3. Energy Sources and End Uses

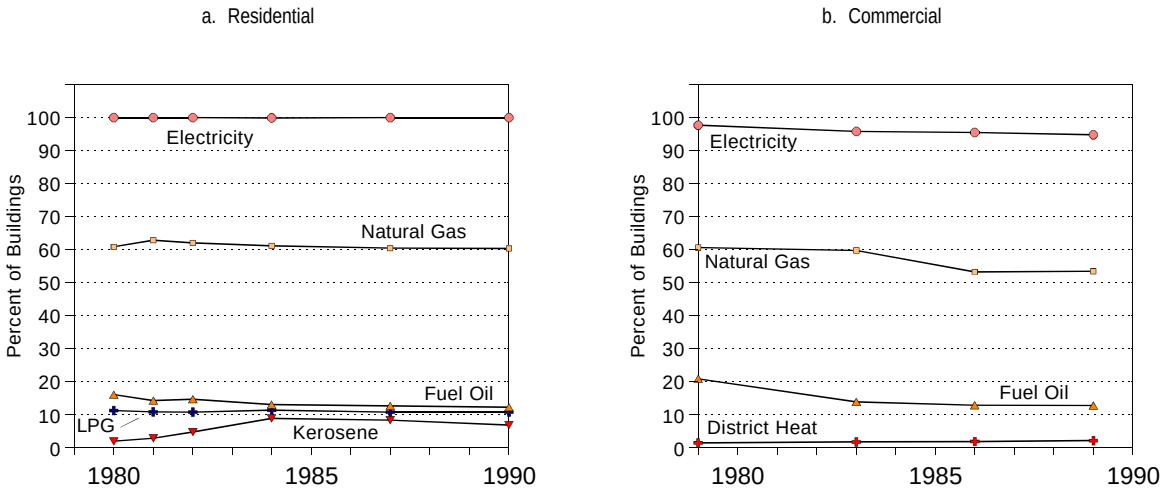
Energy is an important but often unnoticed contributor to the high levels of productivity and quality of life enjoyed by U.S. residents. Energy is used in buildings to provide heating, cooling, lighting, and other services to the building occupants. Throughout the 1980's, the two energy sources that were most widely used in the residential and commercial sectors were electricity and natural gas. The former was used almost universally, while the latter was used in more than half of both residential and commercial buildings. Other energy sources, such as fuel oil and district heat, were used in fewer than 21 percent of buildings (Figure 3.1a and b).

The major purposes for which energy was used in residential and commercial buildings were for space heating, water heating, air conditioning, lighting, and appliances. Electricity, the most versatile, was used for all these end uses. The other major sources of energy were most often used for space heating. Fuel oil was used predominantly in the Northeast Census region.

In residential and commercial buildings throughout the 1980's:

- The percentages of buildings that used electricity and natural gas remained approximately constant.
- The percentage of buildings using fuel oil declined.
- Liquefied petroleum gas (LPG) use in residential buildings was constant at just over 10 percent of buildings, while use of district heat in commercial buildings was constant at two percent.
- Kerosene use in residential buildings increased (due to the increased popularity of portable space heaters).

Figure 3.1. Percent of Buildings Using Major Energy Sources for Any Purpose in the 1980's



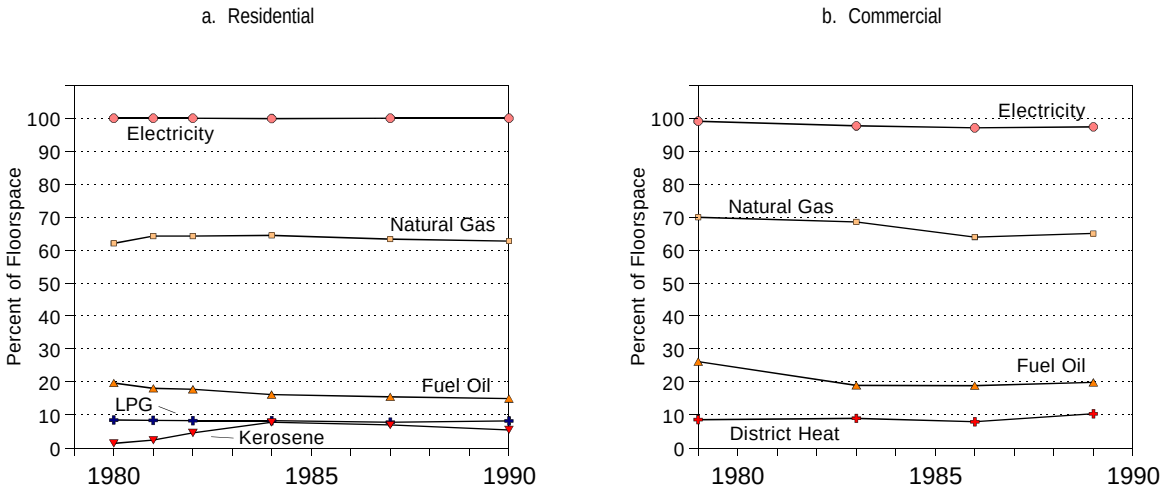
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys; Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys; and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

The choice of energy sources is related to average building floorspace, one of the major differences between the residential and commercial sectors.

- In the commercial sector, natural gas, fuel oil, and district heat were supplied to a greater proportion of floorspace than the proportion of buildings, reflecting their greater use in larger buildings. In the residential sector, the use of energy sources by number of buildings was virtually identical to the percent of floorspace that used the same energy sources.

- The use of district heat provides a striking example of the effect of building size. In commercial buildings, district heat was used in just two percent of the buildings, but these buildings accounted for ten percent of the floorspace. In 1989, 50 percent of the commercial buildings (representing 54 percent of total commercial floorspace) that used district heat were buildings larger than 200,000 square feet, while fewer than eight percent of commercial buildings smaller than 25,000 used district heat.

Figure 3.2. Percent of Floorspace Using Major Energy Sources for Any Purpose in the 1980's



Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys; Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys; and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

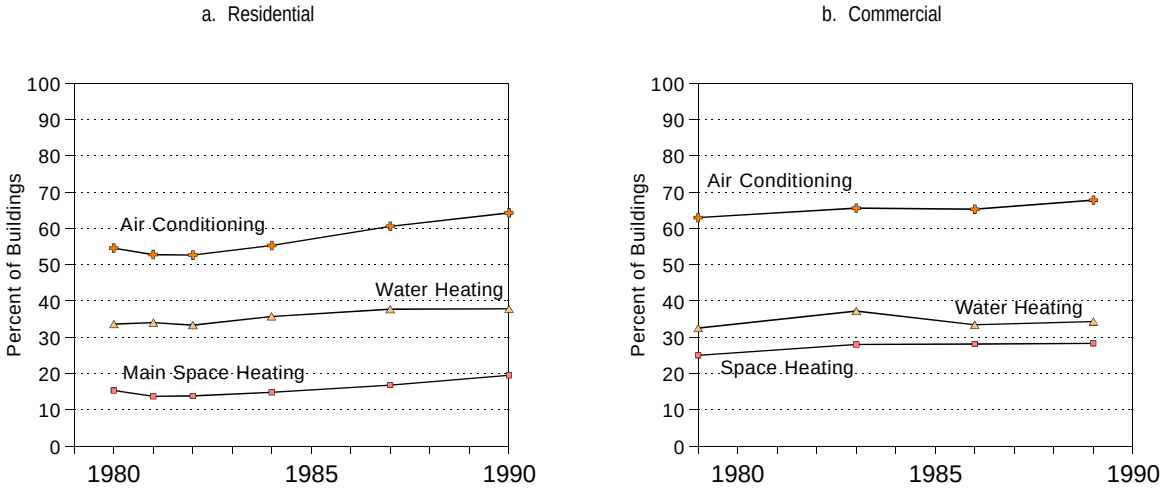
Energy Sources Used for Major End Uses

The energy sources used for the major end uses (space heating, water heating, and air conditioning) varied according to the end use employed. Natural gas was the energy source of choice for space heating in both sectors. Natural gas was the first choice for water heating in residential buildings.[5] Residential and commercial buildings were primarily cooled by electricity. Fuel oil was used in fewer than 13 percent of buildings for space heating and in fewer than five percent for water heating.

The percentage of buildings that used natural gas, electricity, or fuel oil for specific end uses changed little during the 1980's (Figures 3.3a and b, and 3.4a and b). Notable exceptions included the more widespread use of electricity for main space heating and an increase in air conditioning in residential buildings to more than 60 percent by the end of the decade (the latter reflected the increasing popularity of central air conditioning systems).

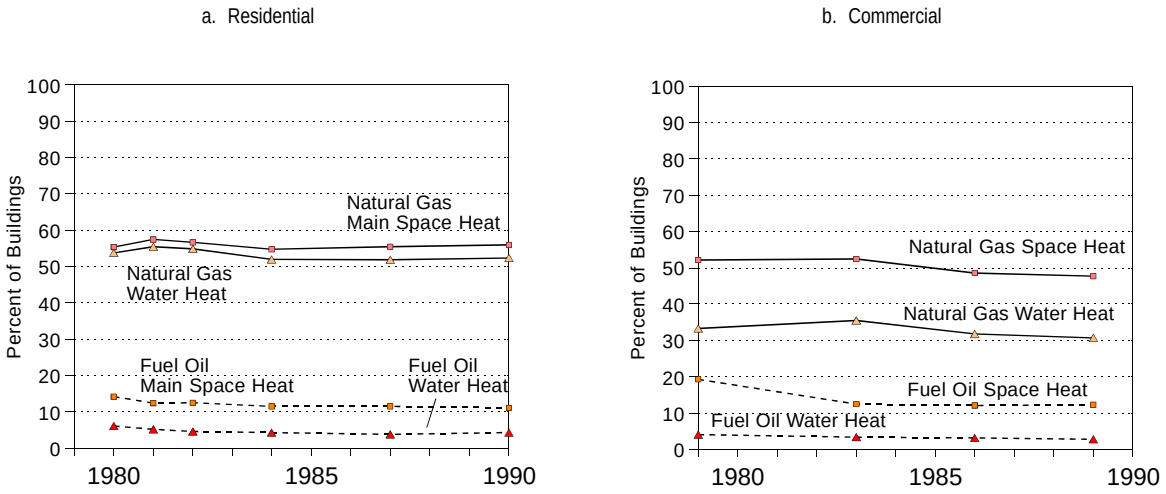
[5]Space heating use in commercial buildings included both main (i.e., most used) and secondary uses.

Figure 3.3. Use of Electricity for Space Heating, Air Conditioning, and Water Heating in Residential and Commercial Buildings in the 1980's



Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys; Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys; and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Figure 3.4. Use of Natural Gas and Fuel Oil for Space Heating and Water Heating in Residential and Commercial Buildings in the 1980's



Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys; Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys; and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Energy Sources Used for Space Heating

Natural gas, electricity, and fuel oil were the major energy sources used for space heating, the end use that accounted for the largest share of energy consumption in both residential and commercial buildings (Figures 3.5a and b):

- Natural gas was the most popular energy source used for space heating in residential and commercial buildings.
- Electricity and fuel oil were used for main space heating in 15 percent of residential buildings at the beginning of the decade, with electricity rising to 20 percent and fuel oil falling to 10 percent by the end of the decade.
- During the 1980's, electricity was used in the commercial sector for space heating in 25 percent to 30 percent of the buildings; fuel oil was used in 10 to 20 percent of the buildings; and district heat was used in fewer than 5 percent of the buildings.

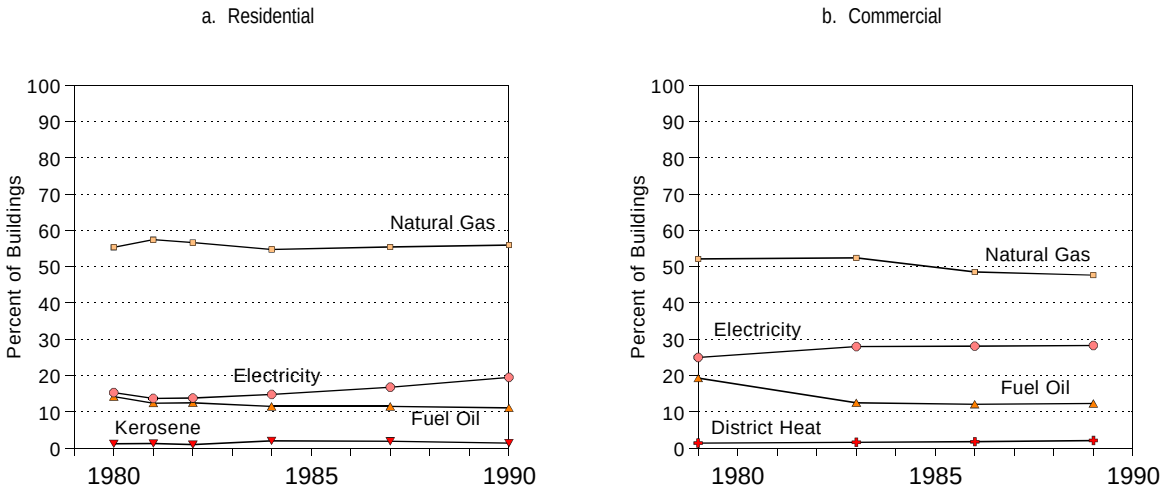
The proportion of natural gas, electricity, and fuel oil used for space heating varied by the age of the buildings and by Census region, but this proportion remained about the same throughout the decade. The use of natural gas, electricity, or fuel oil varied in the building stock by year of construction (Figures 3.6a and b):

- The newer the building, the more likely it was to use electricity.
- The older the building, the more likely it was to use natural gas or fuel oil.

Each of the Census regions used the three major energy sources in different proportions (Figures 3.7a and b):

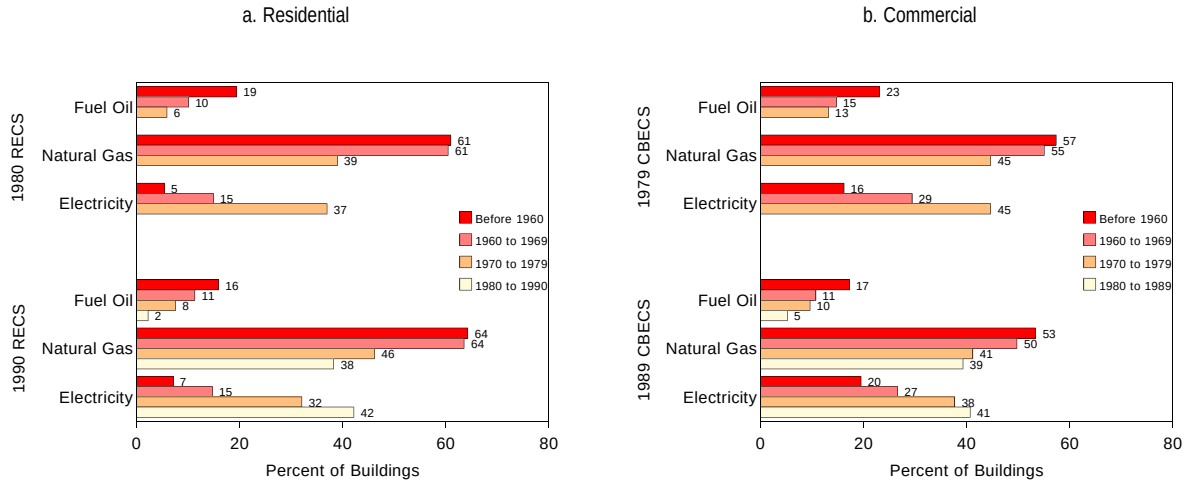
- The Northeast had by far the largest proportion of buildings using fuel oil.
- The proportion of buildings using natural gas was highest in the Midwest and West.
- The proportion of buildings in the South and West using electricity was two to three times higher than the proportion in the Northeast and Midwest.

Figure 3.5. Energy Sources Used for Space Heating in Buildings in the 1980's



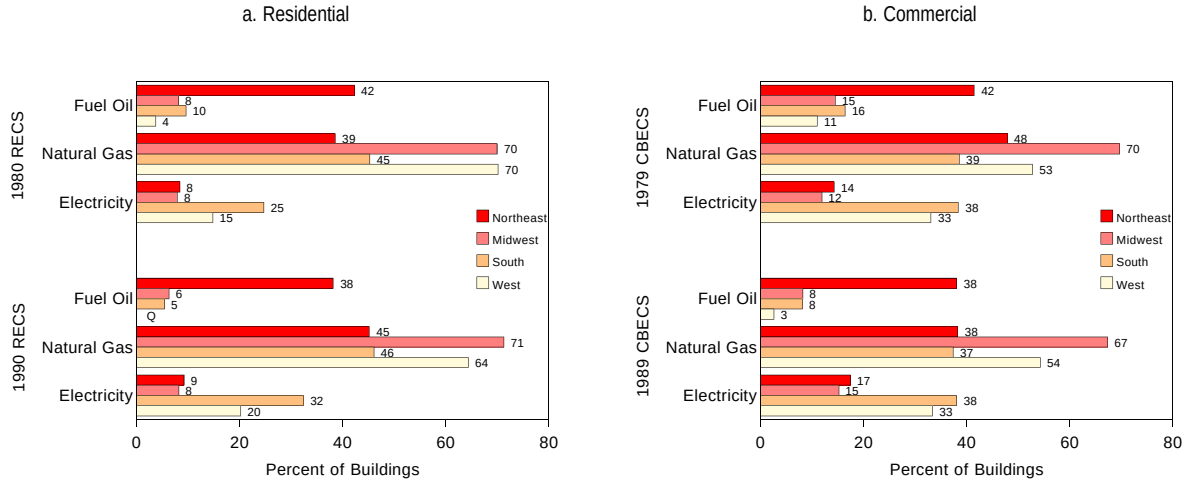
Sources: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys; Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys; and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Figure 3.6. Energy Sources Used for Space Heating in Buildings by Age of Building



Sources: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980 and 1990 Residential Energy Consumption Surveys; Form EIA-143 of the 1979 Nonresidential Buildings Energy Consumption Survey, and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Figure 3.7. Energy Sources Used for Space Heating in Buildings by Census Region



Sources: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980 and 1990 Residential Energy Consumption Surveys; Form EIA-143 of the 1979 Nonresidential Buildings Energy Consumption Survey, and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Table 3.1a. Energy Sources Used for All End Uses in Residential Buildings, Number of Buildings and Total Floorspace

Year of Survey	Energy Sources												RSE Row Factors
	Any Energy Source		Electricity		Natural Gas		Fuel Oil		Kerosene		LPG		
	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	
RSE Column Factors:	0.3	0.4	0.3	0.4	0.8	0.9	1.7	1.6	2.6	2.7	2.5	2.5	
1980	65,471	142,495	65,440	142,480	39,838	88,521	10,506	27,996	1,293	1,983	7,380	12,146	4.3
1981	66,210	144,201	66,174	144,183	41,636	92,768	9,468	26,133	1,919	3,468	7,224	12,151	4.0
1982	66,210	142,247	66,169	142,220	41,111	91,847	9,711	25,293	3,200	6,534	7,171	11,730	4.2
1984	67,576	144,357	67,516	144,274	41,355	93,163	8,837	23,316	6,040	11,259	7,674	11,992	3.5
1987	70,446	156,818	70,424	156,780	42,599	99,357	8,948	24,360	5,918	10,939	7,610	12,286	3.8
1990	74,213	169,227	74,179	169,204	44,829	106,320	9,151	25,386	5,112	9,338	7,979	13,876	4.1

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys.

Table 3.1b. Energy Sources Used for Main Space Heating in Residential Buildings, Number of Buildings and Total Floorspace

Year of Survey	Energy Sources												RSE Row Factors
	Any Energy Source		Electricity		Natural Gas		Fuel Oil		Kerosene		LPG		
	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	
RSE Column Factors:	0.2	0.2	1.3	1.1	0.6	0.6	1.1	1.0	3.5	3.2	3.0	2.0	
1980	65,046	141,964	9,999	22,086	36,293	78,242	9,299	25,084	769	811	3,544	5,152	6.2
1981	65,897	143,734	9,088	20,122	38,073	82,308	8,177	22,729	834	1,038	3,670	5,569	5.9
1982	65,879	141,809	9,125	19,370	37,528	81,429	8,289	21,611	689	900	3,735	5,440	6.9
1984	67,156	143,814	10,012	21,082	37,023	81,495	7,749	20,381	1,332	1,689	3,863	5,216	5.8
1987	69,831	155,839	11,869	26,888	39,075	88,895	8,096	22,060	1,259	1,453	4,141	6,286	6.3
1990	73,703	168,625	14,480	32,372	41,528	96,553	8,228	22,965	999	1,137	4,346	7,266	6.6

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys.

Table 3.2a. Energy Sources Used for All End Uses in Commercial Buildings, Number of Buildings and Total Floorspace

Year of Survey	All Commercial Buildings		Energy Sources										RSE Row Factors
			Any Energy Source		Electricity		Natural Gas		Fuel Oil		District Heat		
	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	
RSE Column Factors:	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	1.6	1.2	2.6	2.4	
1979	3,073	43,546	3,014	43,220	3,001	43,153	1,864	30,477	641	11,397	47	3,722	8.2
1983	3,185	49,471	3,062	48,460	3,052	48,327	1,904	33,935	441	9,409	57	4,454	7.9
1986	4,154	58,199	3,994	56,835	3,965	56,508	2,214	37,263	534	11,005	77	4,625	4.8
1989	4,528	63,184	4,299	61,618	4,294	61,563	2,420	41,143	581	12,600	98	6,578	5.1

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys, and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Table 3.2b. Energy Sources Used for Space Heating in Commercial Buildings, Number of Buildings and Total Floorspace

Year of Survey	All Commercial Buildings		Energy Sources										RSE Row Factors
			Any Energy Source		Electricity		Natural Gas		Fuel Oil		District Heat		
	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	Buildings (thousand)	Floorspace (million sq. ft.)	
RSE Column Factors:	0.6	0.6	0.6	0.6	1.3	1.2	0.9	0.8	1.4	1.1	2.3	2.1	
1979	3,073	43,546	2,814	41,424	769	10,724	1,605	23,725	593	9,186	44	3,586	9.7
1983	3,185	49,471	2,808	45,685	892	15,325	1,671	26,885	397	6,835	54	4,297	9.3
1986	4,154	58,199	3,626	53,915	1,166	18,223	2,018	31,542	504	8,708	74	4,389	5.5
1989	4,528	63,184	3,876	57,868	1,283	18,702	2,158	33,017	555	10,526	94	6,065	6.0

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Table 3.3. Major End Uses by Energy Source Used in Residential Buildings
Number of Buildings
(thousand)

Year of Survey	All Residential Buildings	End-Uses by Type of Energy Source							RSE Row Factors
		Electricity			Natural Gas		Fuel Oil		
		Main Space Heating	Water Heating	Air Conditioning	Main Space Heating	Water Heating	Main Space Heating	Water Heating	
RSE Column Factors:	0.3	1.8	1.1	0.9	0.8	0.8	1.6	2.3	
1980	65,471	9,999	21,991	35,764	36,293	35,204	9,299	3,996	4.2
1981	66,210	9,088	22,514	34,988	38,073	36,755	8,177	3,436	4.3
1982	66,210	9,125	22,078	34,900	37,528	36,377	8,289	3,073	4.5
1984	67,576	10,012	24,121	37,403	37,023	35,126	7,749	2,926	4.1
1987	70,446	11,869	26,532	42,722	39,075	36,553	8,096	2,661	4.3
1990	74,213	14,480	28,023	47,739	41,528	38,924	8,228	3,225	4.2

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980, 1981, 1982, 1984, 1987, and 1990 Residential Energy Consumption Surveys.

Table 3.4. Major End Uses by Energy Sources Used in Commercial Buildings
Number of Buildings
(thousand)

Year of Survey	All Commercial Buildings	End-Uses by Type of Energy Source							RSE Row Factors
		Electricity			Natural Gas		Fuel Oil		
		Space Heating	Water Heating	Cooling	Space Heating	Water Heating	Space Heating	Water Heating	
RSE Column Factors:	0.6	1.3	0.9	0.7	0.9	0.8	1.4	2.0	
1979	3,073	769	998	1,935	1,605	1,024	593	125	9.5
1983	3,185	892	1,186	2,089	1,671	1,130	397	109	9.1
1986	4,154	1,166	1,387	2,712	2,018	1,323	504	132	5.2
1989	4,528	1,283	1,554	3,072	2,158	1,391	555	126	6.3

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Forms EIA-143, 788, and 871 of the 1979, 1983, and 1986 Nonresidential Buildings Energy Consumption Surveys and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.

Table 3.5 Energy Sources Used for Main Space Heating in Residential Buildings, 1980 and 1990
Number of Buildings
(thousand)

Building Characteristics	Electricity		Natural Gas		Fuel Oil		RSE Row Factors
	1980	1990	1980	1990	1980	1990	
RSE Column Factors:	1.2	1.3	0.7	0.7	1.2	1.2	
All Buildings	9,999	14,480	36,293	41,528	9,299	8,228	5.8
Census Region							
Northeast	1,035	1,280	4,740	6,282	5,203	5,313	12.1
Midwest	1,379	1,531	12,179	13,359	1,405	1,174	12.9
South	5,708	8,673	10,460	12,327	2,222	1,457	11.2
West	1,876	2,996	8,914	9,561	468	Q	11.3
Census Division							
New England	175	254	560	747	1,618	1,833	13.2
Middle Atlantic	860	1,025	4,180	5,534	3,585	3,481	15.0
East North Central	1,009	1,083	8,296	9,400	1,014	907	16.4
West North Central	370	448	3,883	3,959	391	267	18.4
South Atlantic	3,264	5,788	3,321	4,103	2,129	1,332	17.2
East South Central	1,549	1,487	1,884	2,405	84	Q	17.0
West South Central	896	1,398	5,255	5,818	Q	*	14.4
Mountain	493	704	2,455	3,082	Q	Q	19.7
Pacific	1,383	2,292	6,459	6,479	394	Q	11.4
Type of Home							
Mobile Home	1,075	1,133	1,364	1,975	389	283	26.1
Single-Family Detached	7,656	9,758	30,066	33,957	7,469	6,732	6.3
Single-Family Attached	504	2,453	1,940	2,754	738	684	19.6
2 to 4 Units	489	725	2,478	2,345	610	456	15.3
5 or More Units	275	411	446	497	92	73	16.3
Building Floorspace (square feet)							
Fewer than 1,001	1,692	2,325	5,105	4,598	740	606	13.2
1,001 to 2,000	4,061	5,718	14,428	15,996	2,561	2,029	8.2
2,001 to 5,000	3,831	5,937	15,721	19,290	5,445	5,177	7.4
5,001 to 10,000	334	360	920	1,412	478	380	16.3
10,001 to 25,000	63	113	100	201	60	Q	28.1
25,001 to 50,000	11	11	12	17	Q	Q	34.1
50,001 to 100,000	2	14	Q	Q	5	Q	20.3
100,001 to 200,000	3	1	Q	3	2	Q	38.8
Over 200,000	Q	Q	Q	1	1	1	21.4
Year Constructed							
1939 or Before	672	814	10,226	10,588	4,133	2,946	10.5
1940 to 1949	335	536	3,910	4,099	1,089	663	14.0
1950 to 1959	974	1,128	8,384	7,628	1,944	1,898	10.6
1960 to 1969	1,801	1,675	7,312	7,226	1,220	1,281	10.8
1970 to 1979	5,651	4,925	5,962	7,075	899	1,161	10.8
1980 to 1990	566	5,402	499	4,912	14	278	19.6

* = Value rounds to zero in the units displayed.

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

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

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-457 of the 1980 and 1990 Residential Energy Consumption Surveys.

Table 3.6. Energy Sources Used for Space Heating in Commercial Buildings, 1979 and 1989
Number of Buildings
(thousand)

Building Characteristics	Electricity		Natural Gas		Fuel Oil		RSE Row Factors
	1979	1989	1979	1989	1979	1989	
RSE Column Factors:	1.3	0.8	0.9	0.6	1.2	1.3	
All Buildings	769	1,283	1,605	2,158	593	555	9.2
Census Region							
Northeast	76	136	254	300	220	298	14.4
Midwest	116	159	681	705	142	86	15.4
South	420	703	422	690	179	150	17.1
West	156	284	249	462	52	22	14.8
Principal Building Activity							
Assembly	100	187	243	311	121	98	16.0
Education	39	54	74	182	42	36	17.1
Food Sales and Service	93	104	166	186	39	36	17.5
Health Care	11	37	31	36	8	12	25.8
Lodging	46	64	35	66	15	11	21.0
Mercantile and Service	193	351	579	687	211	216	11.7
Office	161	283	245	356	64	58	13.0
Warehouse	81	112	152	195	61	48	14.8
Other	27	41	47	65	22	28	19.7
Vacant	19	49	33	76	8	14	26.7
Building Floorspace (square feet)							
1,001 to 2,000	121	251	240	397	83	117	13.7
2,001 to 5,000	243	415	489	715	181	180	11.9
5,001 to 10,000	186	228	398	485	156	95	13.5
10,001 to 25,000	136	239	289	303	102	89	12.5
25,001 to 50,000	45	85	105	134	39	33	12.6
50,001 to 100,000	25	39	50	75	16	21	13.2
100,001 to 200,000	7	17	24	32	10	14	13.5
200,001 to 500,000	3	6	9	14	5	4	16.5
Over 500,000	1	2	1	3	1	3	26.2
Year Constructed							
1899 or Before	15	41	99	88	48	31	25.4
1900 to 1919	37	45	212	141	67	33	17.3
1920 to 1945	101	117	384	345	146	137	13.3
1946 to 1959	139	179	341	473	156	136	13.6
1960 to 1969	174	218	326	409	87	88	13.9
1970 to 1979	302	333	244	364	89	85	13.1
1980 to 1989	--	350	--	338	--	45	11.9

Notes: • To obtain the Relative Standard Error (RSE) percentage for any table cell, multiply the corresponding RSE column factor by the corresponding RSE row factor for the cell. • See "Glossary" for definition of terms used in this report.

Source: Energy Information Administration, Office of Energy Markets and End Use, Form EIA-143 of the 1979 Nonresidential Buildings Energy Consumption Survey and Form EIA-871 of the 1989 Commercial Buildings Energy Consumption Survey.