnasium (see Public Assembly)
   - Infirmary (see Health Care)
   - Library (see Public Assembly)
   - Museum (see Public Assembly)
   - School for the Mentally Retarded (see Health Care)
   - Stadium (see Public Assembly)
   - Student Union (see Public Assembly).

3. **Enclosed Shopping Center/Mall:** See **Mercantile and Service**.

4. **Food Sales:** refers to buildings used for retail or wholesale sale of food. This category includes the following:

   - Convenience store or market
   - Farmer's market, Fruit/Vegetable market
   - Grocery store/Supermarket
   - Meat/Seafood store
   - Retail bakery
   - Specialty food store.

5. **Food Service:** refers to buildings used for preparation and sale of food and beverages for consumption. This category includes the following:

   Prepared-Meal Services:
   - Cafeteria

   Carry-out Service:
   - Caterer
   - Fast-food establishment
   - Pizza parlor
   - Sandwich shop

   Full-Service Restaurant:
   - Bar
   - Bar and grill
   - Coffee shop
   - Diner
   - Full-menu-service establishment .

6. **Health Care:** refers to buildings used as diagnostic and treatment facilities for both inpatient and outpatient care. In the tables of this report, inpatient and outpatient buildings are combined in the "Health Care" Principal Building Activity category. Excluded from this group are skilled nursing or other residential care facilities (nursing homes).

   Inpatient facilities treat the mentally or physically ill. Buildings for overnight care are in this grouping. This category includes the following:

   Medical Care Hospital:
   - Chronic disease
   - Ear, eye, nose, and throat
   - General medical and surgical
   - Maternity
   - Medical infirmary (connected with an institution)
   - Orthopedic
   - Tuberculosis/other respiratory disease

   Mental Facility:
   - Mental retardation/schools for the mentally retarded
   - Psychiatric

   Rehabilitation Facility:
   - Alcoholism
   - Substance abuse/narcotics/drug addiction
   - Physical therapy.

   Outpatient care may be medical, dental, or psychiatric and involves diagnosis and treatment in which services are not required overnight. Buildings used for veterinary practices also fall into this category. This category includes the following:

   Dental Clinic

   Medical Clinic:
   - Abortion/birth control
   - Ear, eye, nose, and throat
   - Emergency walk-in
   - General

Mental Health/Psychiatric Clinic
Veterinary Facilities.

7. **Hospital/Inpatient Health Services:** See **Health Care**.

8. **Hotel/Motel/Dorm, Etc:** See **Lodging**.

9. **Industrial/Manufacturing:** See **Other.**

10. **Laboratory:** See **Other**.

11. **Lodging:** refers to buildings used to offer multiple accommodations for short-term or long-term residents including nursing homes. In the tables of this report, skilled nursing and other residential care facilities are included in the "Lodging" Principal Building Activity category.

    Hotel, Motel, Dorm, or similar residences:

    Short-Term Residence:
    - Convention hotel
    - Hotel
    - Inn
    - Motel
    - Shelter home
    - Tourist home

    Long-Term Residence:
    - Boarding house
    - Convent/monastery
    - Extended Stay Hotels
    - Dormitory/sorority/fraternity
    - Orphanage
    - Assisted-living elder care facilities (limited medical facilities)

    Skilled Nursing/Other Residential Care refers to buildings used as facilities which offer 24-hour nursing/medical care. This category includes the following:

    - Homes for the aged
    - Nursing homes.

12. **Mercantile and Service:** refers to buildings used for sales and displays of goods or services (excluding food). This category includes shopping malls and strip centers, as well as retail and service as outlined below.

    Retail (other than shopping mall or strip center):
    - Automobile dealers
    - Building materials, Garden supply stores, Hardware
    - Department stores
    - Drugstores
    - Furniture, Home equipment stores and Home furnishings
    - Liquor stores
    - Wholesale goods (except food)

    Service (other than food service):
    - Dry cleaner/Car wash/Laundry
    - Gasoline stations
    - Motor vehicle repair/service/maintenance
    - Multiservice establishments

Personal service
Post office.

13. **Nonrefrigerated Warehouse or Storage:** See **Warehouse and Storage**.

14. **Office:** refers to buildings used for general office space, professional offices, and administrative offices. This category includes the following:

    Data Processing:
    Computer center
    Data entry/Keypunch

    Financial Office Building:
    Bank
    Brokerage firm
    Insurance
    Real estate
    Securities

    Professional Office Building:
    Administration of an institution
    Consulting
    Corporate
    Engineering
    Law
    Management
    Medical
    Mixed professional.

15. **Other:** refers to buildings used for activities that do not fit into any of the specifically named categories. In the tables of this report, this category includes laboratories and buildings identified as having several commercial activities that together represent 50 percent or more of the floorspace, but whose largest single activity is agricultural, industrial/manufacturing, or residential. This category includes the following:

    Crematorium
    Hangar
    Public restrooms/Showers
    Telephone exchange
    Greenhouse with retail sales of plants
    Manufacturing with retail sales of products
    Printing plant with retail sales.

    Laboratory refers to buildings used for activities which utilize equipment for experimental testing or for analysis. This category includes the following:

    Mechanical/Electrical Laboratory
    Medical/Dental Laboratory
    Agricultural Laboratory.

16. **Outpatient Health Services/Clinic:** See **Health Care**.

17. **Public Assembly:** refers to buildings in which people gather for social or recreational activities whether in private or nonprivate meeting halls. This category includes the following:

    Entertainment Building:
    Archive/art gallery/exhibit hall/library/museum

Coliseum/arena (enclosed)
Concert hall
Observatory/planetarium
Night Club
Radio/TV station or studio
Theater/movie house/cinema

Recreational Facility:
Amusement arcade
Bowling alley
Community Centers
Gymnasium/YMCA or YWCA/indoor racket sports, recreation center/athletic facility
Indoor pool
Poolroom
Skating rink

Social/Public/Civic Assembly:
Assembly hall
Auditorium
Convention hall
Funeral home
Lecture hall
Lodge hall
Meeting hall
Student union
Town hall

Other Enclosed Assembly Building:
Armory
Passenger terminal
Stadium.

18. **Public Order and Safety:** refers to buildings used for the preservation of law and order or public safety. This category includes the following:

    Courthouse
    Fire station
    Jail
    Penitentiary/Prison
    Police station
    Reformatory
    Sheriff's office.

19. **Refrigerated Warehouse or Storage:** See **Warehouse and Storage.**

20. **Religious Worship:** refers to buildings in which people gather for religious activities. This category includes the following:

    Chapel
    Church
    Mosque
    Synagogue
    Temple.

21. **Residential:** See **Other**.

22. **Retail (other than shopping mall or strip center):** See **Mercantile and Service**.

23. **Service (other than food service):** See **Mercantile and Service**.

24. **Skilled Nursing/Other Residential Care:** See **Lodging**.

25. **Strip Shopping Center:** See **Mercantile and Service**.

26. **Warehouse and Storage:** refers to buildings used to store goods, manufactured products, merchandise, or raw materials. In the tables of this report, both refrigerated and non-refrigerated warehouse and storage are included in the "Warehouse" Principal Building Activity category.

    Refrigerated Storage refers to buildings specifically designed to store perishable goods or merchandise under refrigeration. Includes "cold storage" facilities, which store products at temperatures between 0 degrees Fahrenheit and 50 degrees Fahrenheit and "freezer" facilities, which store products at temperatures between 0 degrees Fahrenheit and 20 degrees Fahrenheit.

    This category includes the following:

    Cheese warehouse
    Cold storage
    Fur storage.

    Nonrefrigerated Warehouse refers to buildings specifically designed to store perishable goods or merchandise without refrigeration.

27. **Vacant:** refers to commercial buildings in which more floorspace was vacant than was used for any single commercial activity (as defined above) at the time of interview. Thus a vacant building may have some occupied floorspace. Vacant space does not include space being maintained and ready for use.

Glossary

Activities with Large Amounts of Hot Water: An energy-related space function within the building that requires large amounts of hot water for other than space heating. Examples of these activities are commercial laundry rooms, heated swimming pools, spas, or sauna and steam rooms.

Agricultural: Activities involving the production, processing, sale, storage, or housing of agricultural products, including livestock. Buildings that contained commercial activities but had 50 percent or more of the floorspace devoted to agricultural activities were considered out of scope, as were farms and farm buildings, which are overwhelmingly residential and agricultural. (See **Commercial Building** and **Principal Building Activity.**)

Air-Handling Unit: A type of heating and/or cooling distribution equipment that channels warm or cool air to different parts of a building. This process of channeling the conditioned air often involves drawing air over heating or cooling coils and forcing it from a central location through ducts or air-handling units. Air-handling units are hidden in the walls or ceilings, where they use steam or hot water to heat or chill water to cool the air inside the duct work. (See **Duct.**)

Baseboard: A type of heating distribution equipment in which either electric resistance coils or finned tubes carrying steam or hot water are mounted behind shallow panels along baseboards. Baseboards rely on passive convection to distribute heated air in the space. Electric baseboards are an example of an Individual Space Heater. (See **Electric Baseboard** and **Individual Space Heater**.)

Boiler: A type of space-heating equipment consisting of a vessel or tank where heat produced from the combustion of such fuels as natural gas, fuel oil, or coal is used to generate hot water or steam. Many buildings have their own boilers, while other buildings have steam or hot water piped in from a central plant. For this survey, only boilers inside the building (or serving only that particular building) are counted as part of the building's heating system. Steam or hot water piped into a building from a central plant is considered district heat.

Building: A structure totally enclosed by walls extending from the foundation to the roof, containing over 1,000 square feet of floorspace and intended for human occupancy. Included in the survey as a specific exception were structures erected on pillars to elevate the first fully enclosed level but leaving the sides at ground level open. Excluded from the survey as nonbuildings were the following: structures (other than the exception just noted) that were not totally enclosed by walls and a roof (such as oil refineries, steel mills, and water towers); street lights, pumps, billboards, bridges, swimming pools, oil storage tanks, construction sites; and mobile homes and trailers, even if they housed commercial activity. The 1995 CBECS excluded parking garages and commercial buildings on manufacturing sites. These buildings were included in previous CBECS. (See **Commercial Building.**)

Building Energy Manager: A person whose chief day-to-day responsibility is the physical operation and maintenance of the building's heating and/or cooling equipment.

Building Floorspace: See **Floorspace**.

Building Shell (Envelope): The thermal envelope of the building, that is, the roof, exterior walls, and bottom floors that enclose conditioned space through which thermal energy may be transferred to or from the exterior.

Building Shell Conservation Features: Features designed to reduce the energy loss or gain through the shell or envelope of the building. This category includes roof, ceiling or wall insulation; storm windows or double- or triple-paned glass (multiple glazing); tinted or reflective glass or shading films; and exterior or interior shadings or awnings. (See **Insulation, Storms or Multiple Glazing, Tinted or Reflective Glass or Shading Film**, and **Exterior or Interior Shadings or Awnings**.)

Built-Up Roof: A roof covering consisting of several successive layers (each of which is called a “ply”), usually of roofing felt, with mopping of hot asphalt between layers and topped by a mineral-surfaced layer or by gravel embedded in a heavy coat of asphalt.

Cases or Cabinets: Refrigeration in open or closed units for the purpose of selling, displaying, or storing perishable materials. "Open" refers to cases or cabinets with no covers or with flexible covers made of plastic or some other material, hung in strips or curtains to stop the flow of warm air into the refrigerated space. "Closed" refers to units with doors that shut.

CDD: See **Cooling Degree-Days (CDD)**.

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

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

Central Chiller: A type of cooling equipment that is centrally located and that produces chilled water in order to cool air. The chilled water or cold air is then distributed throughout the building by use of pipes or air ducts, or both. These systems are also commonly known as "chillers," "centrifugal chillers," "reciprocating chillers" or "absorption chillers." Chillers are generally located in, or just outside, the building they serve. Chillers located at central plants are included under **District Chilled Water**.

Central Physical Plant: A plant that is owned by, and on the grounds of, a multibuilding facility that provides district heating, district cooling, or electricity to one or more buildings on the same facility. The central physical plant may be by itself in a separate building or may be located in a building where other activities occur. (See **Multibuilding Facility, District Heat,** or **District Chilled Water**.)

Centralized Water-Heating System: A type of water-heating equipment that heats and stores water for purposes other than space heating which provides hot water from a single location for distribution throughout a building. A residential-type tank water heater is a good example of a centralized water heater.

Climate Zone: One of five climatically distinct areas, defined by long-term weather conditions affecting the heating and cooling loads in buildings. The zones were determined according to the 45-year average (1931-1975) of the annual heating and cooling degree-days (base 65 degrees Fahrenheit). An individual building was assigned to a climate zone according to the 45-year average annual degree-days for its National Oceanic and Atmospheric Administration (NOAA) Division. (See **Heating Degree-Days (HDD)** and **Cooling Degree-Days (CDD).**)

The climate zones are defined as follows:

Climate Zone	Average Annual Cooling Degree-Days	Average Annual Heating Degree-Days
1	Fewer than 2,000	More than 7,000
2	Fewer than 2,000	5,500 to 7,000
3	Fewer than 2,000	4,000 to 5,499
4	Fewer than 2,000	Fewer than 4,000
5	2,000 or more	Fewer than 4,000.

Coal: A black or brownish-black solid, combustible substance formed by the partial decomposition of vegetable matter without access to air. The term includes anthracite, bituminous and subbituminous coal, as well as the derivative of coal (formed by destructive distillation or imperfect combustion) known as coke. Data on the use of coal were collected but no consumption and expenditure data were collected. Coal is included in the "Other" category for the energy sources, main space-heating energy sources, and space-heating energy sources categories. (See **Energy Source**.)

Commercial: Neither residential, manufacturing/industrial, nor agricultural. (See **Residential**, **Manufacturing/ Industrial**, **Agricultural,** and **Commercial Building**.)

Commercial Building: A building with more than 50 percent of its floorspace used for commercial activities. Commercial buildings include, but are not limited to, the following: stores, offices, schools, churches, gymnasiums, libraries, museums, hospitals, clinics, warehouses, and jails. Government buildings were included except for buildings on sites with restricted access, such as some military bases. Agricultural buildings, parking garages, residences, and manufacturing/industrial buildings were excluded from the survey. In 1995, commercial buildings on manufacturing sites were also excluded. For a list of building types, see the section on Description of Building Types. (See **Building, Commercial, Residential, Manufacturing/ Industrial, Agricultural,** and **Principal Building Activity.**)

Commercial Food Preparation: An energy-related function that has space specifically designed and equipped to meet the needs for preparing and serving food commercially. This includes kitchens in restaurants, diners, and other commercial institutions, such as schools. The term "commercial" also includes what is sometimes classified as "institutional" -- that is, food preparation and serving areas in schools, hospitals, prisons, shelters, churches and nursing homes. This category includes cafeterias where food is brought in and kept warm with steam tables or other warming devices until it is served. It does not include employee or student "lounge" areas with microwaves or other food preparation equipment and/or vending machines.

Commercial Refrigeration/Freezer Equipment: These include: commercial refrigeration/freezer units for the sale or storage of perishable materials; residential-type refrigerators/freezers that are a necessary part of the building's principal activity; or any other commercial refrigeration equipment, excluding air conditioning. Freezers are designed to keep their contents below the freezing point of water (32 degrees Fahrenheit) and refrigeration equipment is designed to maintain the stored items below room temperature but above the freezing point of water. Data are collected on refrigeration/freezer equipment inside and/or adjacent to the building. (See **Cases and Cabinets** and **Walk-in Refrigeration Units.)**

Compact Fluorescent Light Bulb: A light bulb designed to replace screw-in incandescent light bulbs, they are often found in table lamps, wall sconces, and hall and ceiling fixtures of commercial buildings with residential type lights. They combine the efficiency of fluorescent lighting with the convenience of standard incandescent bulbs. Light is produced the same way as with other fluorescent lamps. Compact fluorescent bulbs have either electronic or magnetic ballasts.

Computer Room with Separate Air-Conditioning System: An energy-related function that has space specifically designed and equipped to meet the needs of computer equipment. The air-conditioning system for this area controls the temperature and/or humidity and is separate from that used to control the environment in other parts of the building. The space is usually separated by walls and doors. Sometimes such rooms have raised floors with ventilation equipment located under the floor.

Computer Terminal: Electronic equipment which consists of a computer screen (monitor) or terminal and a data entry device, such as a keyboard. Terminals used in offices usually look like PCs without the box or central processing unit (CPU) case. The "CPU" for the terminal is the mainframe computer located in a central place. (See **Personal Computer**.)

Concrete Panels: A wall construction panel made of concrete which is either prefabricated in a factory or poured at the site and then hoisted onto the structure. (See **Precast Concrete Panels**.)

Concrete Roof: A poured concrete roof, often intended to bear the load of a parking garage that occupies the roof area of a building.

Cooking: As an energy end use, the use of energy for commercial or institutional food preparation. Specifically, cooking that took place in a kitchen facility that was not part of a residence. It does not include employee lounge areas that are equipped with microwaves, other food preparation equipment, and/or vending machines. (See **Energy End Use**.)

Cooling: As an energy end use, the conditioning of air in a room for human comfort by a refrigeration unit (such as an air conditioner or heat pump) or by a central cooling or district cooling system that circulates chilled water. Excluded is the use of fans or blowers by themselves, without chilled air or water. (See **Energy End Use.**)

Cooling Degree-Days (CDD): A measure of how hot a location was over a period of time, relative to a base temperature. In this report, the base temperature is 65 degrees Fahrenheit, and the period of time is one year. The cooling degree-day is the difference between that day's average temperature and 65 degrees if the daily average is greater than 65; it is zero if the daily average temperature is less than or equal to 65. Cooling degree-days for a year are the sum of the daily cooling degree-days for that year.

Cooling Distribution Equipment: The part of a cooling system that distributes conditioned water and/or air throughout a building by means of pipes, ducts, or fans. Often the distribution serves both heating and cooling. (See **Duct**, **Individual Air Conditioner**, and **Fan-Coil Unit**.)

Cooling Equipment: The equipment used for cooling room air in the building for human comfort. (See **Residential- Type Central Air Conditioner, Heat Pump, Individual Air Conditioner, Central Chiller, District Chilled Water, Packaged Unit,** and **Evaporative Cooler (Swamp Cooler)**.)

Distributed Water-Heating System: A type of water-heating system for heating water for other than space-heating purposes which is located at more than one place within a building. Often called a "point-of-use" water heating system, the water heater is located at the faucet and heats water only as required for immediate use. Because water is not heated until it is required, this equipment is more energy efficient.

District Chilled Water: Water chilled outside of the building in a central plant and piped into the building as an energy source for cooling. Chilled water may be purchased from a utility or provided by a central physical plant in a separate building that is part of the same multibuilding facility (for example, a hospital complex or university). (See **Energy Source.**)

District Heat: Steam or hot water produced outside of the building in a central plant and piped into the building as an energy source for space heating or another end use. The district heat may be purchased from a utility or provided by a central physical plant in a separate building that is part of the same multibuilding facility (for example, a hospital complex or university.) District heat includes district steam and/or district hot water. (See **Energy Source**.)

District Hot Water: District heat in the form of hot water. (See **District Heat**.)

District Steam: District heat in the form of steam. (See **District Heat**.)

Duct: A type of heating and/or cooling distribution equipment that is a passageway made of sheet metal or other suitable material to convey air from the heating, ventilating, and cooling systems to and from the point of utilization. (See **Air-Handling Unit**.)

Economizer Cycle: A heating, ventilation, and cooling (HVAC) conservation feature consisting of indoor and outdoor temperature and humidity sensors, dampers, motors, and motor controls for the ventilation system to reduce the air-conditioning load. Wherever the temperature and humidity of the outdoor air are more favorable (lower heat content) than the temperature and humidity of the return air, more outdoor air is brought into the building.

Electric Baseboard: An individual space heater with electric resistance coils mounted behind shallow panels along baseboards. Electric baseboards rely on passive convection to distribute heated air to the space. (See **Individual Space Heater** and **Baseboard**.)

Electricity: Electric energy supplied to a building by a central utility via power lines or from a central physical plant in a separate building that is part of the same multibuilding facility. Electric power generated within a building for exclusive use in that building is specifically excluded from the definition of electricity as an energy source. (See **Energy Source**.)

Electricity Generation: As an energy end use, the *onsite* production of electricity by mean of electricity generators on either a regular or emergency basis. (See **Energy End Use** and **Electricity**.)

EMCS: See **Energy Management and Control System (EMCS)**.

Energy Audit: An energy management practice consisting of an evaluation to provide information on the physical and operating characteristics of a building and its energy uses and processes. The energy audit is conducted at the premise or facility by trained auditors. Audit services vary from simple walk-throughs to building management training programs and site-specific process and efficiency evaluations. Audits can be initiated or sponsored and performed by a local utility; a Federal, State or local government; a building owner; or an energy service contractor.

Energy Conservation Features: This category includes building shell conservation features, HVAC conservation features, and lighting conservation features incorporated by the building. (See **Building Shell Conservation Features, HVAC Conservation Features**, and **Lighting Conservation Features**.)

Energy-Efficient Ballasts: A lighting conservation feature consisting of an energy-efficient version of a conventional electromagnetic ballast. The ballast is the transformer for fluorescent and high-intensity discharge (HID) lamps and provides the necessary current, voltage, and wave-form conditions to operate the lamp. An energy-efficient ballast requires lower power input than a conventional ballast to operate HID and fluorescent lamps.

Energy End Use: A use for which energy is consumed in a building. Information on six specific end uses was collected in this survey. (See **Cooking, Cooling, Electricity Generation, Manufacturing, Space Heating,** and **Water Heating**.)

Energy Management and Control System (EMCS): An energy management feature that uses mini/microcomputers, instrumentation, control equipment, and software to manage a building's use of energy for heating, ventilation, air conditioning, lighting, and/or business-related processes. These systems can also manage fire control, safety, and security. Not included as an EMCS are time-clock thermostats.

Energy-Related Space Functions: The use of space in the building for one or more of three specific functions: commercial food preparation, computer rooms with separate air conditioning systems, and activities requiring large amounts of hot water. (See **Commercial Food Preparation, Computer Room with Separate Air-Conditioning System,** and **Activities with Large Amounts of Hot Water**.)

Energy Source: A type of energy or fuel consumed in the building. In this survey, information about the use of electricity, natural gas, fuel oil, district heat, district chilled water, propane, wood, coal, and solar thermal panels in commercial buildings was obtained from the building respondent. In most tables, wood, coal, and solar thermal panels are included in "Other" in the Energy Sources category. (See **Electricity, Natural Gas, Fuel Oil, District Heat, District Chilled Water, Liquefied Petroleum Gas (LPG), Propane, Wood, Coal** and **Solar Thermal Panels**.)

Establishments: As defined by the Standard Industrial Classification Manual developed by the U.S. Office of Management and Budget, "an economic unit, generally at a single physical location where business is conducted or where services or industrial operations are performed." However, "establishment" is not synonymous with "building." In this survey, respondents were asked how many establishments or organizations occupy the building -- i.e., hold or lease space in it on a full-time basis.

Evaporative Cooler (Swamp Cooler): A type of cooling equipment that turns air into moist, cool air by saturating the air with water vapor. It does not cool air by use of a refrigeration unit. This type of equipment is commonly used in warm, dry climates.

Exterior or Interior Shadings or Awnings: A building shell conservation feature designed to reduce the flow of light into a building. Exterior shadings or awnings include any type of shading (including architectural) or awning on the outside of the building designed to limit solar penetration. Interior shadings are drapes, horizontal or vertical shades, mini blinds, or any other means of covering a window from the inside to limit the amount of solar or thermal penetration.

Fan-Coil Unit: A type of heating and/or cooling distribution equipment that circulates hot or chilled water with fans but without ducts. Fan-coil units have thermostatically controlled built-in fans that draw air from the room and then carry the air across finned tubes containing hot water, steam, or chilled water. The hot water, steam, or chilled water can be produced by equipment within the building or can be piped into the building as part of a district heating or cooling system. (See **Space Heating** and **Cooling**.)

Floors: The number of levels in the tallest section of a building that are actually considered a part of the building, including parking areas, basements, or other floors below ground level.

Floorspace: All the area enclosed by the exterior walls of a building, including indoor parking facilities, basements, hallways, lobbies, stairways, and elevator shafts. For aggregate floorspace statistics, floorspace was summed or aggregated over all buildings in a category (such as all office buildings in the United States). (See **Square Footage**.)

Fluorescent Light Bulb: This is usually a long, narrow, white tube made of glass coated on the inside with fluorescent material that is connected to an electric fixture at both ends of the light bulb; the tube may also be circular or U-shaped. The light bulb produces light by passing electricity through mercury vapor, causing the fluorescent coating to glow or fluoresce. Excluded are compact fluorescent light bulbs, which are listed in a separate category . Fluorescent light bulbs are included in **Standard Fluorescent** in the **Lighting Equipment** category.

Forced Air through Vents: See **Air-Handling Unit**.

Fuel Oil: A liquid petroleum product used as an energy source that is less volatile than gasoline. Fuel oil includes distillate fuel oil (Nos. 1, 2, and 4), residual fuel oil (Nos. 5 and 6), and kerosene. (See **Energy Source**.)

Furnace: A type of space-heating equipment with an enclosed chamber where fuel is burned or electrical resistance is used to heat air directly without steam or hot water. The heated air is then distributed throughout the building, typically by air ducts.

Geothermal Heat Pump: A renewable energy feature that uses the natural heat storage ability of the earth and/or the earth's groundwater to heat and/or cool the building. The earth has the ability to absorb and store heat energy from the sun. To use that stored energy, heat is extracted from the earth through a liquid medium (groundwater or an anti-freeze solution) and is pumped to the heat pump or heat exchanger. There, the heat is used to heat the building. In the summer, the process is reversed and indoor heat is extracted from the building and transferred to the earth through the liquid. The geothermal heat pump is more efficient than an air-source heat pump. (See **Heat Pump**.)

Government Owned: A building owned by a Federal, State, or local government agency. The building may be occupied by agencies of more than one government and may also be shared with nongovernment establishments.

Ground Source Heat Pump: See **Geothermal Heat Pump**.

Halogen Light Bulb: A type of incandescent light bulb that lasts much longer and is more efficient than the common incandescent light bulb. The light bulb uses a halogen gas, usually iodine or bromine, that causes the evaporating tungsten to be redeposited on the filament, thus prolonging its life.

HDD: See **Heating Degree-Days (HDD).**

Heating Degree-Days (HDD): A measure of how cold a location was over a period of time, relative to a base temperature. In this report, the base temperature used is 65 degrees Fahrenheit, and the period of time is one year. The heating degree-day is the difference between that day's average temperature and 65 degrees if the daily average is less than 65; it is zero if the daily average temperature is greater than or equal to 65. Heating degree-days for a year are the sum of the daily heating degree-days for days that year.

Heating Distribution Equipment: The part of a heating system that distributes conditioned water and/or air throughout a building by means of pipes, ducts, or fans. Often the distribution equipment serves both heating and cooling. (See **Radiators**, **Baseboard**, **Duct**, **Individual Space Heater**, and **Fan-Coil Unit**.)

Heating Equipment: The equipment used for heating ambient air in the building such as a heat pump, furnace, boiler, packaged-heating unit, individual space heater, and district steam or hot water piped in from outside the building. (See **Boiler, Furnace, Heat Pump, Individual Space Heater,** and **Packaged Unit**.)

Heating, Ventilation, and Air Conditioning (HVAC): The system or systems that condition air in a building.

Heat Pump: A type of heating and/or cooling equipment that draws heat into a building from outside and, during the cooling season, ejects heat from the building to the outside. Heat pumps are vapor-compression refrigeration systems whose indoor/outdoor coils are used reversibly as condensers or evaporators, depending on the need for heating or cooling.

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

HVAC: See **Heating, Ventilation, and Air Conditioning (HVAC)**.

HVAC Conservation Features: A building feature designed to reduce the amount of energy consumed by the heating, cooling, and ventilating equipment. This category includes the presence of a variable air-volume (VAV) system, an economizer cycle, and HVAC maintenance programs. (See **Variable Air-Volume (VAV) System, Economizer Cycle**, and **HVAC Maintenance**.)

HVAC Maintenance: An HVAC conservation feature consisting of a program of routine inspection and service for heating and/or cooling equipment. The inspection is performed on a regular basis, even if there are no apparent problems.

Imputation: A statistical method used to generate values for missing items, designed to minimize the bias of estimates based on the resulting data set. In this survey, missing responses were generated by using a Hot-Deck imputation procedure which used a random resampling from nonmissing cases to generate values for missing cases.

Incandescent Light Bulb: A light bulb that produces a soft warm light by electrically heating a tungsten filament so that it glows. Because so much of the energy is lost as heat, these are highly inefficient sources of light. Included in this category are the familiar type of light bulbs which screw into sockets, as well as energy-efficient incandescent bulbs, such as Reflector or R-Lamps (accent and task lighting), Parabolic Aluminized Reflector (PAR) lamps (flood and spot lighting), and Ellipsoidal Reflector (ER) lamps (recessed lighting).

Individual Air Conditioner: A type of cooling equipment installed in either walls or windows (with heat-radiating condensers exposed to the outdoor air). These self-contained units are characterized by a lack of pipes or duct work for distributing the cool air; the units condition only air in the room or areas where they are located.

Individual Space Heater: A type of space heating equipment that is a free-standing or a self-contained unit that generates and delivers heat to a local zone within the building. The heater may be permanently mounted in a wall or floor or may be portable. Examples of individual space heaters include electric baseboards, electric radiant or quartz heaters, heating panels, gas- or kerosene-fired unit heaters, wood stoves, and infrared radiant heaters. These heaters are characterized by a lack of pipes or duct work for distributing hot water, steam, or warm air through the building.

Insulation: A building shell conservation feature consisting of material placed between the interior of a building (in the roof below the waterproofing layer or in the ceiling of the top floor in the building or between the exterior and interior walls of a building) and the outdoor environment to reduce the rate of heat loss to the environment or heat gain from the environment. Examples include glass-wool fill and foam board.

Kerosene: A petroleum distillate with properties similar to those of No. 1 fuel oil; used primarily in space heaters, cooking stoves, and water heaters. In this report, no distinction is made between kerosene and fuel oil. (See **Fuel Oil.**)

Lighting Conservation Features: A building feature or practice designed to reduce the amount of energy consumed by the lighting system. Lighting Conservation Features include natural lighting control sensors, manual dimmer switches, occupancy sensors, specular reflectors, time clocks or timed switches, and energy-efficient ballasts. (See **Natural Lighting Control Sensors, Manual Dimmer Switches, Occupancy Sensors, Specular Reflectors**, **Time Clocks or Timed Switches,** and **Energy-Efficient Ballasts**.)

Lighting Equipment: Light bulbs used to light a building's interior, such as incandescent light bulbs, standard and compact fluorescent light bulbs, high-intensity discharge (HID) lights, and halogen bulbs. (See **Incandescent Light Bulb, Standard Fluorescent Light Bulb, Compact Fluorescent Light Bulb, High-Intensity Discharge (HID) Light Bulb,** and **Halogen Light Bulb**.)

Liquefied Petroleum Gas (LPG): Any fuel gas supplied to a building in liquid form. Propane is the usual LPG, but gases such as butane, propylene, butylene, and ethane are also LPG. For this report, any LPG reported was assumed to be propane. (See **Energy Source, Propane**, and **Natural Gas.**)

LPG: See **Liquefied Petroleum Gas (LPG).**

Manual Dimmer Switches: A lighting conservation feature that changes the level of light in the building. These are like residential-style dimmer switches, which are not commonly used with fluorescent or HID lamps.

Manufacturing: As an energy end use, any of the energy-using operations required for manufacturing/industrial processes. (See **Energy End Use** and **Manufacturing/Industrial**.)

Manufacturing/Industrial: Activities involving the processing or procurement of goods, merchandise, raw materials, or food. Manufacturing/industrial buildings were out of scope for the CBECS and were not listed. Unlike previous CBECS, the 1995 CBECS excluded commercial buildings that were located on manufacturing sites (such as offices on manufacturing sites). (See **Principal Building Activity**.)

Masonry: A general term covering wall construction and using masonry materials, such as brick, concrete block, stone, and tile that are set in mortar; also included is stucco. This category does not include concrete panels since concrete panels represent a different method of constructing buildings. Concrete panels are reported separately.

Mean: The simple average for a population characteristic is the sum of all the values in a population divided by the size of the population. For this report, population means are estimated by computing the weighted sum of the sample values, then dividing by the sum of the sample weights. For example, "Mean Hours per Week" is the weighted sum of the number of operating hours divided by the weighted sum of the number of buildings; "Mean Square Feet per Building" is the weighted sum of the total square feet divided by the weighted sum of the number of buildings; and "Mean Square Feet per Worker" is the weighted sum of the total square feet divided by the weighted sum of the total number of main shift workers. (See **Weight**.)

Median: The middle value of the population characteristic; half the population has a value above the median and half has a value below. The median is different from the mean in that the median is not influenced much by extremes in the sample. An estimate of the mean square feet per building would be affected by the inclusion of some very large buildings and would not express square footage for a "typical" building. In contrast, the median square feet would not be so affected. For example, "Median Age of the Building" is the middle age of all CBECS buildings; "Median Hours per Week" is the middle number of operating hours of all CBECS buildings; "Median Square Feet per Building" is the middle size (in square feet) of all CBECS buildings; and "Median Square Feet per Worker" is the middle amount of the floorspace per worker of all CBECS buildings.

Metal Panels: An exterior wall construction material made of aluminum or galvanized steel panels fabricated in factories and fastened to the frame of the building to form outside walls. Pre-engineered metal buildings are also included in this category.

Metal Surfacing: Light-gauge metal sheets used for roofing.

Metric Conversion Factors: In this report, estimates are presented in customary U.S. units. Floorspace estimates may be converted to metric units by using the relationship: 1 square foot is approximately equal to .0929 square meters. Energy estimates may be converted to metric units by using the relationship: 1 Btu is approximately equal to 1,055 joules; one kilowatthour is exactly equal to 3,600,000 joules; and one gigajoule (10^9 joules) is approximately 278 kilowatthours (kWh).

Metropolitan: Buildings located within an MSA, as defined by the U.S. Office of Management and Budget. (See **Metropolitan Statistical Area (MSA).**)

Metropolitan Statistical Area (MSA): As defined by the U.S. Office of Management and Budget, an MSA is a county or group of contiguous counties that contain (1) at least one city of 50,000 inhabitants or more (or "twin cities" with a combined population of at least 50,000), or (2) an urbanized area of at least 50,000 inhabitants and a total MSA population of at least 100,000 (75,000 in New England). The contiguous counties are included in an MSA if, according to certain criteria, they are essentially metropolitan in character and are socially and economically integrated with the central city. In New England, MSA's consist of towns and cities, rather than counties.

More than One May Apply: A row stub accompanied by this phrase indicates overlapping categories, so that a particular building may be represented in more than one line under this stub. In general, row stubs without this designation are exclusive--that is, they divide the population of buildings into distinct groups, so that a particular building is represented in no more than one line under this stub.

Multibuilding Facility: A group of two or more buildings on the same site owned or operated by a single organization, business, or individual. Examples include university campuses and hospital complexes.

Multistage Area Probability Sample: A sample design executed in stages with geographic "clusters" of sampling units selected at each stage.

Natural Gas: Hydrocarbon gas (mostly methane) supplied as an energy source to individual buildings by pipelines from a central utility company. Natural gas does not refer to liquefied petroleum gas (LPG) or to privately owned gas wells operated by a building owner. (See **Energy Source, Liquefied Petroleum Gas (LPG),** and **Propane.**)

Natural Lighting Control Sensors: A lighting conservation feature that takes advantage of sunlight to cut the amount of electric lighting used in a building by varying output of the lighting system in response to variations in available daylight. It is sometimes referred to as "daylighting controls" or "photocells."

Nongovernment Owned: Owned by an individual or a group, such as a private business, a nonprofit organization, a privately-owned utility company; or a church, synagogue, or other religious organization. The building may be occupied by more than one agency and may be owner occupied, nonowner occupied or unoccupied.

Nonmetropolitan: Buildings not located within an MSA as defined by the U.S. Office of Management and Budget. (See **Metropolitan Statistical Area (MSA)**.)

Nonowner Occupied: Refers to a building that has anyone other than the owner or the owner's business represented at the site.

Occupancy Sensors: A lighting conservation feature that uses motion or sound to switch lights on or off; also known as "ultrasonic switching." When movement is detected, the lights turn on and remain on as long as there is movement in the room. Occupancy sensors that detect sound work like ultrasonic switching; when sound is detected, the lights turn on. In this report, occupancy sensors refer to detecting movement, not sound.

Off-Hours Equipment Reduction: A method of conserving energy by changing the temperature setting or reducing the use of heating, cooling, or lighting equipment either manually or automatically when the building is closed.

Owner Occupied: Refers to a building that has the owner or the owner's business represented at the site.

Ownership and Occupancy: Ownership refers to the individual, agency, or organization that owns the building. In this report, building ownership is grouped into Government ownership (Federal, State, or local) and Nongovernment ownership (a private business or nonprofit organization owned by a group or an individual). Occupancy refers to the individual, agency, or organization that leases or holds the space on a full-time basis. (See **Owner Occupied** and **Nonowner Occupied.**)

Packaged Air-Conditioning Unit: See **Packaged Unit.**

Packaged-Heating Unit: See **Packaged Unit.**

Packaged Unit: A type of heating and/or cooling equipment that is assembled at a factory and installed as a self-contained unit. Packaged units are in contrast to engineer-specified units built up from individual components for use in a given building. Some types of electric packaged units are also called "Direct Expansion," or DX, units.

Passive Solar Features: A renewable energy feature with a deliberate approach to designing buildings to make use of natural ways to heat buildings in the winter and keep them cool in the summer. No external mechanical power is used to move the collected solar heat. Passive solar design features include structuring the building on the lot so that large window areas face south to capture sunlight during the winter months; building "overhangs" on the south-facing windows to keep the sun from over heating the building during

the summer; using certain types of building material to absorb heat during the day and release heat at night; and planting trees and vegetation to minimize heat gain in the building in the summer.

Percent Lit When Closed: The percentage of the building's square footage that is lit electrically during all hours other than the usual operating hours.

Percent Lit When Open: The percentage of the building's square footage that is lit electrically during usual operating hours.

Percent of Floorspace Cooled: The percentage of the building's square footage that is cooled to meet the comfort requirements of the occupants.

Percent of Floorspace Heated: The percentage of the building's square footage designed to be heated to at least 50 degrees Fahrenheit.

Personal Computer: A self-contained electronic system with all the components necessary to perform computerized functions including a screen (monitor), keyboard and/or mouse, and a central processing unit. (See **Computer Terminal**.)

Photovoltaic (PV) Arrays: A renewable energy feature that is a device that produces electrical current by converting light or similar radiation.

Precast Concrete Panel: A wall construction material usually made in factories and delivered to the construction site, where they are hoisted onto the structure. Sometimes concrete panels are poured at the site and then hoisted on the structure. The panels are either solid or insulated. They can have plain, colored, or textured finishing. Pre-cast concrete panels are included in **Concrete Panels** in the **Predominant Exterior Wall Materials** category.

Predominant Exterior Wall Material: The major type of exterior wall construction material used in a building. See **Masonry, Siding, Shingles, Metal Panels, Concrete Panels,** and **Window or Vision Glass.**

Predominant Roof Material: The material used the most for the roof of a building. See **Built-Up Roof, Shakes, Shingles, Metal Surfacing, Synthetic or Rubber, Wooden Materials, Slate or Tile,** and **Concrete Roof**.

Primary Sampling Unit (PSU):A sampling unit selected at the first stage in a multistage area probability sample. A PSU typically consists of one to several contiguous counties--for example, an MSA with surrounding suburban counties.

Primary Space-Heating Energy Source: The energy source used to heat most of the floorspace in a building most of the time.

Principal Building Activity: The activity or function occupying the most floorspace in a building. The categories were designed to group buildings that have similar patterns of energy consumption. Examples of various types of principal activity include office, health care, lodging, and mercantile and service. (See the section on Description of Building Types.)

Propane: A gaseous petroleum product that liquefies under pressure; propane is the major component of liquefied petroleum gas, or LPG. Any LPG reported in the CBECS was assumed to be propane. (See **Liquefied Petroleum Gas (LPG)**.)

Radiator: A type of heating distribution equipment that is usually visibly exposed within the room or space to be heated; it transfers heat from steam or hot water by radiation to objects within visible range and by conduction to the surrounding air, which, in turn, is circulated by natural convection. Typically, a radiator is a freestanding, cast-iron fixture.

Refrigeration Equipment: See **Commercial Refrigeration/Freezer Equipment**.

Reheating Coils: A part of some air-conditioning systems, these are electric coils in air ducts used primarily to raise the temperature of circulated air after it was over cooled to remove moisture. Some buildings report reheating coils as their sole heating source. (See **Air-Handling Unit, Cooling,** and **Space Heating**.)

Residential: Activities related to use as a dwelling for one or more households. Buildings that contained commercial activities but had 50 percent or more of their floorspace devoted to residential activities were considered out-of- scope. (See **Principal Building Activity** and **Commercial Building.**)

Residential-Type Central Air Conditioner: A type of cooling equipment in which there are four basic parts: (1) a condensing unit, (2) a cooling coil, (3) ductwork, and (4) a control mechanism, such as a thermostat. There are two basic configurations of residential central systems: (1) a "split system," where the condensing unit is located outside and the other components are inside, and (2) a packaged-terminal air-conditioning (PTAC) unit that both heats and cools or cools only. This system contains all four components encased in one unit and is usually found in a "utility closet." If the residential type is a "PTAC," it is considered a "Packaged air-conditioning unit."

Roof or Ceiling Insulation: See **Insulation**.

RSE Column Factor: An adjustment factor that appears above each column of the detailed tables and is used to compute RSE's. The column factor is equal to the geometric mean of the RSE's in a particular column of the main tables. (See **RSE or Relative Standard Error** and **RSE Row Factor**.)

RSE or Relative Standard Error: A measure of the reliability or precision of a survey statistic. Variability occurs in survey statistics because the different samples that could be drawn would each produce different values for the survey statistics. The RSE is defined as the standard error (the square root of the variance) of a survey estimate, divided by the survey estimate and multiplied by 100. For example, an RSE of 10 percent means that the standard error is one-tenth as large as the survey estimate. For a survey estimate in a particular row and column of a table (that is, a particular "cell"), the approximate RSE is obtained by multiplying the RSE row factor by the RSE column factor for that cell.

RSE Row Factor: An adjustment factor that appears to the right of each row of the detailed tables and is used to compute RSE's. The row factor is equal to the geometric mean of the RSE's in a particular row of the main tables. (See **RSE or Relative Standard Error** and **RSE Column Factor**.)

Shakes: Flat pieces of weatherproof material laid with others in a series of overlapping rows as covering for roofs and sometimes the sides of buildings. Shakes are similar to wood shingles, but, instead of having a cut and smoothly planed surface, shakes have textured grooves and a rough or "split" appearance to give a rustic feeling.

Shingles: Flat pieces of weatherproof material laid with others in a series of overlapping rows as covering for roofs and sometimes the walls of buildings. Shingles are manufactured in a variety of materials, including fiberglass, plastic, baked clay, tile, asbestos, asphalt, aluminum, and wood. Wood Shingles are included in " Wooden" in the **Predominant Roof Material** category.

Siding: An exterior wall covering material made of wood, plastic (including vinyl), or metal. The structural walls may be masonry or wood. Siding is generally produced in the shape of boards and applied to the outside of a building in overlapping rows.

Slate or Tile Shingles: A type of roofing material. Tile refers to any thin, square, or rectangular piece of baked clay, stone, or concrete used as a roofing material. Slate refers to a particular stone used for roofing.

Solar Thermal Panels: A system that actively concentrates thermal energy from the sun by means of solar collector panels. The panels typically consist of flat, sun-oriented boxes with transparent covers, containing water tubes or air baffles under a blackened heat absorbent panel. The energy is usually used for space heating, water heating, and for heating swimming pools. Passive collection of solar thermal energy is not included in this definition. (See **Energy Source**.)

Space Heating: As an energy end use, the use of mechanical equipment (including wood stoves and active solar heating devices) to heat all, or part, of a building to at least 50 degrees Fahrenheit. (See **Energy End Use**.)

Space in Building Vacant for at Least Three Consecutive Months: See **Vacant**.

Specular Reflectors: A lighting conservation feature that is the mirror-like backing of a fluorescent lighting fixture specifically designed to reflect light into the room. The materials and shape of the reflector are designed to reduce absorption of light within the

fixture, while delivering light in the desired angular pattern. The most common materials used are silver (highest reflectivity) and aluminum (lowest cost).

Square Footage: Floorspace, in units of square feet. One square foot is approximately equal to 0.0929 square meters. (See **Floorspace**.)

Standard Error: A measure of the precision of an estimate, equal to the square root of the variance. (See **Variance** and **RSE or Relative Standard Error**.)

Standard Fluorescent Light Bulb: See **Fluorescent Light Bulb**.

Storms or Multiple Glazing: A building shell conservation feature consisting of storm windows, storm doors, or double- or triple-pane glass that are placed on the exterior of the building to reduce the rate of heat loss. For **Storm Doors,** the feature consists of a second door installed outside or inside a prime door creating an insulating air space. Included are sliding glass doors made of double glass or of insulating glass, such as thermopane, double- or triple-pane glass as well as sliding glass doors with glass or plexiglass installed outside or inside of the door. For **Storm Windows,** the feature consists of a window or glazing material placed outside or inside a window creating an insulating air space. Windows with double glass or thermopanes are considered storm windows as well as windows with glass or plexiglass placed on the outside or inside of the window. Plastic material(s) over windows or doors are counted only if they can be used year after year.

Swamp Cooler: See **Evaporative Cooler (Swamp Cooler)**.

Time Clocks or Timed Switches: A lighting conservation feature which has automatic controls that turn lights off and on at predetermined times.

Tinted or Reflective Glass, or Shading Film: A building shell conservation feature consisting of tinted or reflective glass or shading films installed on the exterior glazing of a building to reduce the rate of solar penetration into the building.

Vacant: A building was considered vacant if 50 percent or more of the floorspace was not occupied by any tenant or establishment. A vacant building may contain occupants who are using up to 50 percent of the floorspace. For all buildings, data were collected on whether the building had any floorspace that was vacant for three or more consecutive months and on the number of months the building was in use. (See **Principal Building Activity**.**)**

Variable Air-Volume (VAV) System: An HVAC conservation feature usually referred to as "VAV" that supplies varying quantities of conditioned (heated or cooled) air to different parts of a building according to the heating and cooling needs of those specific areas.

Variance: A measure of the variability of a set of observations that are subject to some chance variation, equal to the expected squared difference between a single observation and the average of all possible observations obtained in the same manner. The variance is the square of the standard error of estimates. The variance indicates the likely difference between the value computed from the CBECS sample and the average of the values that could have been computed from all possible samples that might have been obtained by the same sample selection process. (See **Standard Error**.)

Walk-In Refrigeration Units: Refrigeration/freezer units (within a building) that are large enough to walk into. They may be portable or permanent, such as a meat storage locker in a butcher store. Walk-in units may or may not have a door, plastic strips, or other flexible covers.

Wall Insulation: See **Insulation**.

Water Heating: As an energy end use, the use of energy to heat water for purposes other than space heating. (See **Energy End Use**.)

Water-Heating Equipment: Automatically controlled, thermally insulated equipment designed for heating water at temperatures less than 180 degrees Fahrenheit for other than space heating purposes. This survey collected data to distinguish between two types of water heating equipment: centralized and distributed. (See **Centralized Water-Heating System** and **Distributed Water-Heating System**.)

Weekly Operating Hours: The number of hours per week that a building is used, excluding hours when the building is occupied only by maintenance, security, or other support personnel. For buildings with a schedule that varied during the year, "Weekly Operating Hours" refer to the total weekly hours for the schedule most often followed. If operating hours varied throughout a building, the usual operating hours of the largest business in the building (based on floorspace) determined the operating hours for the building.

Weight: The number of buildings in the United States that a particular sample building represents. To estimate the total value of an attribute (such as square footage) in the U.S. commercial buildings population as a whole, each sample building's value is multiplied by the building's weight. Summing (aggregating) the weighted sample values provides an estimate of the national total.

Well Water for Cooling: A renewable energy feature with cooling that uses water from a well drilled specifically for that purpose. The temperature of the ground water remains relatively constant; therefore, it provides a means of obtaining 55-degree Fahrenheit water with no mechanical cooling. Usually used for heat rejections in a water source heat pump.

Wind Generation: A renewable energy feature that converts wind energy into mechanical energy. The mechanical energy is then used to generate electricity. Wind energy generators are distinguished by a propeller which rotates with the wind and a tall tower on which the propeller and generator are mounted.

Window or Vision Glass: An exterior wall construction material made of glass that can be seen through from the inside of the building, like the glass found in windows. Walls that are glass-covered or constructed of non-transparent material are excluded from this category.

Wood: As an energy source, wood logs, chips, or wood products that are used as fuel. (See **Energy Source**.)

Wooden Materials: Wood shingles, wood shakes, or other wooden materials used as roofing materials or exterior wall materials. Wooden materials are included in **Siding or Shingles** in the **Predominant Exterior Wall Material** category.

Workers (Main Shift): The number of people working in a building during the main shift on a typical workday during the year. The main shift is the time when most people are in the building. Included in this definition are self-employed workers and volunteers. Excluded from this definition are customers, patients, and students, unless they are working for establishments in the building. Also excluded are employees who work out of the office, such as salespeople who report into the office, delivery people with routes, and messengers.

Year Constructed: The year in which the major part or the largest portion of a building was constructed.