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Residential and Commercial Buildings Data Book

Third Edition

G. R. Amols
K. B. Howard
A. K. Nicholls
T. D. Guerra

February 1988

Prepared for the U.S. Department of Energy
under Contract DE-AC06-76RLO 1830

Pacific Northwest Laboratory
Operated for the U.S. Department of Energy
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RESIDENTIAL AND COMMERCIAL BUILDINGS DATA BOOK

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under Contract DE-AC06-76RL0 183D

Pacific Northwest Laboratory
Richland, Washington 99352

SUMMARY

This Data Book updates and expands the previous Data Book originally published by the Department of Energy in September, 1986 (DOE/RL/01830/16). Energy-related information is provided under the following headings:

- Characteristics of Residential Buildings in the U.S.
- Characteristics of New Single Family Construction in the U.S.
- Characteristics of New Multi-Family Construction in the U.S.
- Household Appliances
- Residential Sector Energy Consumption, Prices, and Expenditures
- Characteristics of U.S. Commercial Buildings
- Commercial Buildings Energy Consumption, Prices, and Expenditures
- Additional Buildings and Community Systems Information

This Data Book complements another Department of Energy document entitled "Analysis and Technology Transfer Annual Report - 1986" August, 1987 (DOE/CE-0140). The Data Book provides supporting data and documentation to the report.

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CHAPTER ONE: INTRODUCTION

1.1 OVERVIEW

The possession of current and reliable information on building characteristics and energy consumption patterns is a fundamental prerequisite for effective R&D and program planning in the Office of Buildings and Community Systems (BCS). The Residential and Commercial Buildings Data Book is intended to complement other BCS information sources by compiling the most current data on the existing stock of residential and commercial buildings and their energy consumption characteristics. Most of this data is provided in tabular form with accompanying figures used to highlight key points. The Data Book also provides information on forecasts and historical trends for the residential and commercial sectors. The information contained herein was drawn from diverse sources and was compiled into a single volume in order to provide BCS staff with easier access to it.

Current plans call for this document to be updated and revised from time to time as new data become available. Accordingly, users of this data book are encouraged to submit requests, comments, and information to the Pacific Northwest Laboratory.

1.2 ORGANIZATION OF THE REPORT

This report can be divided into three basic subject areas: residential buildings, commercial buildings, and energy consumption forecasts. These subject areas are covered in the following chapters:

Residential Buildings

Chapter 2	Characteristics of Residential Building Stock
Chapter 3	Characteristics of New Single Family Construction
Chapter 4	Characteristics of New Multi-Family Construction
Chapter 5	Household Appliances
Chapter 6	Residential Sector Energy Consumption and Prices

Commercial Buildings

Chapter 7	Characteristics of U.S. Commercial Building Stock
Chapter 8	Commercial Buildings Sector Energy Consumption, Prices, and Expenditures

The complete list of data sources used in producing the Data Book is provided in Appendix A.

1.3 THE FOUR ENERGY CONSUMPTION SECTORS

Information on total national energy consumption is frequently broken down into four end-use sectors: residential, commercial, industrial, and transportation. Tables 1.1 and 1.2 provide information on the energy consumption characteristics of these sectors over the period of 1960 through 1983. It should be noted that the information for the commercial sector includes both buildings and "nonbuilding" energy consumers. Thus the figures for total energy consumption in the commercial sector are not synonymous with energy consumption by commercial buildings alone.

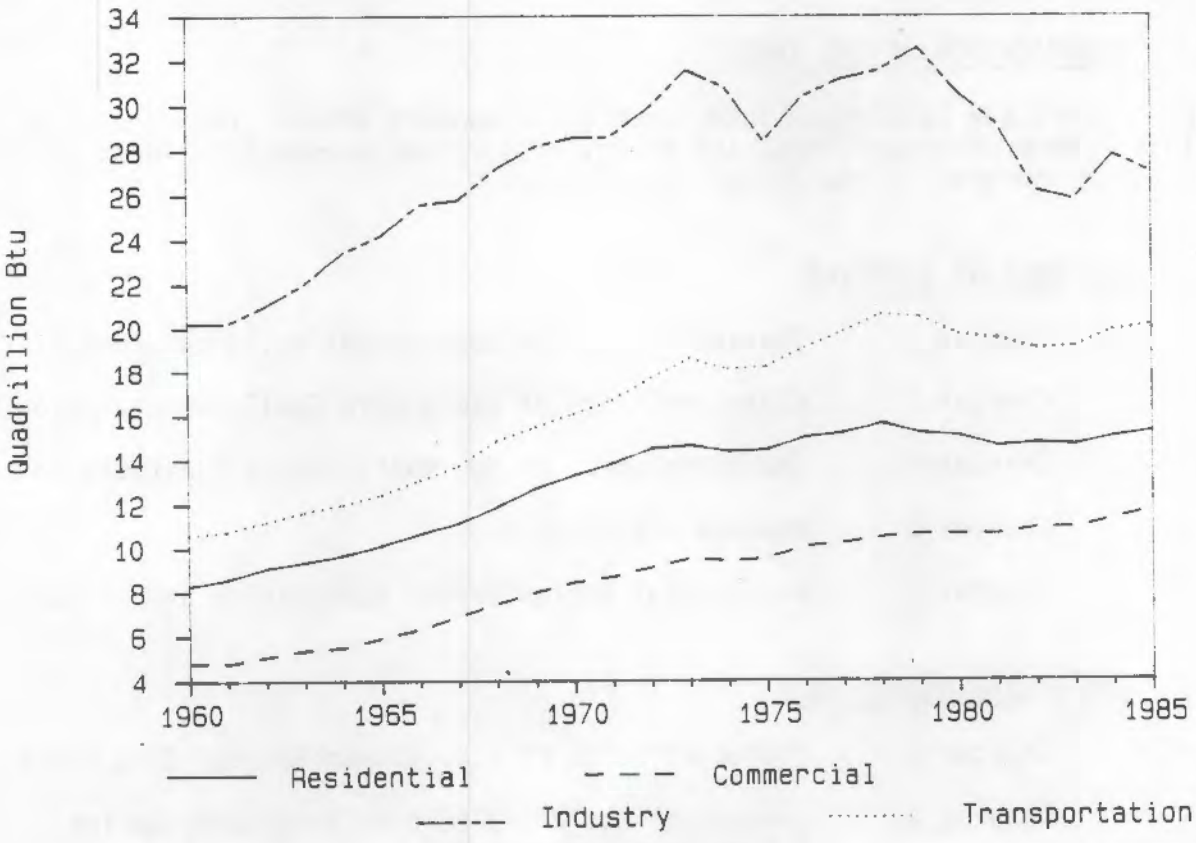

FIGURE 1.1 U.S. Energy Consumption, 1960 through 1985, by End-Use Sector

TABLE 1.1 U.S. Energy Consumption by End-Use Sector, 1960 - 1985
(Trillion Btu)

Year	Residential	Commercial	Industry	Transportation	Total
1960	8,284	4,749	20,164	10,598	43,796
1961	8,582	4,846	20,256	10,772	44,455
1962	9,102	5,154	21,053	11,222	46,531
1963	9,367	5,333	21,989	11,654	48,342
1964	9,684	5,531	23,296	11,996	50,507
1965	10,119	5,900	24,252	12,425	52,697
1966	10,654	6,386	25,543	13,088	55,671
1967	11,142	6,946	25,773	13,730	57,591
1968	11,865	7,361	26,937	14,838	61,000
1969	12,717	7,859	28,121	15,478	64,174
1970	13,310	8,344	26,610	16,069	66,334
1971	13,842	8,694	28,555	16,698	67,788
1972	14,518	9,158	29,874	17,694	71,243
1973	14,642	9,532	31,579	18,598	74,351
1974	14,361	9,357	30,697	18,112	72,527
1975	14,454	9,443	28,433	18,240	70,569
1976	15,006	10,017	30,268	19,094	74,385
1977	15,212	10,169	31,119	19,809	76,309
1978	15,625	10,476	31,464	20,591	78,155
1979	15,194	10,613	32,641	20,465	78,913
1980	15,067	10,584	30,629	19,695	75,976
1981	14,606	10,645	29,288	19,497	74,016
1982	14,733	10,855	26,135	19,068	70,790
1983	14,644	10,944	25,735	19,133	70,457
1984	15,026	11,340	27,756	19,878	74,000
1985	15,263	11,582	27,056	20,123	74,023

Source: State Energy Data Report, U.S. DOE/EIA, April 1987.

TABLE 1.2 End-Use Sector Shares of Total U.S. Energy Consumption, 1960 - 1985

Year	Residential	Commercial	Industrial	Transportation	Percent Change in Total Consumption
1960	18.92	10.84	46.04	24.20	--
1961	19.30	10.90	45.56	24.23	1.51
1962	19.56	11.08	45.25	24.12	4.67
1963	19.38	11.03	45.49	24.11	3.89
1964	19.17	10.95	46.12	23.75	4.48
1965	19.20	11.20	46.02	23.58	4.34
1966	19.14	11.47	45.88	23.51	5.64
1967	19.35	12.06	44.75	23.84	3.45
1968	19.45	12.07	44.16	24.32	5.92
1969	19.82	12.25	43.82	24.12	5.20
1970	20.06	12.58	43.13	24.22	3.37
1971	20.42	12.82	42.12	24.63	2.19
1972	20.38	12.85	41.93	24.84	5.10
1973	19.69	12.82	42.47	25.01	4.36
1974	19.80	12.90	42.32	24.97	-2.45
1975	20.48	13.38	40.29	25.85	-2.70
1976	20.17	13.47	40.69	25.67	5.41
1977	19.93	13.33	40.78	25.96	2.59
1978	19.99	13.40	40.26	26.35	2.42
1979	19.25	13.45	41.36	25.93	0.97
1980	19.83	13.93	40.31	25.92	-3.72
1981	19.73	14.38	39.54	26.34	-2.58
1982	20.81	15.33	36.92	26.94	-4.36
1983	20.78	15.53	36.53	27.16	-0.47
1984	20.31	15.32	37.51	26.86	5.03
1985	20.62	15.65	36.55	27.18	0.03

Source: State Energy Data Report, U.S. DOE/EIA, April 1987.

Note: The percentages given for the annual change in total energy consumption represent the percentage change in consumption in the current year when compared with the previous year ((Year 1 - Year 0) / Year 0).

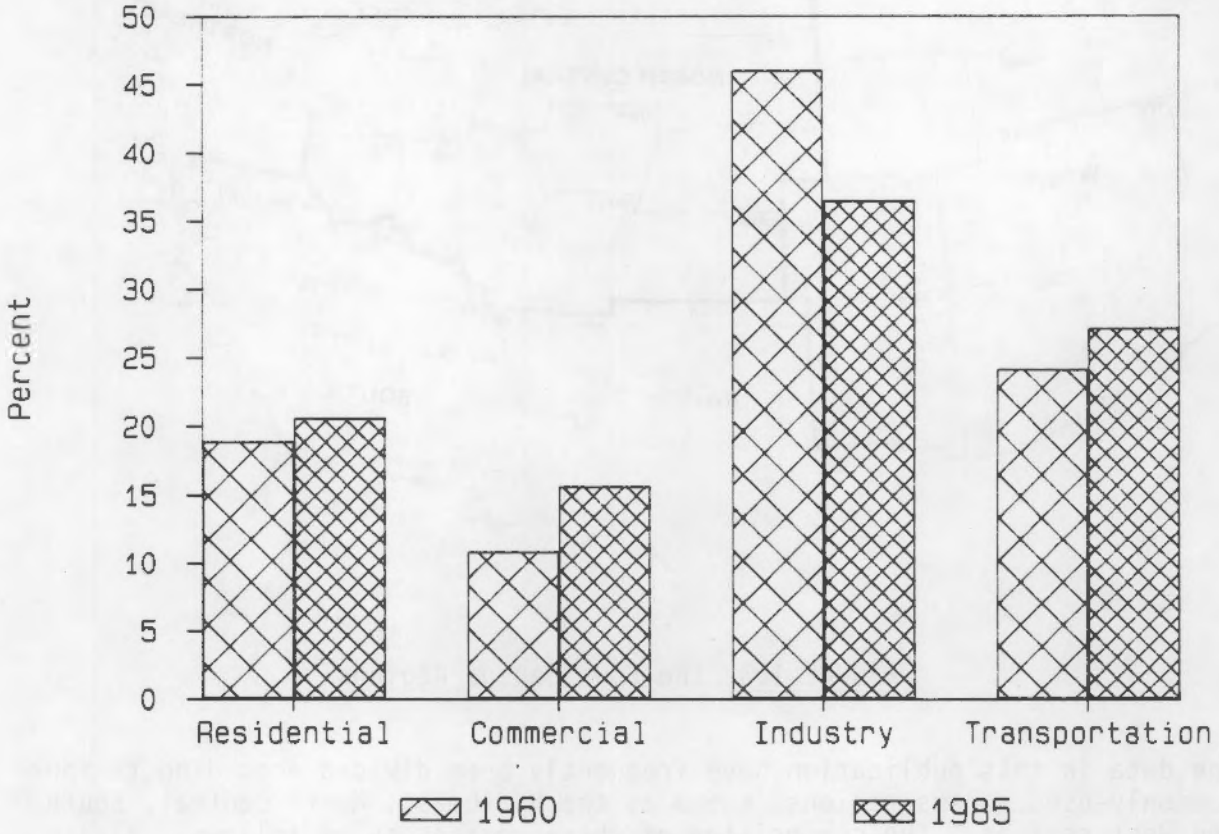

FIGURE 1.2 End-Use Sector Energy Consumption in 1960 and 1985

1.4 THE FOUR CENSUS REGIONS

FIGURE 1.3 The Four Census Regions

The data in this publication have frequently been divided according to four commonly-used census regions, known as the Northeast, North Central, South, and West regions. The composition of these regions is as follows. Please note that the states of Alaska and Hawaii are not included in these regions. Data from these states were also excluded from the EIA-produced reports.

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

1.5 GROSS NATIONAL PRODUCT, POPULATION, AND NUMBER OF HOUSEHOLDS

Table 1.3 provides information on U.S. gross national product, population, and number of households for each year between 1960 and 1985. The GNP figures are given in constant 1982 dollars. Table 1.4 compares GNP with total and end-use energy consumption for the country as a whole.

TABLE 1.3 Gross National Product, Population, and Number of Households, 1960 - 1985

Year	GNP (Billion 1982 Dollars)	Total Energy Consumption (Trillion Btu)	End-Use Energy Consumption (Trillion Btu)	Total Energy per GNP Dollar (Thousand Btu)	End-Use Energy per GNP Dollar (Thousand Btu)	Yearly Change of End-Use Energy per GNP Dollar (Percent)
1960	1,665.3	43,795.5	37,951.6	26.30	22.79	--
1961	1,708.7	44,454.9	38,449.3	26.02	22.51	-1.20
1962	1,799.4	46,530.5	40,151.0	25.86	22.31	-0.90
1963	1,873.3	48,341.8	41,546.5	25.80	22.17	-0.60
1964	1,973.3	50,506.8	43,222.6	25.59	21.90	-1.20
1965	2,087.6	52,696.6	44,924.3	25.24	21.52	-1.70
1966	2,208.3	55,670.5	47,192.9	25.20	21.37	-0.70
1967	2,271.4	57,591.2	48,627.2	25.35	21.41	0.20
1968	2,365.6	60,999.7	51,203.7	25.79	21.65	1.10
1969	2,423.3	64,174.0	53,462.2	26.49	22.07	1.90
1970	2,416.2	66,333.6	54,817.1	27.49	22.72	2.90
1971	2,484.8	67,788.2	55,661.1	27.32	22.44	-1.20
1972	2,608.5	71,243.2	58,165.8	27.32	22.30	-0.60
1973	2,744.1	74,351.1	60,352.3	27.07	21.97	-1.50
1974	2,729.3	72,526.7	58,329.1	26.58	21.38	-2.70
1975	2,695.0	70,588.9	56,185.3	26.18	20.84	-2.50
1976	2,826.7	74,384.7	59,137.4	26.31	20.91	0.30
1977	2,958.6	76,309.3	60,257.3	25.79	20.36	-2.60
1978	3,115.2	76,155.1	61,308.2	25.07	19.66	-3.40
1979	3,192.4	78,912.8	61,857.0	24.71	19.37	-1.50
1980	3,187.1	75,975.9	58,595.4	23.83	18.39	-5.10
1981	3,248.8	74,016.2	56,556.3	22.77	17.41	-5.30
1982	3,166.0	70,790.1	53,705.7	22.37	16.96	-2.60
1983	3,279.1	70,456.5	52,965.7	21.50	16.14	-4.80
1984	3,489.9	73,999.7	55,903.7	21.22	16.02	-0.70
1985	3,585.2	74,023.4	55,384.9	20.63	15.44	-3.60

Source: State Energy Data Report, US DOE/EIA, April 1987.
Annual Energy Review, US DOE/EIA, May 1987.

TABLE 1.4 Energy Consumption per Constant Dollar of Gross National Product

Year	GNP (Billion 1982$)	Population (Millions)	Households (Millions)	Population per Household	GNP per Capita (Thousand Dollars)	GNP per Household
1960	1,665.3	180.0	52.8	3.41	9.25	31.54
1961	1,708.7	183.0	53.6	3.42	9.34	31.90
1962	1,799.4	185.8	54.8	3.39	9.69	32.86
1963	1,873.3	188.5	55.3	3.41	9.94	33.89
1964	1,973.3	191.1	56.2	3.40	10.32	35.14
1965	2,087.6	193.5	57.4	3.37	10.79	36.34
1966	2,208.3	195.6	58.4	3.35	11.29	37.81
1967	2,271.4	197.5	59.2	3.33	11.50	38.34
1968	2,365.6	199.4	60.8	3.28	11.86	38.90
1969	2,423.3	201.4	62.2	3.24	12.03	38.95
1970	2,416.2	204.0	63.4	3.22	11.85	38.11
1971	2,484.8	206.8	64.8	3.19	12.01	38.36
1972	2,608.5	209.3	66.7	3.14	12.46	39.12
1973	2,744.1	211.4	68.3	3.10	12.98	40.21
1974	2,729.3	213.3	69.9	3.05	12.79	39.07
1975	2,695.0	215.5	71.1	3.03	12.51	37.89
1976	2,826.7	217.6	72.9	2.99	12.99	38.79
1977	2,958.6	219.8	74.1	2.96	13.46	39.91
1978	3,115.2	222.1	76.0	2.92	14.03	40.97
1979	3,192.4	224.6	77.3	2.90	14.22	41.28
1980	3,187.1	227.3	80.8	2.81	14.02	39.45
1981	3,248.8	229.6	82.4	2.79	14.15	39.44
1982	3,166.0	232.0	83.5	2.78	13.65	37.90
1983	3,279.1	234.3	83.9	2.79	14.00	39.07
1984	3,489.9	236.5	85.29	2.77	14.76	40.92
1985	3,585.2	238.7	86.79	2.75	15.02	41.31

Source: Current Population Reports, Population Characteristics, Series P-20, No. 412, US Department of Commerce, November 1986,
Annual Energy Review 1986, US DOE/EIA, May 1987.

CHAPTER TWO: CHARACTERISTICS OF RESIDENTIAL BUILDINGS IN THE U.S.

This chapter provides general information on some energy-related characteristics of the U.S. residential sector as of 1985. Data for this chapter was taken primarily from the Annual Housing Survey; 1983, Part F, Energy-Related Housing Characteristics, Series H-150-83, 1985. This is a publication of the U.S. Department of Commerce, Bureau of the Census. At the time that this edition of the Residential and Commercial Buildings Data Book was produced this was the most current information available.

This chapter is comprised of the following sections:

2.1 RESIDENTIAL HOUSING TYPES

TABLE 2.1 United States Housing Stock, by Region and Housing Type, 1983
(Number of Occupied Units, in Thousands)

Regions	Regional Totals		Single Family Homes		Multi-Family Units		Mobile Homes and Trailers	
	No. of Units	Percent of Region	No. of Units	Percent of Region	No. of Units	Percent of Region	No. of Units	Percent of Region
Northeast	18,221	100.00	10,410	57.13	7,463	40.96	348	1.91
Midwest	21,618	100.00	15,621	72.26	5,241	24.24	756	3.50
South	27,931	100.00	20,622	73.83	5,451	19.52	1,858	6.65
West	16,868	100.00	11,000	65.21	4,831	28.64	1,037	6.15
Total US	84,638	100.00	57,653	68.12	22,986	27.16	3,999	4.72

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Remarks:

1. The South contains one third of all U.S. residential units, making it the largest of the 4 census regions in this regard. 74% of all dwellings in the South are single family homes, the highest percentage in any region. 7% of the regions dwellings are mobile homes, also the highest percentage of any region. The South contains almost one half of all mobile homes in the US. The South has the lowest percentage (20%) of multi-family homes.

2. The North Central region contains approximately one quarter of all US residential units. The proportion of single family homes in this region (72%) is almost equal to the proportion in the South. In contrast to the South, however, multi-family units are more prevalent (24% of all units in the region) and mobile homes are less prevalent (4% of all units).

3. The Northeast region, with approximately one fifth of all US units, exhibits the greatest divergence from the national averages. In the Northeast single family homes account for only 57% of total units, the lowest proportion for single family units for any region. The Northeast also has the lowest proportion of mobile homes (2%). However, the Northeast does have the highest proportion of multi-family units (41%), which constitute one third of all such units in the US.

4. The West, with approximately one fifth of all US units, is the region which most closely approximates the averages for the country as a whole. Sixty-five percent of its units are single family homes; 29% are multi-family units, and 6% are mobile homes.

2.2 RESIDENTIAL SPACE HEATING FUEL USAGE

Residential Space Heating Fuel Usage in the United States

TABLE 2.2 Residential Space Heating Fuel Usage in the United States, by Housing Type, 1983
(Number of Occupied Units, in Thousands)

Item	Total U.S.		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Utility Gas	46,701	55.18	33,290	57.74	11,980	52.12	1,432	35.81
Bottled, Tank, or LP Gas	3,889	4.57	2,815	4.88	128	0.58	926	23.16
Fuel Oil, Kerosene	13,031	15.40	8,165	14.16	4,340	18.88	527	13.18
Electricity	15,683	18.53	8,742	15.16	6,072	26.42	869	21.73
Coal or Coke	432	0.51	399	0.69	27	0.12	5	0.13
Wood	4,087	4.83	3,826	6.64	48	0.21	213	5.33
Solar Heat	25	0.03	21	0.04	4	0.02	-	-
Other Fuel	133	0.16	25	0.04	108	0.47	-	-
None	677	0.80	368	0.64	282	1.23	28	0.70
All Occupied Housing Units	84,638	100.00	57,653	100.00	22,986	100.00	3,999	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department September 1985.

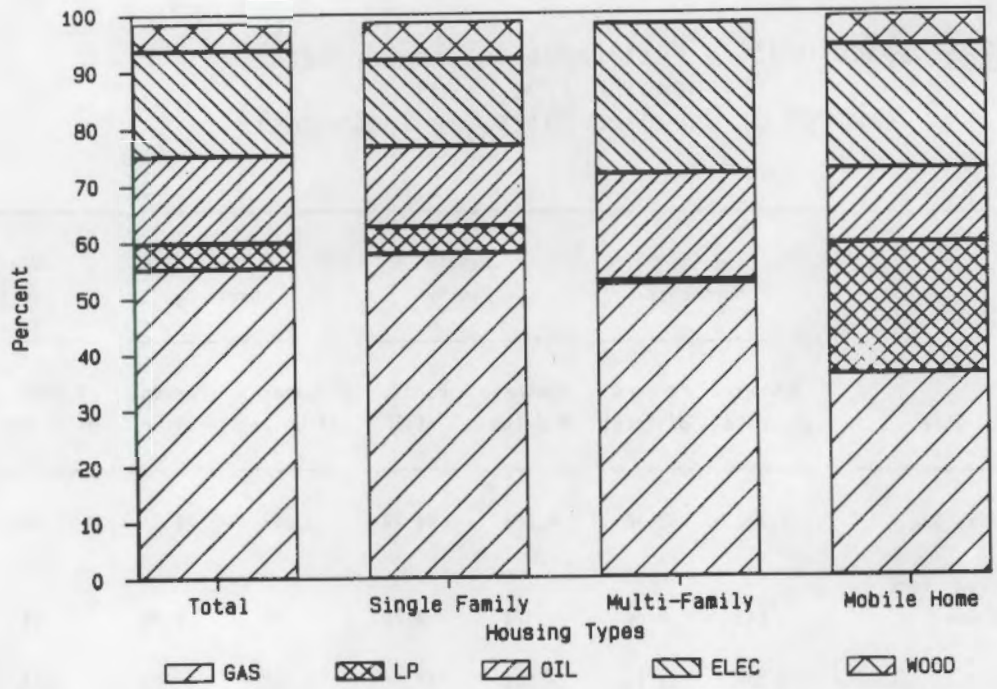

FIGURE 2.1 Residential Space Heating Fuel Usage in the U.S., by Housing Type, 1983

Note: The use of solar heat, other fuels, and no fuels is not specifically portrayed in Figure 2.1. Their sum is equivalent to the space between the tops of the bars and the 100% line.

Space Heating Fuel Usage in the Northeast Region

TABLE 2.3 Space Heating Fuel Usage in the Northeast, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total Northeast		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Utility Gas	7,741	42.48	4,663	44.79	3,003	40.24	74	21.28
Bottled, Tank, or LP Gas	145	0.80	73	0.70	47	0.63	24	6.90
Fuel Oil, Kerosene	8,228	45.15	4,328	41.56	3,685	49.38	216	62.07
Electricity	1,319	7.24	625	6.00	680	9.11	14	4.02
Coal or Coke	212	1.16	196	1.88	16	0.21	1	0.29
Wood	544	2.99	516	4.96	12	0.16	18	5.17
Solar Heat	1	0.01	1	0.01	0	0.00	0	0.00
Other Fuel	26	0.14	9	0.09	17	0.23	0	0.00
None	6	0.03	1	0.01	5	0.07	0	0.00
All Occupied Housing Units	18,221	100.00	10,410	100.00	7,463	100.00	348	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department September 1985.

Space Heating Fuel Usage in the North Central Region

TABLE 2.4 Space Heating Fuel Usage in the North Central Region, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total North Central		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Utility Gas	15,657	72.43	11,266	72.12	4,038	77.05	352	46.56
Bottled, Tank, or LP Gas	1,166	5.39	942	6.03	24	0.46	200	26.46
Fuel Oil, Kerosene	1,774	8.21	1,419	9.08	275	5.25	80	10.58
Electricity	2,172	10.05	1,216	7.78	872	16.64	85	11.24
Coal or Coke	68	0.31	57	0.36	10	0.19	1	0.13
Wood	745	3.45	701	4.49	5	0.10	39	5.16
Solar Heat	4	0.02	4	0.03	0	0.00	0	0.00
Other Fuel	26	0.12	10	0.06	17	0.32	0	0.00
None	5	0.02	4	0.03	2	0.04	0	0.00
All Occupied Housing Units	21,618	100.00	15,621	100.00	5,241	100.00	756	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Space Heating Fuel Usage in the Southern Region

TABLE 2.5 Space Heating Fuel Usage in the Southern Region, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total South		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Utility Gas	12,347	44.21	9,751	47.28	2,123	38.95	472	25.40
Bottled, Tank, or LP Gas	2,168	7.78	1,581	7.67	50	0.92	538	28.96
Fuel Oil, Kerosene	2,559	9.16	2,023	9.81	317	5.82	220	11.84
Electricity	8,558	30.64	5,189	25.16	2,845	52.19	525	28.26
Coal or Coke	138	0.49	133	0.64	0	0.00	3	0.16
Wood	1,882	6.74	1,780	8.63	17	0.31	85	4.57
Solar Heat	1	0.00	1	0.00	0	0.00	0	0.00
Other Fuel	17	0.06	4	0.02	13	0.24	0	0.00
None	264	0.95	162	0.79	89	1.63	15	0.81
All Occupied Housing Units	27,931	100.00	20,622	100.00	5,451	100.00	1,858	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Space Heating Fuel Usage in the Western Region

TABLE 2.6 Space Heating Fuel Usage in the West, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total West		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Utility Gas	10,958	64.95	7,610	69.18	2,812	58.21	533	51.40
Bottled, Tank, or LP Gas	389	2.31	219	1.99	7	0.14	164	15.81
Fuel Oil, Kerosene	471	2.79	395	3.59	67	1.39	10	0.96
Electricity	3,635	21.55	1,712	15.56	1,675	34.67	248	23.72
Coal or Coke	16	0.09	15	0.14	2	0.04	0	0.00
Wood	916	5.43	829	7.54	15	0.31	71	6.85
Solar Heat	19	0.11	15	0.14	4	0.08	0	0.00
Other Fuel	65	0.39	2	0.02	63	1.30	0	0.00
None	400	2.37	201	1.83	185	3.83	14	1.35
All Occupied Housing Units	16,868	100.00	11,000	100.00	4,831	100.00	1,037	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

2.3 RESIDENTIAL SPACE HEATING EQUIPMENT TYPES

TABLE 2.7 Residential Sector Heating Equipment, by Housing Type, 1983
(Number of Occupied Units in the U.S., in Thousands)

Item	Total United States		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Warm Air Furnace	44,320	52.36	32,475	56.33	8,625	37.52	3,219	80.50
Heat Pump	2,171	2.57	1,708	2.96	441	1.92	25	0.63
Steam or Hot Water	13,772	16.27	6,461	11.21	7,299	31.75	13	0.33
Built in Electric Units	6,207	7.33	3,072	5.33	3,019	13.13	116	2.90
Floor, Wall, or Pipeless Furnace	5,977	7.06	4,076	7.07	1,747	7.60	153	3.83
Room Heaters with Flue	3,438	4.06	2,450	4.25	918	3.99	72	1.80
Room Heaters without Flue	2,926	3.46	1,351	2.34	421	1.83	93	2.33
Fireplaces, Stoves, or Portable Heaters	5,152	6.09	4,634	8.04	237	1.03	282	7.05
None	677	0.80	368	0.64	282	1.23	28	0.70
All Occupied Housing Units	84,638	100.00	57,653	100.00	22,986	100.00	3,999	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

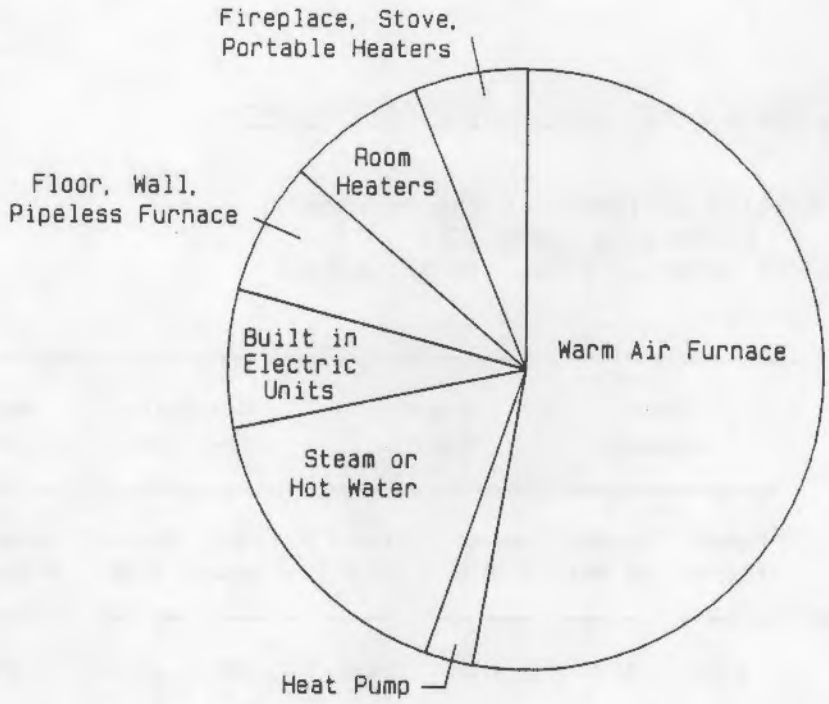

FIGURE 2.2 Residential Space Heating Equipment, U.S. Stock, 1985

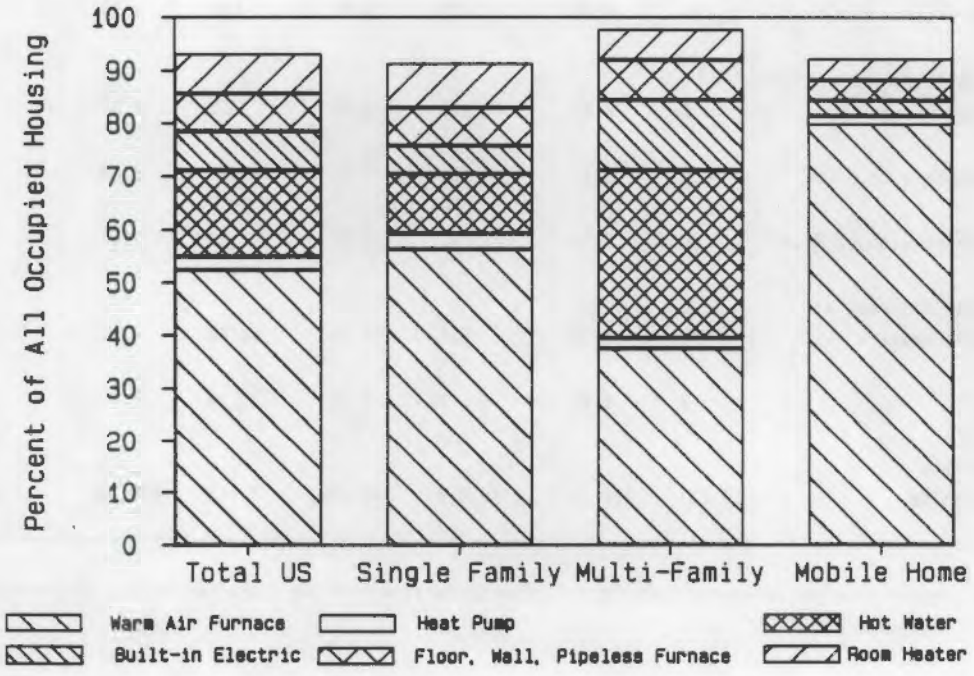

FIGURE 2.3 Residential Space Heating Equipment, by Housing Type, 1983

Note: The gap between the bars in Figure 2.7 and the 100% line represents the percentage of U.S. households which use either fireplaces, wood stoves, portable heaters, or no heating equipment.

Space Heating Equipment Usage in the Northeast Region

TABLE 2.8 Space Heating Equipment in the Northeast, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total Northeast		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Warm Air Furnace	6,501	35.68	4,544	43.65	1,658	22.21	299	85.92
Heat Pump	117	0.64	97	0.93	20	0.27	1	0.29
Steam or Hot Water	9,191	50.44	4,417	42.43	4,762	63.79	12	3.45
Built in Electric Units	1,109	6.09	482	4.63	622	8.33	6	1.72
Floor, Wall, or Pipeless Furnace	159	0.87	125	1.20	28	0.38	5	1.44
Room Heaters with Flue	410	2.25	134	1.29	269	3.60	7	2.01
Room Heaters without Flue	55	0.30	21	0.20	33	0.44	1	0.29
Fireplaces, Stoves, or Portable Heaters	674	3.70	589	5.66	68	0.91	18	5.17
None	6	0.03	1	0.01	5	0.07	0	0.00
All Occupied Housing Units	18,221	100.00	10,410	100.00	7,465	100.00	348	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Space Heating Equipment Usage in the North Central Region

TABLE 2.9 Space Heating Equipment in the North Central Region, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total North Central		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Warm Air Furnace	14,898	68.9	11,798	75.5	2,451	46.7	651	85.8
Heat Pump	275	1.3	243	1.6	30	0.5	2	0.1
Steam or Hot Water	3,005	13.9	1,209	7.7	1,796	34.2	1	0.1
Built in Electric Units	1,272	5.9	636	4.1	617	11.7	19	2.5
Floor, Wall, or Pipeless Furnace	457	2.1	347	2.2	82	1.5	29	3.8
Room Heaters with Flue	782	3.6	565	3.6	207	3.9	10	1.3
Room Heaters without Flue	91	0.4	43	0.3	45	0.8	3	0.4
Fireplaces, Stoves, or Portable Heaters	832	3.8	776	5.0	13	0.2	43	5.6
None	5	0.0	4	0.0	2	0.0	0	0.0
All Occupied Housing Units	21,618	100.0	15,621	100.0	5,241	100.0	758	100.0

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Space Heating Equipment Usage in the Southern Region

TABLE 2.10 Space Heating Equipment in the South, by Housing Type, 1983
(Number of Occupied Units, in Thousands)

Item	Total Southern		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Warm Air Furnace	14,474	52	9,901	48	3,118	57	1,457	78
Heat Pump	1,406	5	1,078	5	311	6	17	1
Steam or Hot Water	988	4	626	3	362	7	0	0
Built in Electric Units	1,891	7	1,236	6	591	11	64	3
Floor, Wall, or Pipeless Furnace	2,003	7	1,625	8	312	6	65	3
Room Heaters with Flue	1,703	6	1,399	7	265	5	38	2
Room Heaters without Flue	2,656	10	2,273	11	307	6	75	4
Fireplaces, Stoves, or Portable Heaters	2,548	9	2,322	11	98	2	127	7
None	264	1	182	1	89	2	15	1
All Occupied Housing Units.....	27,931	100	20,622	100	5,451	100	1,858	100

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Space Heating Equipment Usage in the Western Region

TABLE 2.11 Space Heating Equipment in the West, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Item	Total Western		Single Family		Multi-Family Dwellings		Mobile Home or Trailer	
	Number of Units	Percent of Total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Warm Air Furnace	8,445	50.07	6,232	56.65	1,401	29.00	813	78.40
Heat Pump	373	2.21	288	2.62	80	1.66	5	0.48
Steam or Hot Water	588	3.49	208	1.89	381	7.89	0	0.00
Built in Electric Units	1,935	11.47	718	6.53	1,190	24.63	27	2.60
Floor, Wall, or Pipeless Furnace	3,359	19.91	1,980	18.00	1,325	27.43	54	5.21
Room Heaters with Flue	544	3.23	351	3.19	176	3.64	16	1.54
Room Heaters without Flue	124	0.74	74	0.67	36	0.75	14	1.35
Fireplaces, Stoves, or Portable Heaters	1,099	6.52	948	8.62	57	1.18	95	9.18
None	400	2.37	201	1.83	185	3.83	14	1.35
All Occupied Housing Units.....	16,868	100.00	11,000	100.00	4,831	100.00	1,037	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

2.4 RESIDENTIAL AIR CONDITIONER EQUIPMENT USAGE

TABLE 2.12 Residential Air Conditioning Equipment in the U.S., by Housing Type, 1983
(Number of Occupied Units, in Thousands)

	Total United States		Single Family		Multi-Family		Mobil Home or Trailer	
Equipment	Number of Units	Percent of total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Units With Air Conditioning	50,009	59.08	34,810	60.38	12,639	41.80	2,555	36.40
Room Units	25,329	29.93	17,157	29.76	6,872	37.00	1,297	29.00
1 unit	16,887	19.95	10,736	18.62	5,085	22.13	1,065	26.63
2 units	6,258	7.39	4,624	8.02	1,417	6.17	218	5.40
3 units	1,595	1.88	1,276	2.21	308	1.33	12	0.30
4 units	396	0.47	344	0.60	48	0.21	3	0.08
5 or more units	193	0.23	177	0.31	16	0.07	1	0.03
Central System	24,680	29.16	17,653	30.62	5,767	25.09	1,258	31.48
Units With No Air Conditioning	34,631	40.92	22,842	39.62	10,344	45.01	1,445	36.13
All Occupied Housing Units	84,640	100.00	57,652	100.00	22,983	100.00	3,999	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

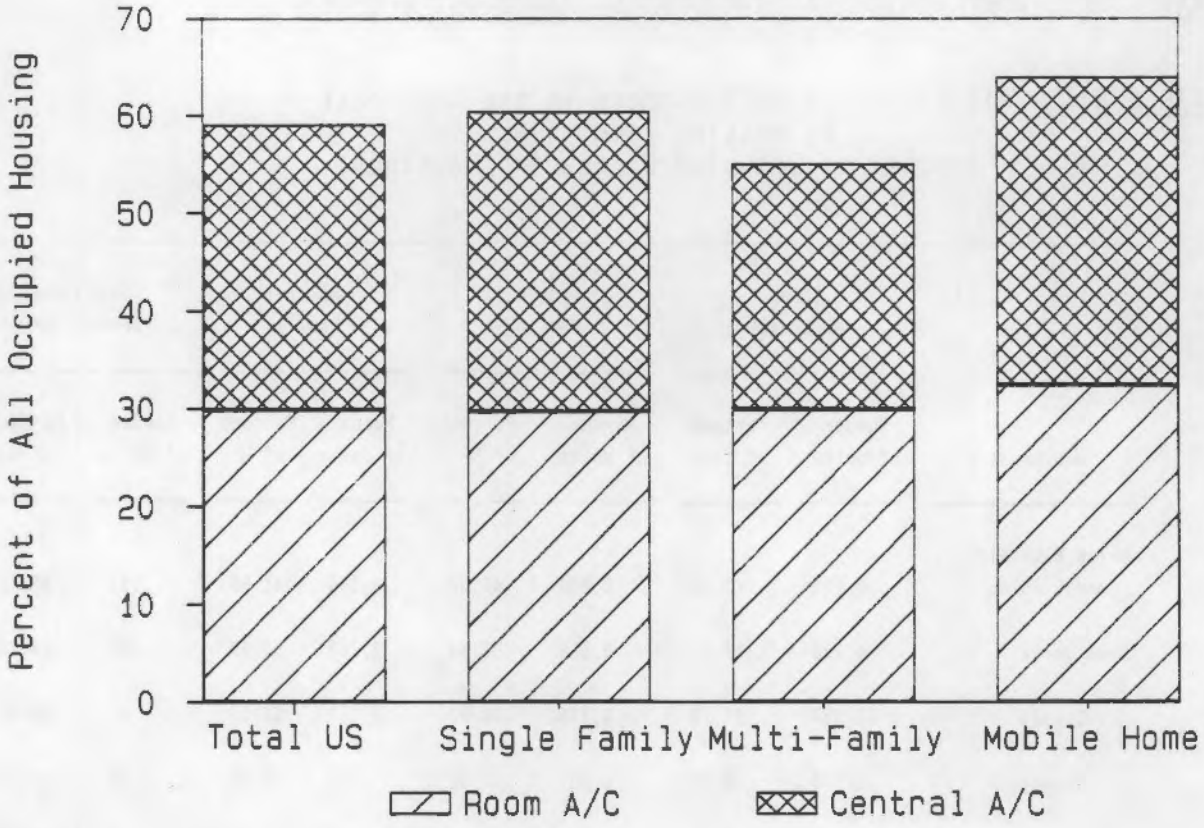

FIGURE 2.4 Residential Air Conditioning Equipment in the U.S., by Housing Type, 1983

Air Conditioner Equipment Usage in the Northeast Region

TABLE 2.13 Air Conditioning Equipment in the Northeast, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Equipment	Total Northeast		Single Family		Multi-Family		Mobil Home or Trailer	
	Number of Units	Percent of total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Units With Air Conditioning	8,528	48.80	5,056	48.57	3,345	41.80	127	36.40
Room Units	6,785	37.24	3,918	37.64	2,767	37.00	101	29.00
1 unit	3,957	21.72	2,115	20.32	1,758	23.56	83	23.85
2 units	1,948	10.69	1,151	11.06	780	10.45	19	5.46
3 units	624	3.42	432	4.15	192	2.57	0	0.00
4 units	170	0.93	141	1.35	30	0.40	0	0.00
5 or more units	86	0.47	79	0.76	8	0.11	0	0.00
Central System	1,743	9.57	1,138	10.93	580	7.77	27	7.76
Units With No Air Conditioning	9,693	53.20	5,355	51.44	4,119	55.19	221	63.51
All Occupied Housing Units	18,221	100.00	10,410	100.00	7,463	100.00	348	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Air Conditioner Equipment Usage in the North Central Region

TABLE 2.14 Air Conditioning Equipment in the North Central Region, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Equipment	Total North Central		Single Family		Multi-Family		Mobil Home or Trailer	
	Number of Units	Percent of total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Units With Air Conditioning	13,341	61.71	9,796	62.71	3,078	58.70	467	61.70
Room Units	6,968	32.23	4,732	30.29	1,975	37.60	261	34.50
1 unit	5,181	23.97	3,350	21.45	1,605	30.60	225	29.70
2 units	1,478	6.80	1,121	7.18	321	6.12	31	4.10
3 units	257	1.19	210	1.34	45	0.86	4	0.50
4 units	36	0.17	30	0.19	6	0.11	0	0.00
5 or more units	24	0.11	21	0.13	2	0.04	1	0.10
Central System	6,372	29.48	5,063	32.41	1,103	21.05	207	27.30
Units With No Air Conditioning	8,276	38.28	5,825	37.29	2,162	41.20	289	38.20
All Occupied Housing Units	21,618	100.00	15,621	100.00	5,241	100.00	756	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

TABLE 2.15 Air Conditioning Equipment in the South, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Equipment	Total Southern		Single Family		Multi-Family		Mobil Home or Trailer	
	Number of Units	Percent of total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Units With Air Conditioning	21,856	78.25	15,965	77.42	4,440	81.45	1,452	78.10
Room Units	9,167	32.82	7,174	34.79	1,260	23.12	733	39.50
1 unit	5,729	20.51	4,209	20.41	934	17.13	586	31.50
2 units	2,523	9.03	2,120	10.28	261	4.79	142	7.60
3 units	665	2.38	609	2.95	51	0.94	5	0.20
4 units	175	0.63	162	0.79	13	0.24	0	0.00
5 or more units	74	0.26	74	0.36	0	0.00	0	0.00
Central System	12,689	45.43	8,790	42.62	3,180	58.34	719	38.60
Units With No Air Conditioning	6,075	21.75	4,657	22.58	1,011	18.55	406	21.80
All Occupied Housing Units	27,931	100.00	20,622	100.00	5,451	100.00	1,858	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

Air Conditioning Equipment Usage in the Western Region

TABLE 2.16 Air Conditioning Equipment in the West, by Housing Type, 1983 (Number of Occupied Units, in Thousands)

Equipment	Total Western		Single Family		Multi-Family		Mobil Home or Trailer	
	Number of Units	Percent of total	Number of Units	Percent of SF	Number of Units	Percent of MF	Number of Units	Percent of MH
Units With Air Conditioning	6,282	37.24	3,995	36.32	1,768	36.68	518	49.13
Room Units	2,408	14.28	1,332	12.11	861	17.86	203	19.58
1 unit	2,020	11.98	1,062	9.65	785	16.29	172	16.57
2 units	317	1.88	231	2.10	61	1.27	25	2.41
3 units	49	0.29	25	0.23	12	0.25	3	0.29
4 units	14	0.08	11	0.10	0	0.00	3	0.29
5 or more units	5	0.03	3	0.03	3	0.06	0	0.00
Central System	3,874	22.97	2,663	24.21	907	18.82	306	29.48
Units With No Air Conditioning	10,585	62.76	7005	63.68	3,052	63.32	528	50.87
All Occupied Housing Units	16,867	100.00	11,000	100.00	4,820	100.00	1,038	100.00

Source: Annual Housing Survey: 1983, Part F, Energy Related Housing Characteristics, US Department of Commerce, September 1985.

CHAPTER THREE: CHARACTERISTICS OF NEW SINGLE FAMILY CONSTRUCTION IN THE U.S

This chapter provides general information on energy-related characteristics of single family homes constructed in the U.S. between 1973 and 1986. Data for this chapter was taken primarily from various issues of Characteristics of New Housing, an annual publication of the Bureau of the Census.

This chapter is comprised of the following sections:

3.1 NEW SINGLE AND MULTI-FAMILY CONSTRUCTION IN THE U.S.

TABLE 3.1 New Residential Construction in the U.S., 1966 through 1986 (in Thousands)

Year	Number of Single Family Units	Percent of all Units	Number of Multi-Family Units	Percent of all Units	Number of Multi-Family Buildings
1966	779	66.87	386	33.13	N/A
1967	844	65.33	448	34.67	N/A
1968	899	59.65	608	40.35	N/A
1969	811	55.28	656	44.72	N/A
1970	813	56.69	621	43.31	N/A
1971	1,014	59.44	692	40.56	74
1972	1,143	57.99	828	42.01	86
1973	1,174	58.29	840	41.71	90
1974	932	55.08	760	44.92	75
1975	866	66.82	430	33.18	45
1976	1,034	75.09	343	24.91	48
1977	1,258	75.92	399	24.08	59
1978	1,369	73.33	498	26.67	73
1979	1,301	69.54	570	30.46	78
1980	957	63.72	545	36.28	74
1981	819	64.69	447	35.31	64
1982	632	62.82	374	37.18	47
1983	924	66.43	467	33.57	60
1984	1,025	62.05	627	37.95	75
1985	1,072	62.95	631	37.05	73
1986	1,120	63.78	636	36.22	72

Source: Characteristics of New Housing. Construction Reports, Series C25, Bureau of the Census, various issues.

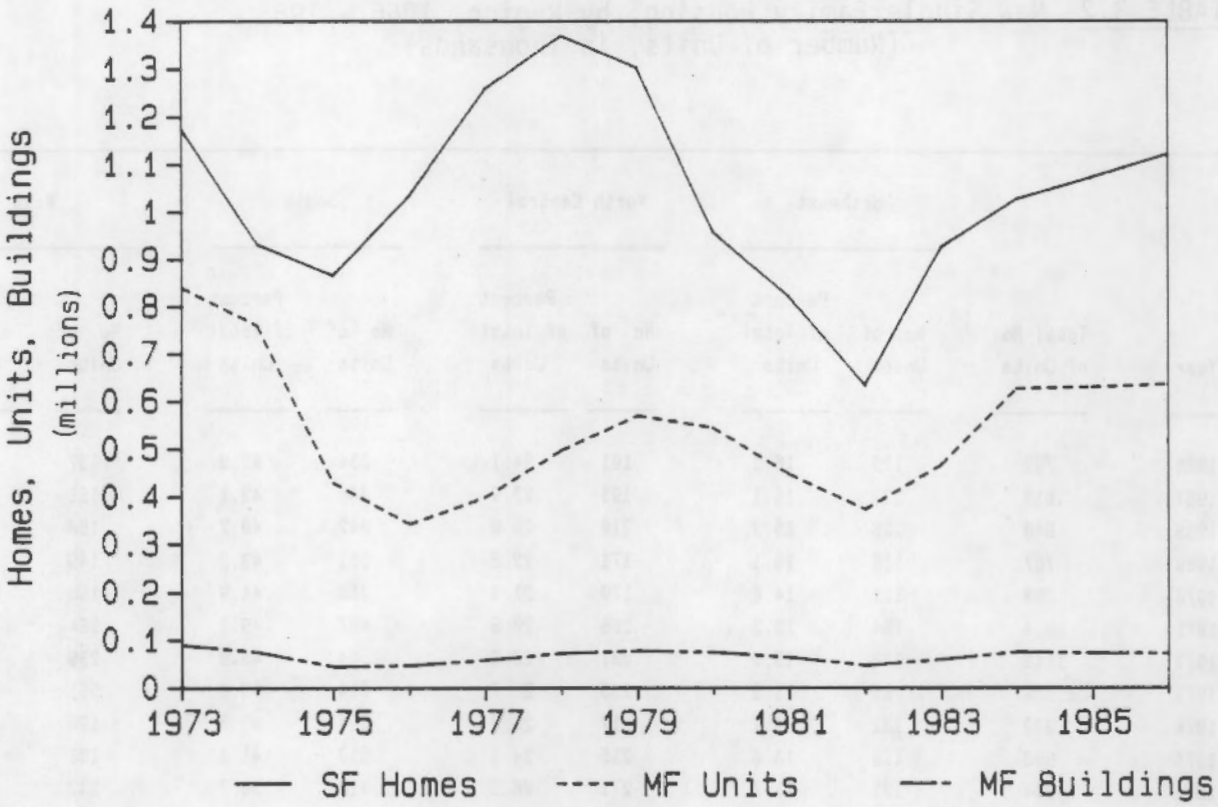

FIGURE 3.1 New Residential Construction in the U.S., 1973 - 1986

3.2 REGIONAL DISTRIBUTION OF NEW SINGLE FAMILY HOMES

TABLE 3.2 New Single Family Housing, by Region, 1966 - 1986
(Number of Units, in Thousands)

		Northeast		North Central		South		West	
Year	Total No. of Units	No. of Units	Percent of Total Units	No. of Units	Percent of Total Units	No. of Units	Percent of Total Units	No. of Units	Percent of Total Units
1966	792	129	16.3	191	24.1	334	42.2	137	17.3
1967	817	123	15.1	195	23.9	344	42.1	155	19.0
1968	840	128	15.2	210	25.0	342	40.7	160	19.0
1969	767	116	15.1	171	22.3	331	43.2	149	19.4
1970	793	111	14.0	170	21.4	356	44.9	156	19.7
1971	1014	134	13.2	208	20.5	467	46.1	204	20.1
1972	1143	149	13.0	231	20.2	524	45.8	239	20.9
1973	1,174	155	13.2	255	21.7	514	43.8	251	21.4
1974	932	131	14.1	217	23.3	394	42.3	190	20.4
1975	866	113	13.0	215	24.8	358	41.3	181	20.9
1976	1,034	121	11.7	271	26.2	410	39.7	232	22.4
1977	1,258	135	10.7	300	23.8	512	40.7	311	24.7
1978	1,369	141	10.3	300	21.9	571	41.7	357	26.1
1979	1,301	135	10.4	294	22.6	535	41.1	337	25.9
1980	957	100	10.4	170	17.8	455	47.5	233	24.3
1981	819	87	10.6	140	17.1	408	49.8	183	22.3
1982	632	79	12.5	92	14.6	340	53.8	121	19.1
1983	924	106	11.5	142	15.4	476	51.5	200	21.6
1984	1,025	129	12.6	156	15.2	508	49.6	233	22.7
1985	1,072	168	15.7	151	14.1	514	47.9	239	22.3
1986	1,120	193	17.2	170	15.2	505	45.1	253	22.6

Source: Characteristics of New Housing. Construction Reports, Series C25, Bureau of the Census, various issues.

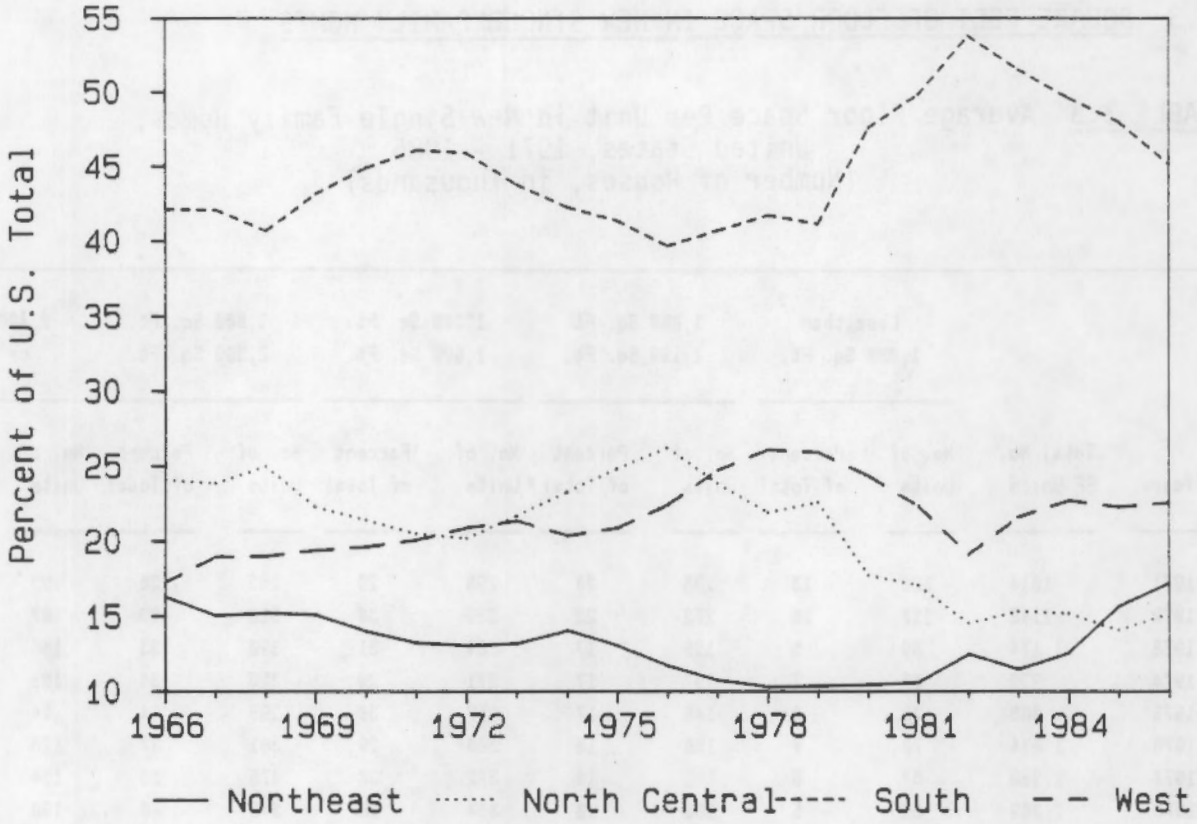

FIGURE 3.2 Number of New Single Family Homes, by Region, 1966 - 1986

3.3 SQUARE FEET OF FLOOR SPACE IN NEW SINGLE FAMILY HOMES

TABLE 3.3 Average Floor Space Per Unit in New Single Family Homes, United States, 1971 - 1986
(Number of Houses, in Thousands)

		Less than 1,000 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. 1,599 Sq. Ft.		1,600 Sq. Ft. 2,399 Sq. Ft.		2,400 Sq. Ft. or More	
Year	Total No. SF Units	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1971	1014	128	13	233	23	295	29	265	26	93	9
1972	1143	117	10	252	22	339	30	328	29	107	9
1973	1,174	89	8	195	17	364	31	390	33	136	12
1974	932	63	7	157	17	271	29	320	34	121	13
1975	866	73	8	145	17	257	30	298	34	94	11
1976	1,034	70	7	156	15	300	29	381	37	128	12
1977	1,258	67	5	181	14	372	30	475	38	164	13
1978	1,369	66	5	180	13	384	28	543	40	196	14
1979	1,301	68	5	175	13	363	28	496	38	199	15
1980	957	64	7	137	14	281	29	330	35	145	15
1981	819	70	9	125	15	238	29	261	32	124	15
1982	632	57	9	104	16	188	30	188	30	95	15
1983	924	71	8	130	14	285	31	299	33	138	15
1984	1,025	60	6	137	13	312	30	345	33	171	17
1985	1,072	64	6	145	14	322	30	358	33	184	17
1986	1,120	62	6	123	14	333	30	398	33	205	17

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census various issues.

TABLE 3.4 Average Floor Space Per Unit in New Single Family Homes, Northeast Region, 1971 - 1986
(Number of Houses, in Thousands)

Year	Total No. SF Units	Less than 1,000 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. 1,599 Sq. Ft.		1,600 Sq. Ft. 2,399 Sq. Ft.		2,400 Sq. Ft. or more	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1971	134	23	17	24	18	33	24	36	27	18	14
1972	149	21	13	36	24	36	24	40	27	16	11
1973	155	20	13	28	18	43	28	45	29	19	12
1974	131	16	13	26	20	34	26	41	31	14	11
1975	113	13	12	24	21	32	28	33	30	11	10
1976	121	14	12	21	17	32	26	41	34	13	11
1977	135	14	10	22	17	35	26	47	35	16	12
1978	141	12	8	23	16	33	24	52	36	22	15
1979	135	9	7	17	13	34	25	49	36	26	20
1980	100	7	7	14	14	26	26	36	36	17	17
1981	87	9	11	11	13	20	23	30	34	17	19
1982	79	11	14	11	14	18	22	25	32	15	19
1983	100	8	8	14	13	28	26	37	35	19	18
1984	129	9	7	16	12	34	27	42	33	27	21
1985	168	8	5	21	12	48	29	58	34	32	19
1986	193	7	4	18	9	64	33	67	35	38	19

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census various issues.

TABLE 3.5 Average Floor Space Per Unit in New Single Family Homes, North Central Region, 1971 - 1986 (Number of Houses, in Thousands)

Year	Total No. SF Units	Less than 1,000 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. 1,599 Sq. Ft.		1,600 Sq. Ft. 2,399 Sq. Ft.		2,400 Sq. Ft. or more	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1971	208	31	15	43	21	58	28	56	27	20	10
1972	231	27	21	46	20	70	30	66	28	22	9
1973	255	24	10	52	20	78	31	72	28	29	11
1974	217	15	7	44	21	63	29	67	30	28	13
1975	215	20	9	44	20	65	30	70	32	17	8
1976	271	22	8	53	20	76	28	85	31	34	13
1977	300	17	6	57	19	86	29	100	36	33	11
1978	300	17	6	48	16	83	28	111	37	42	14
1979	294	18	6	49	17	79	27	105	35	43	15
1980	170	16	9	31	19	46	27	51	29	26	15
1981	140	18	13	23	16	39	28	38	27	22	16
1982	92	12	13	20	22	24	26	22	23	15	16
1983	142	14	10	26	19	37	26	39	27	26	18
1984	156	12	8	24	16	41	26	48	30	30	20
1985	151	11	7	23	15	40	26	47	31	31	21
1986	170	5	7	20	11	47	27	59	34	36	21

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census various issues.

TABLE 3.6 Average Floor Space Per Unit in New Single Family Homes, Southern Region, 1971 - 1986
(Number of Houses, in Thousands)

Year	Total No. SF Units	Less than 1,000 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. 1,599 Sq. Ft.		1,600 Sq. Ft. 2,399 Sq. Ft.		2,400 Sq. Ft. or more	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1971	467	55	12	130	28	138	30	110	23	34	7
1972	524	50	10	130	25	157	30	143	27	44	8
1973	514	32	6	78	15	163	32	187	36	54	11
1974	394	23	6	56	14	109	28	149	38	57	14
1975	358	27	7	51	14	100	28	135	38	45	13
1976	410	22	5	61	12	112	27	171	42	54	13
1977	512	20	4	62	12	154	30	204	40	73	14
1978	571	20	4	60	11	164	29	244	42	83	15
1979	535	18	3	60	11	160	30	226	40	81	15
1980	455	22	5	60	13	140	31	167	37	65	14
1981	408	25	6	65	16	130	32	132	32	57	14
1982	340	23	7	55	16	114	34	100	29	47	14
1983	476	31	7	64	13	157	33	158	33	67	14
1984	508	27	5	70	14	161	32	175	34	76	15
1985	514	30	6	68	13	161	31	173	33	81	16
1986	505	33	6	54	11	146	29	181	36	91	18

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census various issues.

TABLE 3.7 Average Floor Space Per Unit in New Single Family Homes, Western Region, 1971 - 1986
(Number of Houses, in Thousands)

Year	Total No. SF Units	Less than 1,000 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. 1,599 Sq. Ft.		1,600 Sq. Ft. 2,399 Sq. Ft.		2,400 Sq. Ft. or More	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1971	204	20	10	38	18	66	32	62	30	20	10
1972	239	19	8	40	17	76	32	79	33	25	11
1973	251	13	5	38	15	79	32	86	34	35	14
1974	190	9	5	31	16	65	34	63	33	22	11
1975	181	14	8	27	15	61	33	60	33	19	11
1976	232	12	5	31	13	79	34	83	36	26	11
1977	311	16	5	40	13	97	31	117	37	42	14
1978	357	18	5	49	14	104	29	137	38	49	14
1979	337	23	7	49	15	90	27	127	37	48	14
1980	233	19	8	32	14	69	30	76	32	37	16
1981	183	18	10	27	15	49	27	62	34	28	15
1982	121	12	10	17	14	32	26	42	35	19	16
1983	200	18	9	27	14	63	32	66	33	26	13
1984	233	12	5	27	12	75	32	81	35	37	16
1985	239	15	6	33	14	73	30	79	33	40	17
1986	253	13	5	32	13	77	30	91	36	41	17

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census various issues.

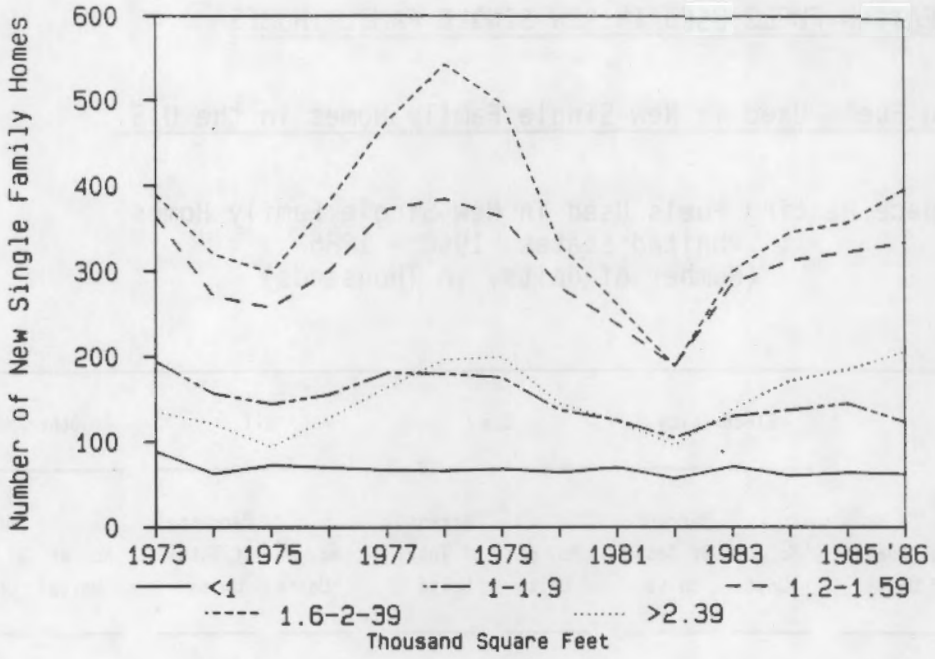

FIGURE 3.3 Number of New SF Homes by Square Footage Category, 1973 - 1986, Numbers in Thousands

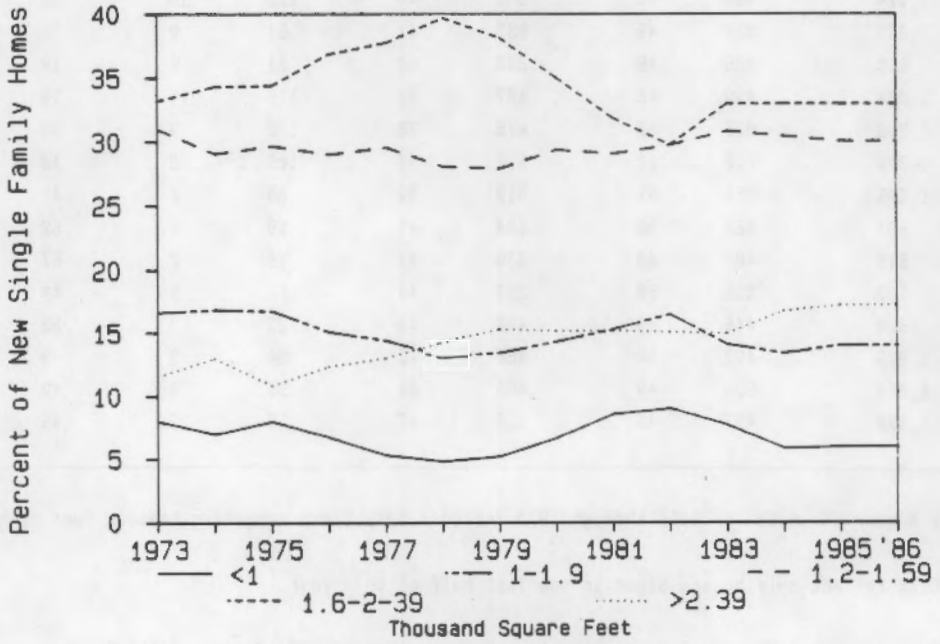

FIGURE 3.4 Percentage Distribution of New Single Family Homes by Square Footage Category

3.4 SPACE HEATING FUELS USED IN NEW SINGLE FAMILY HOMES

Space Heating Fuels Used in New Single Family Homes in the U.S.

TABLE 3.8 Space Heating Fuels Used in New Single Family Homes, United States, 1966 - 1986 (Number of Units, in Thousands)

		Electricity		Gas		Oil		Other/None	
Year	Total Number of Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1966 *	319	63	20	205	64	42	13	10	3
1967	764	153	20	506	66	86	11	19	3
1968	797	173	22	516	65	92	11	16	2
1969	714	180	25	457	64	66	9	9	1
1970	745	210	28	466	62	59	8	11	1
1971	1,014	313	31	605	60	83	8	15	1
1972	1,143	416	36	621	54	93	8	13	1
1973	1,174	488	42	549	47	123	10	16	1
1974	932	454	49	382	41	84	9	11	1
1975	866	425	49	343	40	81	9	18	2
1976	1,034	499	48	407	39	110	11	19	2
1977	1,258	635	50	476	38	120	9	28	2
1978	1,369	710	52	511	37	109	8	40	3
1979	1,301	662	51	512	39	86	7	41	3
1980	957	482	50	394	41	29	3	52	5
1981	819	407	50	339	41	16	2	57	7
1982	632	315	50	252	40	17	3	48	8
1983	924	448	49	400	43	22	2	53	6
1984	1,025	492	48	460	45	24	2	49	5
1985	1,072	528	49	466	44	36	3	42	4
1986	1,120	497	44	527	47	52	5	45	4

Note: Total Number of units for 1966 through 1970 includes only those reporting heating fuel usage.

* = Data reflect only houses begun in the last half of this year.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

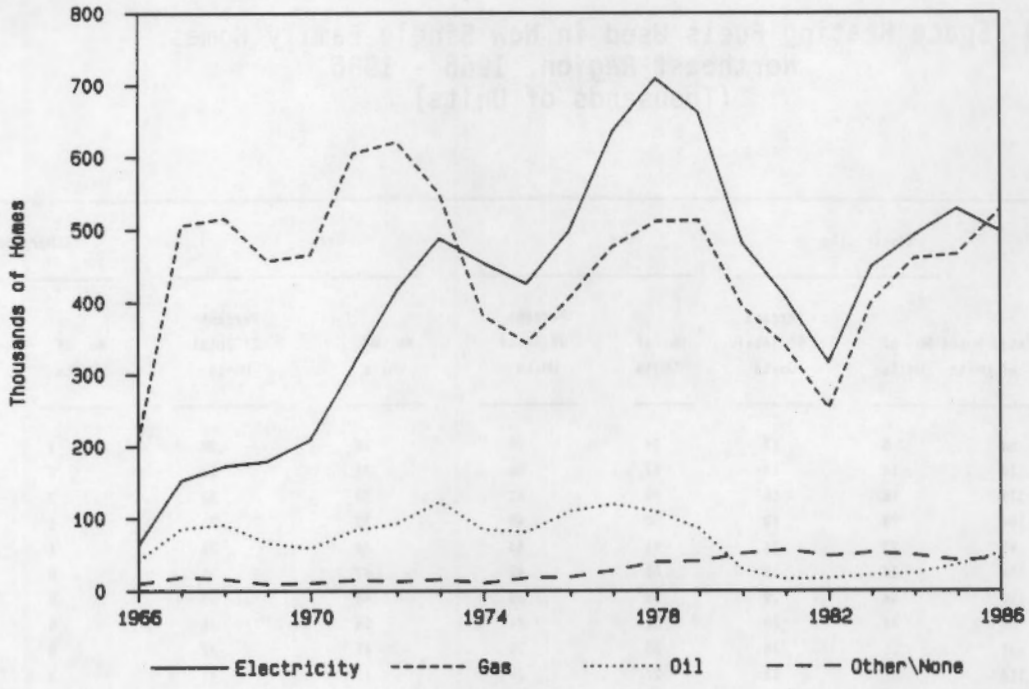

FIGURE 3.5 Space Heating Fuels Used In New Single Family Homes, United States, 1966 - 1986

Space Heating Fuels Used in New Single Family Homes in the Northeast

TABLE 3.9 Space Heating Fuels Used in New Single Family Homes, Northeast Region, 1966 - 1986 (Thousands of Units)

Year	Total Number of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1966 *	50	6	13	24	48	18	36	2	4
1967	110	14	13	62	56	31	28	3	3
1968	110	18	15	60	51	39	33	2	2
1969	104	20	19	50	49	32	31	1	1
1970	95	23	24	41	43	30	31	1	1
1971	134	34	26	56	42	42	31	8	8
1972	149	44	29	55	36	48	33	8	8
1973	156	44	28	52	34	54	35	5	3
1974	131	51	38	38	29	41	32	8	8
1975	113	37	33	27	24	46	41	3	3
1976	121	38	31	18	15	62	51	4	3
1977	135	42	31	22	17	67	49	5	3
1978	141	48	34	23	16	60	42	11	8
1979	135	47	35	32	24	49	36	7	5
1980	100	36	36	35	35	17	17	11	11
1981	87	34	39	30	35	11	13	12	14
1982	79	27	34	28	36	14	18	10	12
1983	106	38	36	40	38	18	17	9	9
1984	129	46	36	53	41	21	16	9	7
1985	168	63	37	65	39	32	19	8	5
1986	193	58	30	80	42	47	24	7	4

Note: Total Number of units for 1966 through 1970 includes only those reporting heating fuel usage.
* = Data reflects only houses begun in the last half of this year.
B = Insufficient sample size.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

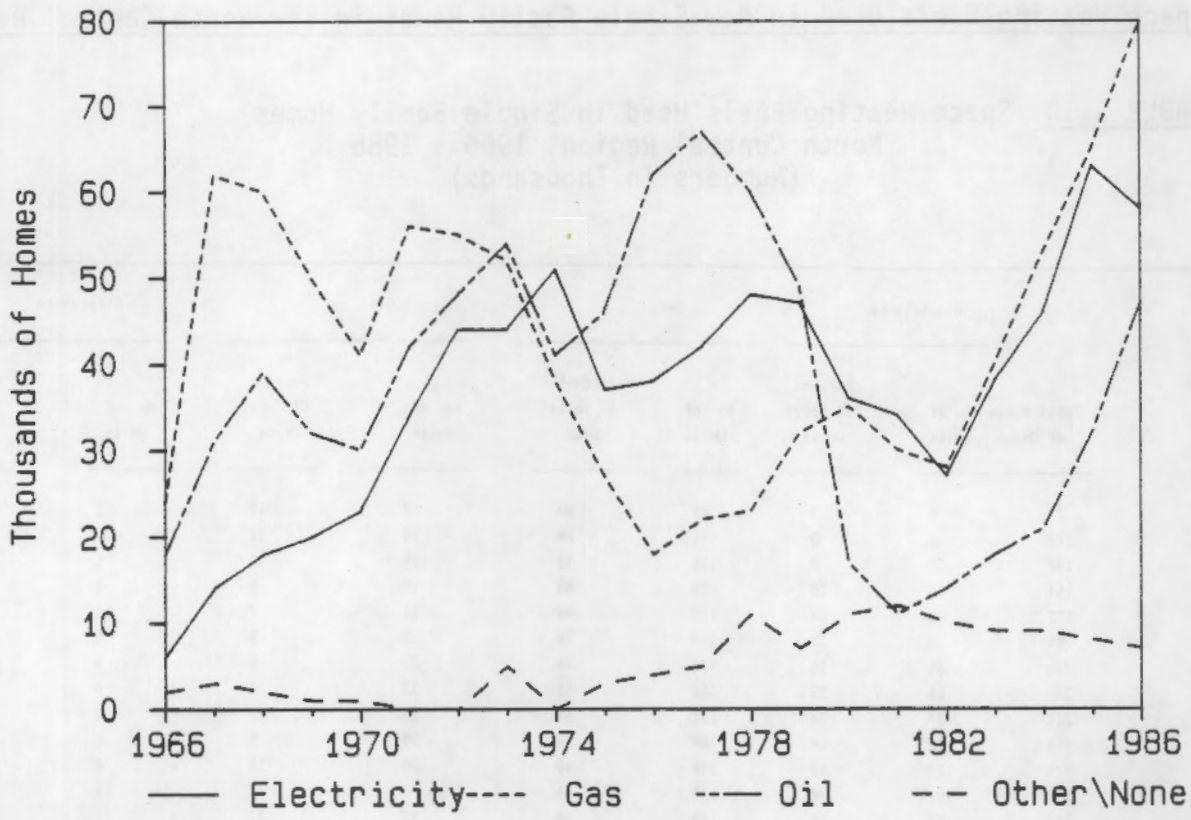

FIGURE 3.6 Space Heating Fuels Used in Single Family Homes, Northeast Region, 1966 - 1986

Space Heating Fuels Used in New Single Family Homes in the North Central Region

TABLE 3.10 Space Heating Fuels Used in Single Family Homes, North Central Region, 1966 - 1986 (Numbers in Thousands)

Year	Total Number of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1966 *	77	5	7	63	83	7	10	1	1
1967	178	15	9	141	80	19	11	2	1
1968	197	16	8	155	78	25	13	1	1
1969	154	15	10	129	83	10	6	1	1
1970	161	21	13	128	80	11	7	1	1
1971	208	26	12	162	78	19	9	B	B
1972	231	38	16	170	74	22	9	B	B
1973	255	65	25	155	61	33	13	B	B
1974	217	77	36	111	51	26	12	3	1
1975	215	82	38	107	49	20	9	8	4
1976	271	109	40	130	48	26	10	6	2
1977	300	121	40	138	46	30	10	11	4
1978	300	107	36	149	50	32	11	11	4
1979	294	96	33	162	55	22	7	14	5
1980	170	46	27	101	60	6	4	16	10
1981	140	37	26	87	62	B	B	13	10
1982	92	24	26	53	57	3	3	13	14
1983	142	35	24	92	65	B	B	13	9
1984	156	30	19	110	71	B	B	14	9
1985	151	31	21	111	74	B	B	7	5
1986	170	30	17	132	78	B	B	6	4

Note: Total Number of units for 1966 through 1970 includes only those reporting heating fuel usage.
* = Data reflects only houses begun in the last half of this year.
B = Insufficient sample size.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census,

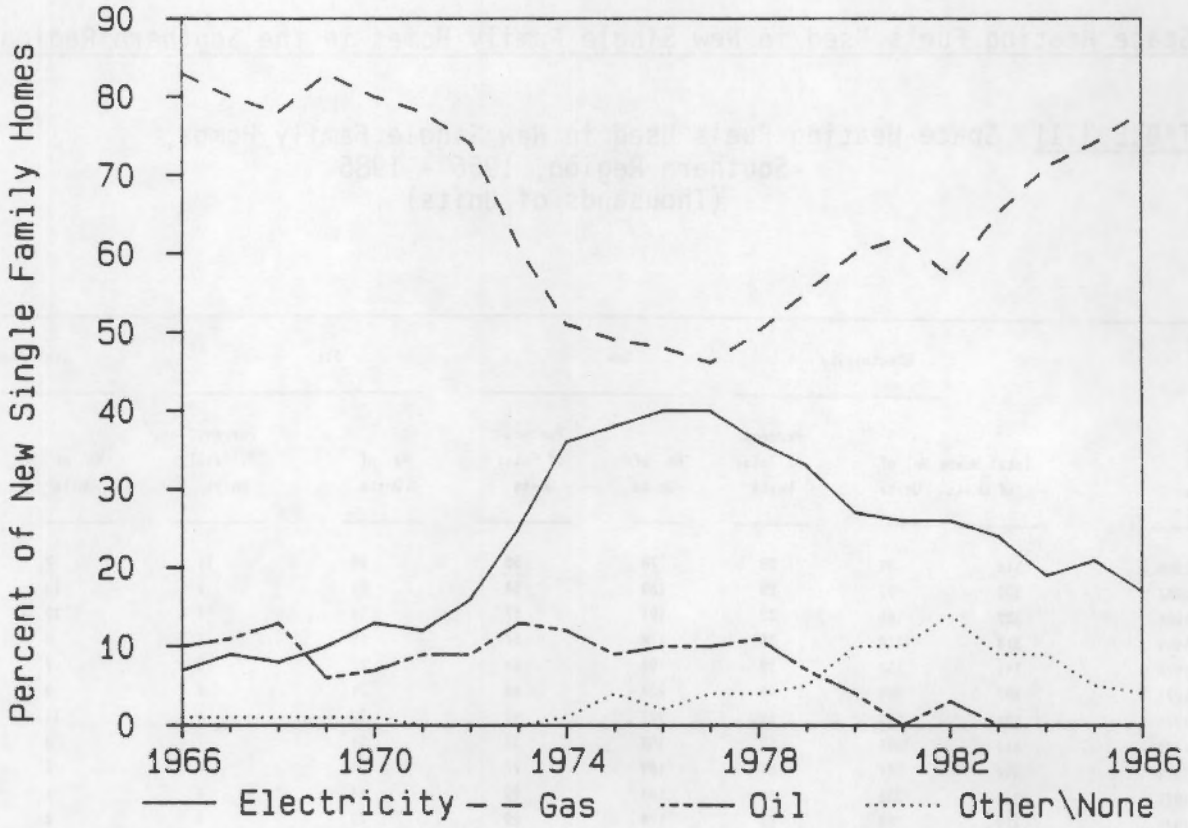

FIGURE 3.7 Space Heating Fuels Used in New Single Family Homes, North Central Region, 1966 - 1986

Space Heating Fuels Used in New Single Family Homes in the Southern Region

TABLE 3.11 Space Heating Fuels Used in New Single Family Homes, Southern Region, 1966 - 1986 (Thousands of Units)

Year	Total Number of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1966 e	140	39	28	78	56	16	11	7	5
1967	329	95	29	189	58	31	9	13	4
1968	332	105	32	191	57	25	7	12	4
1969	316	110	35	178	57	21	7	6	2
1970	341	133	39	183	54	17	5	7	2
1971	467	209	45	227	49	21	4	8	2
1972	524	272	52	222	42	22	4	11	2
1973	514	305	59	168	33	34	7	8	1
1974	394	264	67	109	27	16	4	5	1
1975	358	236	66	104	29	14	4	4	1
1976	410	260	63	120	29	22	5	8	2
1977	512	341	67	139	27	23	4	8	2
1978	571	392	69	153	27	16	3	9	2
1979	535	365	68	147	28	14	3	9	2
1980	455	303	67	136	30	5	1	11	2
1981	408	262	64	128	31	B	B	16	4
1982	340	214	63	112	33	B	B	13	4
1983	476	296	62	163	34	B	B	15	3
1984	500	325	64	170	33	B	B	12	2
1985	514	354	69	146	29	B	B	11	2
1986	505	335	66	153	30	B	B	14	3

Note: Total Number of units for 1966 through 1970 includes only those reporting heating fuel usage.
e = Data reflects only houses begun in the last half of this year.
B = Insufficient sample size.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

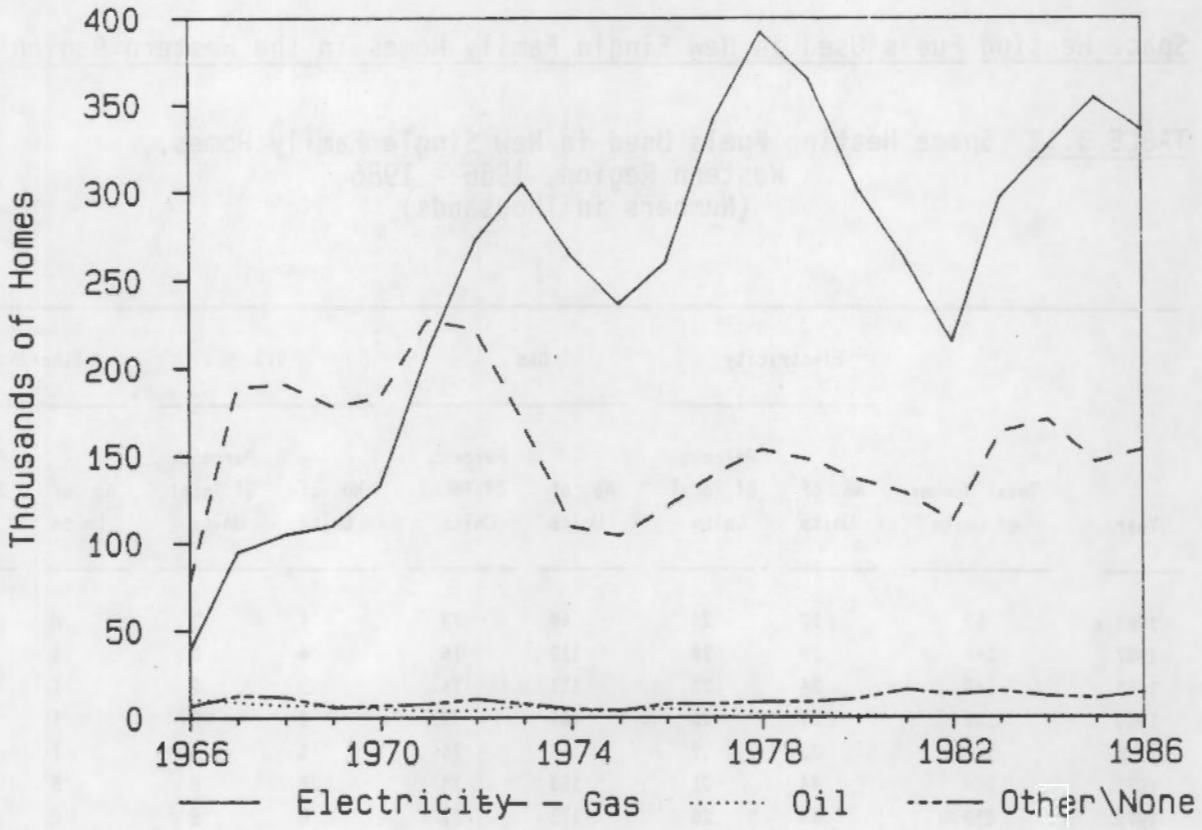

FIGURE 3.8 Space Heating Fuels Used in New Single Family Homes, Southern Region, 1966 - 1986

Space Heating Fuels Used in New Single Family Homes in the Western Region

TABLE 3.12 Space Heating Fuels Used in New Single Family Homes, Western Region, 1966 - 1986 (Numbers in Thousands)

Year	Total Number of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1966 *	53	12	24	40	73	1	2	B	1
1967	147	28	20	113	76	4	3	1	1
1968	149	34	23	111	74	3	2	1	1
1969	140	35	25	101	72	3	2	1	1
1970	148	33	22	113	76	1	1	1	1
1971	204	44	21	158	78	B	B	B	B
1972	239	63	26	173	72	B	B	B	B
1973	251	73	29	174	69	B	B	B	B
1974	190	63	33	124	66	B	B	B	B
1975	181	70	39	107	59	B	B	3	2
1976	232	91	39	139	60	B	B	B	B
1977	311	130	42	176	57	B	B	4	1
1978	357	162	45	186	52	B	B	9	2
1979	337	154	46	170	51	B	B	12	4
1980	233	97	42	121	52	B	B	14	6
1981	183	74	41	94	51	B	B	15	8
1982	121	50	41	59	49	B	B	12	10
1983	200	79	40	105	53	B	B	16	8
1984	233	91	39	127	55	B	B	14	6
1985	239	79	33	144	60	B	B	16	7
1986	253	74	29	162	64	B	B	17	7

Note: Total Number of units for 1966 through 1970 includes only those reporting heating fuel usage.
* = Data reflects only houses begun in the last half of this year.
B = Insufficient sample size.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

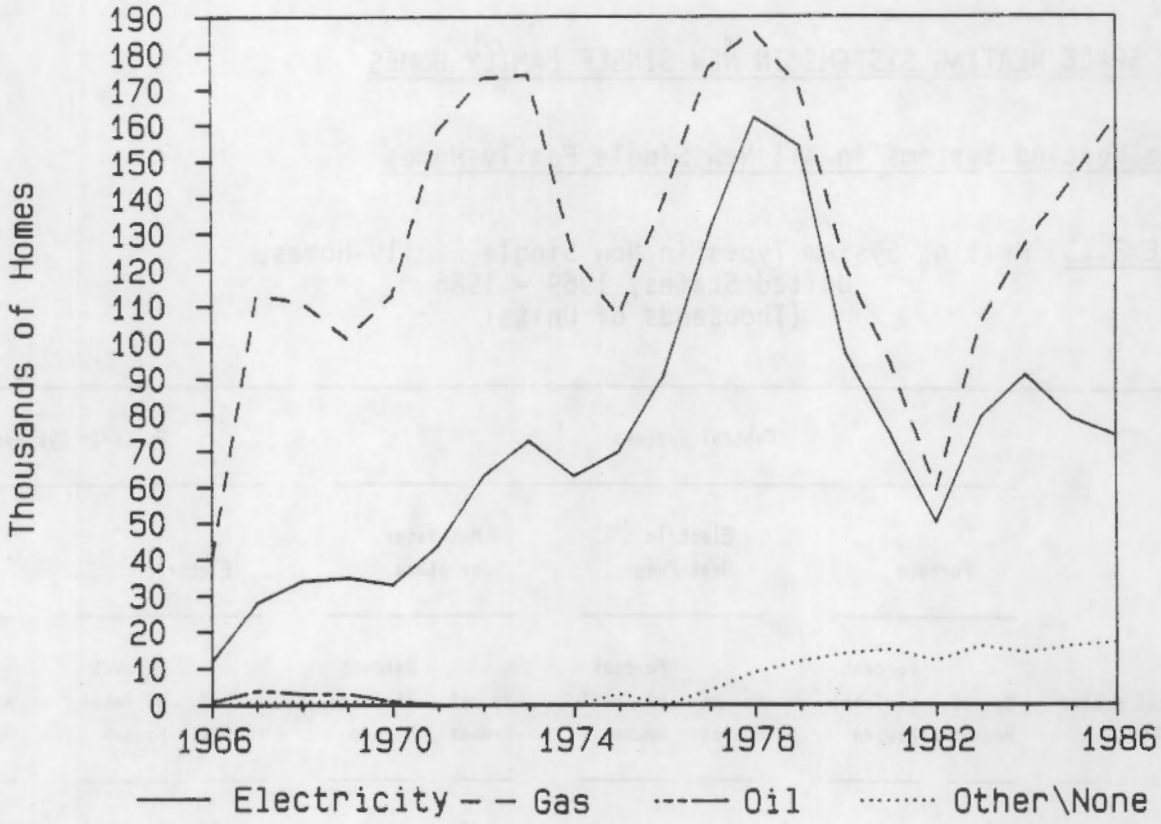

FIGURE 3.9 Space Heating Fuels Used in New Single Family Homes, Western Region, 1966 - 1986

3.5 SPACE HEATING SYSTEMS IN NEW SINGLE FAMILY HOMES

Space Heating Systems in All New Single Family Homes

TABLE 3.13 Heating System Types in New Single Family Homes, United States, 1969 - 1986 (Thousands of Units)

		Central Systems						Built-In Systems			
		Furnace		Electric Heat Pump		Hot Water or Steam		Electric		Other/None	
Year	Total Number SF Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses
1969	696	551	73			72	10	65	9	93	9
1970	735	524	71			91	12	75	10	84	7
1971	1014	733	72			64	6	124	12	57	5
1972	1143	845	74			63	8	150	13	36	4
1973	1,174	873	74			68	6	176	15	45	5
1974	932	679	73			54	6	163	17	36	4
1975	866	626	72			54	6	142	16	45	6
1976	1,034	788	75			59	6	147	14	40	4
1977	1,258	977	76			67	6	154	12	60	5
1978	1,369	781	57	336	25	65	5	132	10	56	4
1979	1,301	727	56	333	26	62	5	127	10	52	4
1980	957	541	57	233	24	36	4	86	9	62	6
1981	819	458	56	202	25	26	3	68	8	64	8
1982	632	334	53	166	26	24	4	50	8	58	9
1983	924	513	56	265	29	35	4	56	6	54	6
1984	1,025	565	55	309	30	42	4	60	6	50	5
1985	1,072	582	54	324	30	53	5	70	6	45	4
1986	1,120	607	54	321	29	76	7	64	6	52	5

Note: Electric Heat Pump classified under "Furnace" until 1978.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

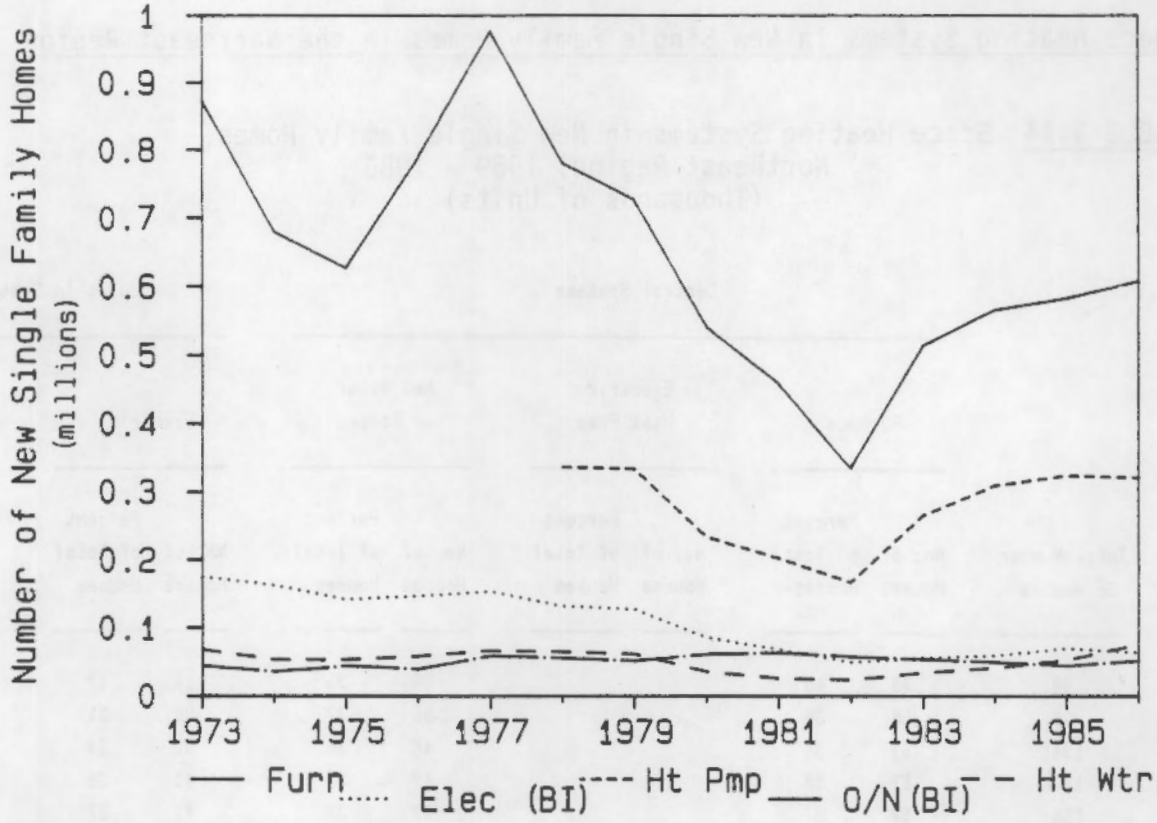

FIGURE 3.10 Space Heating Systems Used in New Single Family Homes, United States, 1973 - 1986

Space Heating Systems In New Single Family Homes in the Northeast Region

TABLE 3.14 Space Heating Systems in New Single Family Homes, Northeast Region, 1969 - 1986 (Thousands of Units)

		Central Systems						Built-In Systems			
		Furnace		Electric Heat Pump		Hot Water or Steam		Electric		Other/None	
Year	Total Number SF Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses
1969	99	46	46			35	35	17	17	2	2
1970	93	36	38			35	37	20	21	3	3
1971	134	51	38			48	36	32	24	3	2
1972	149	57	38			49	33	41	28	Z	Z
1973	155	57	37			52	33	41	27	5	3
1974	131	46	35			39	29	44	33	5	2
1975	113	36	32			40	36	34	30	3	3
1976	121	41	34			46	38	31	26	3	2
1977	135	47	35			50	37	34	25	4	3
1978	141	39	28	12	8	46	33	34	24	10	7
1979	135	40	29	14	11	43	32	31	23	7	5
1980	100	34	34	11	11	23	23	24	24	8	8
1981	87	27	31	12	13	19	22	19	22	10	12
1982	79	25	32	10	13	20	26	16	20	8	11
1983	106	34	32	15	15	28	26	21	20	7	7
1984	129	42	32	21	16	36	28	23	18	7	5
1985	168	58	35	30	18	45	27	29	17	6	3
1986	193	61	32	28	15	69	36	29	15	6	3

Note: Electric Heat Pump classified under "Furnace" until 1978.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Systems in New Single Family Homes in the North Central Region

TABLE 3.15 Space Heating Systems in New Single Family Homes, North Central Region, 1969 - 1986 (Thousands of Units)

Year	Total Number SF Houses	Central Systems						Built-In Systems			
		Furnace		Electric Heat Pump		Hot Water or Steam		Electric		Other/None	
		No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses
1969	150	129	86			10	6	9	6	2	1
1970	156	132	84			7	5	15	10	2	1
1971	208	174	84			11	5	18	9	5	2
1972	231	191	83			9	4	29	13	Z	Z
1973	255	192	75			14	5	45	18	4	1
1974	217	153	71			13	6	45	21	6	3
1975	215	156	72			11	5	39	18	9	4
1976	271	203	75			11	4	51	19	7	Z
1977	300	224	75			12	4	50	16	15	5
1978	300	196	65	53	18	14	5	29	10	7	2
1979	294	202	69	45	15	14	5	25	9	7	2
1980	170	117	69	21	12	9	5	14	9	9	5
1981	140	98	70	16	11	5	4	14	10	7	5
1982	92	61	66	7	7	3	3	12	13	10	10
1983	142	102	72	16	11	4	3	10	7	9	6
1984	156	122	78	12	8	4	3	10	6	7	5
1985	151	121	80	15	10	4	3	8	5	3	2
1986	170	140	83	15	9	4	2	7	4	3	2

Note: Electric Heat Pump classified under "Furnace" until 1978.
Z = Less than 0.5 percent.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Systems in New Single Family Homes in the Southern Region

TABLE 3.16 Space Heating Systems in New Single Family Homes, Southern Region, 1969 - 1986 (Thousands of Units)

Year	Total Number SF Houses	Central Systems						Built-In Systems			
		Furnace		Electric Heat Pump		Hot Water or Steam		Electric		Other/None	
		No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses
1969	309	220	71			3	1	35	11	51	16
1970	335	233	70			2	1	41	12	58	17
1971	467	334	72			5	1	57	12	72	15
1972	524	394	75			4	1	61	12	64	12
1973	514	407	79			3	1	66	13	38	8
1974	394	324	82			B	B	48	12	20	5
1975	358	292	82			B	B	40	11	23	7
1976	410	353	86			B	B	30	7	25	6
1977	512	447	87			B	B	29	6	33	6
1978	571	302	53	209	37	3	Z	29	5	28	5
1979	535	275	51	206	38	B	B	29	5	23	4
1980	455	244	54	154	34	B	B	25	5	30	7
1981	408	220	54	133	33	B	B	22	5	32	8
1982	340	183	54	116	34	B	B	14	4	26	8
1983	476	259	55	179	38	B	B	15	3	22	5
1984	508	260	51	214	42	B	B	13	3	20	4
1985	514	249	49	230	45	B	B	16	3	17	3
1986	505	233	46	231	46	B	B	16	3	23	5

Notes: Electric Heat Pump classified under "Furnace" until 1978.
B = Insufficient sample size.
Z = Less than 0.5 percent.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Systems in New Single Family Homes in the Western Region

TABLE 3.17 Space Heating Systems in New Single Family Homes, Western Region, 1969 - 1986 (Thousands of Units)

Year	Total Number SF Houses	Central Systems						Built-In Systems			
		Furnace		Electric Heat Pump		Hot Water or Steam		Electric		Other/None	
		No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses	No. of Houses	Percent of Total Houses
1969	138	116	84			2	1	11	8	11	8
1970	151	123	81			1	1	15	10	12	8
1971	204	172	84			B	B	17	8	14	7
1972	239	202	84			B	B	20	8	16	7
1973	190	215	86			B	B	25	10	10	4
1974	181	155	82			B	B	26	13	8	4
1975	182	142	78			B	B	29	16	9	5
1976	232	190	82			B	B	35	15	5	Z
1977	311	258	83			3	1	41	13	9	3
1978	357	242	68	62	17	3	1	39	11	12	3
1979	337	211	62	67	20	3	1	42	13	14	4
1980	233	147	63	46	20	B	B	22	10	15	6
1981	183	112	61	42	23	B	B	13	7	15	8
1982	121	65	54	32	27	B	B	9	8	14	11
1983	200	117	58	55	27	B	B	10	5	16	8
1984	233	141	60	62	26	B	B	13	6	16	7
1985	239	153	64	49	21	B	B	16	7	19	8
1986	253	172	68	47	18	B	B	13	5	19	8

Note: Electric Heat Pump classified under "Furnace" until 1978.
B = Insufficient sample size.
Z = Less than 0.5 percent.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

3.6 CENTRAL AIR CONDITIONING EQUIPMENT IN NEW SINGLE FAMILY HOMES

TABLE 3.18 Central Air Conditioning in New Single Family Homes, United States, 1966 - 1986 (Thousands of Units)

Year	Total No. of Units	Installed		Uninstalled	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1966	760	193	25	566	75
1967	771	214	28	557	72
1968	794	244	31	550	69
1969	711	259	36	452	64
1970	734	246	34	488	66
1971	1014	365	36	649	64
1972	1143	489	43	654	57
1973	1,174	571	49	604	51
1974	932	448	48	484	52
1975	866	399	46	467	54
1976	1,034	511	49	523	51
1977	1,258	679	54	579	46
1978	1,369	797	58	572	42
1979	1,301	784	60	517	40
1980	957	598	63	358	37
1981	819	530	65	289	35
1982	632	416	66	216	34
1983	924	642	70	282	30
1984	1,025	723	71	302	29
1985	1,072	746	69	326	31
1986	1,120	775	70	346	30

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 3.19 Central Air Conditioning in New Single Family Homes, Northeast Region, 1966 - 1986 (Thousands of Units)

Year	Total No. of Units	Installed		Uninstalled	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1966	124	9	7	115	93
1967	113	10	9	103	91
1968	117	12	10	106	90
1969	103	11	11	92	89
1970	93	9	10	84	90
1971	134	14	10	121	90
1972	149	17	11	132	89
1973	155	22	14	133	86
1974	131	21	16	110	84
1975	113	14	13	98	87
1976	121	16	13	105	87
1977	135	23	17	112	83
1978	141	28	20	113	80
1979	135	35	26	100	74
1980	100	29	29	71	71
1981	87	25	29	62	71
1982	79	21	27	58	73
1983	106	35	33	72	67
1984	129	44	34	85	66
1985	168	70	42	98	58
1986	193	84	43	109	57

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 3.20 Central Air Conditioning in New Single Family Homes, North Central Region, 1966 - 1986 (Thousands of Units)

Year	Total No. of Units	Installed		Uninstalled	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1966	180	31	17	149	83
1967	177	32	18	145	82
1968	193	38	20	155	80
1969	152	39	26	112	74
1970	157	38	24	119	76
1971	208	53	25	156	75
1972	231	68	29	163	71
1973	255	89	35	166	65
1974	217	78	36	139	64
1975	215	76	35	139	65
1976	271	107	40	164	60
1977	300	132	44	169	56
1978	300	141	47	159	53
1979	294	137	47	157	53
1980	170	77	45	93	55
1981	140	67	48	73	52
1982	92	40	43	53	57
1983	142	70	50	71	50
1984	156	86	55	70	45
1985	151	90	59	61	41
1986	170	105	62	65	38

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 3.21 Central Air Conditioning in New Single Family Homes, Southern Region, 1966 - 1986 (Thousands of Units)

Year	Total No. of Units	Installed		Uninstalled	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1966	323	117	36	206	64
1967	330	133	40	197	60
1968	332	157	47	175	53
1969	314	163	52	151	48
1970	334	154	46	180	54
1971	467	227	49	240	51
1972	524	299	57	225	43
1973	514	355	69	160	31
1974	394	284	72	110	28
1975	358	255	71	102	29
1976	410	320	78	90	22
1977	512	412	80	100	20
1978	571	480	84	90	16
1979	535	457	85	78	15
1980	455	384	84	71	16
1981	408	344	84	65	16
1982	340	290	85	50	15
1983	476	428	90	48	10
1984	508	466	92	42	8
1985	514	470	92	44	8
1986	505	460	91	45	9

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 3.22 Central Air Conditioning in New Single Family Homes, Western Region, 1966 - 1986 (Thousands of Units)

Year	Total No. of Units	Installed		Uninstalled	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1966	134	36	27	97	73
1967	151	39	26	112	74
1968	152	37	25	115	75
1969	143	46	32	97	68
1970	150	45	30	105	70
1971	204	70	35	134	65
1972	239	105	44	134	56
1973	251	103	41	148	59
1974	190	64	34	126	66
1975	181	53	29	128	71
1976	232	68	29	164	71
1977	311	112	36	199	64
1978	357	149	42	209	58
1979	337	155	46	182	54
1980	233	109	47	124	53
1981	183	94	51	90	49
1982	121	64	53	56	47
1983	200	109	55	91	45
1984	233	127	55	105	45
1985	239	116	49	123	51
1986	253	126	50	126	50

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

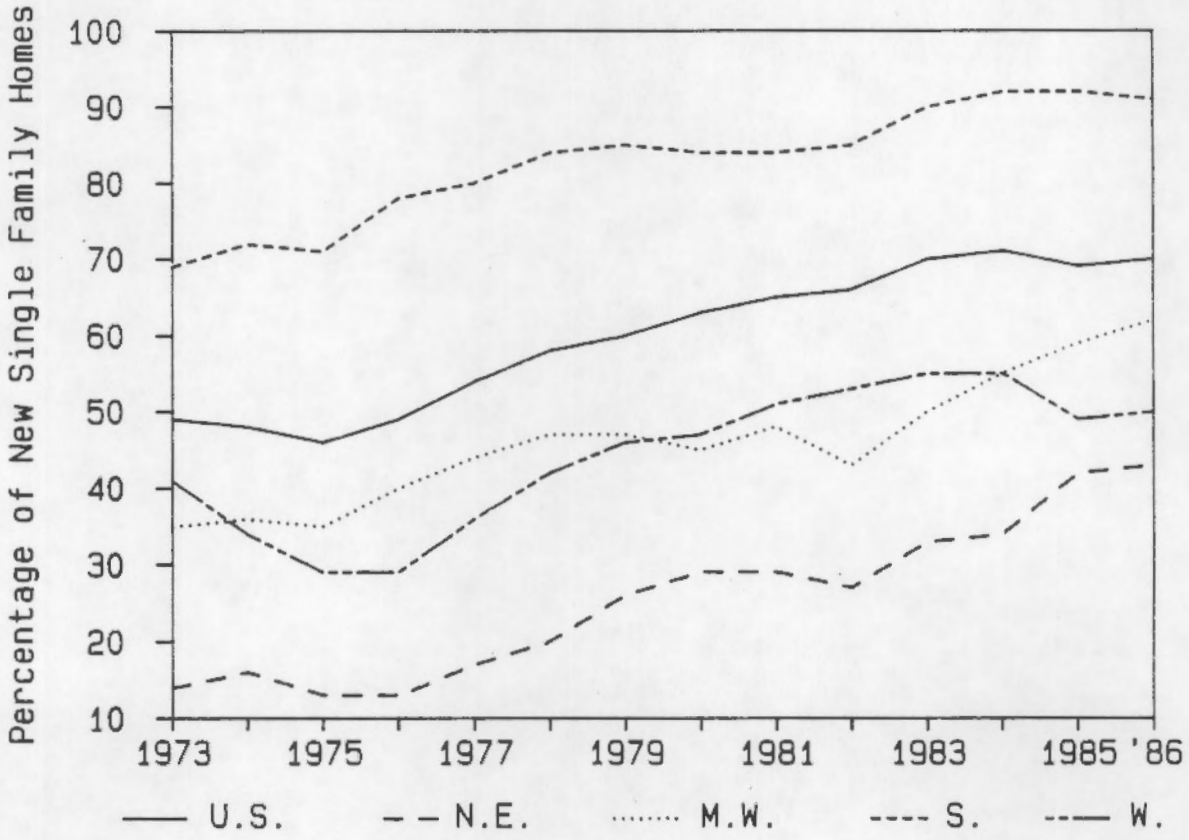

FIGURE 3.11 Central Air Conditioning in New Single Family Homes, by Region, 1973 - 1986 (Thousands of Units)

CHAPTER FOUR: CHARACTERISTICS OF NEW MULTI-FAMILY CONSTRUCTION IN THE U.S.

This chapter provides general information on energy-related characteristics of multi-family homes constructed in the U.S. between 1971 and 1986. Data for this chapter was taken primarily from various issues of Characteristics of New Housing, an annual publication of the Bureau of the Census.

This chapter is comprised of the following sections:

4.1 A COMPARISON OF NEW MULTI-FAMILY BUILDINGS AND UNITS

TABLE 4.1 Number of Units Per Multi-Family Building, United States (Thousands of Buildings)

Year	Total Number of Buildings	2 - 4 Units		5 - 9 Units		10 - 19 Units		20 - 29 Units		30 - 49 Units		50 or More	
		Number of Buildings	% of Total	Number of Buildings	% of Total	Number of Buildings	% of Total	Number of Buildings	% of Total	Number of Buildings	% of Total	Number of Buildings	% of Total
1971	74	38	52	16	22	12	16	4	5	2	2	1	2
1972	86	42	49	20	23	16	19	5	5	2	2	2	2
1973	90	43	48	23	25	16	18	4	5	2	2	1	2
1974	75	33	44	21	28	13	18	4	5	2	3	2	2
1975	45	22	49	12	27	7	15	2	4	1	3	1	2
1976	48	30	62	9	20	6	12	2	3	1	2	Z	S
1977	59	36	61	12	20	8	13	2	3	1	1	Z	S
1978	73	44	60	15	22	9	13	2	3	1	1	1	1
1979	78	47	60	17	21	10	13	2	3	1	2	1	1
1980	74	43	59	17	23	10	13	2	2	1	2	1	1
1981	64	41	64	13	20	7	11	2	3	1	1	1	1
1982	47	28	60	10	21	6	13	2	4	1	2	1	1
1983	60	33	55	15	25	9	15	2	3	1	1	1	1
1984	75	38	49	19	26	14	18	4	5	1	2	1	1
1985	73	34	47	19	26	14	20	4	5	1	2	1	1
1986	72	31	43	20	28	16	22	4	5	1	1	1	1

Notes: Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

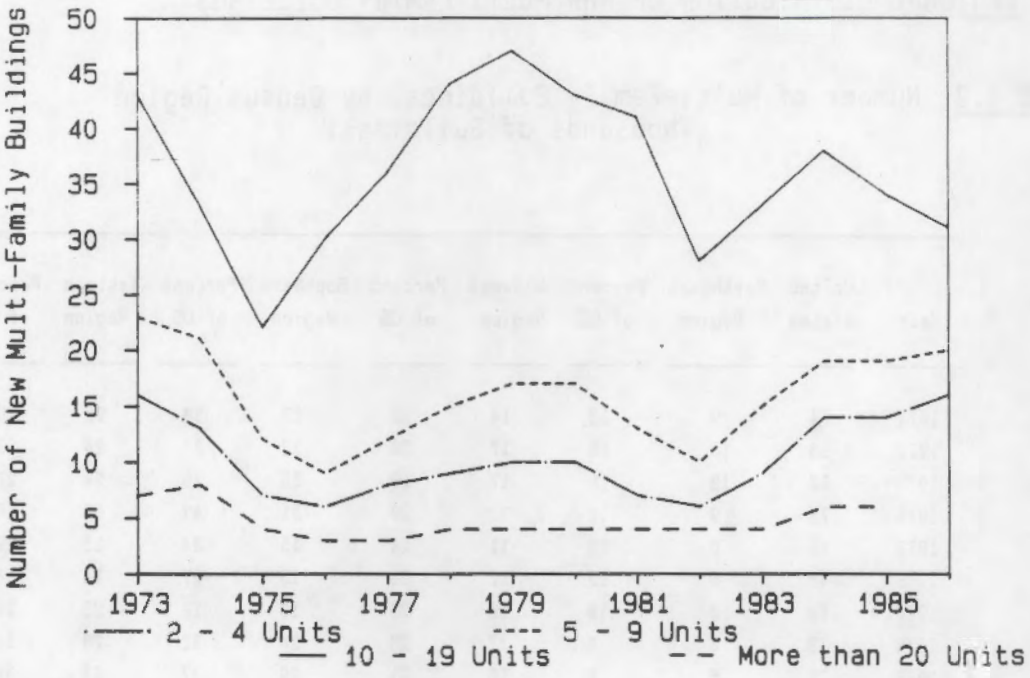

FIGURE 4.1 Number of New Multi-Family Buildings, by Units per Building (Thousands of Buildings)

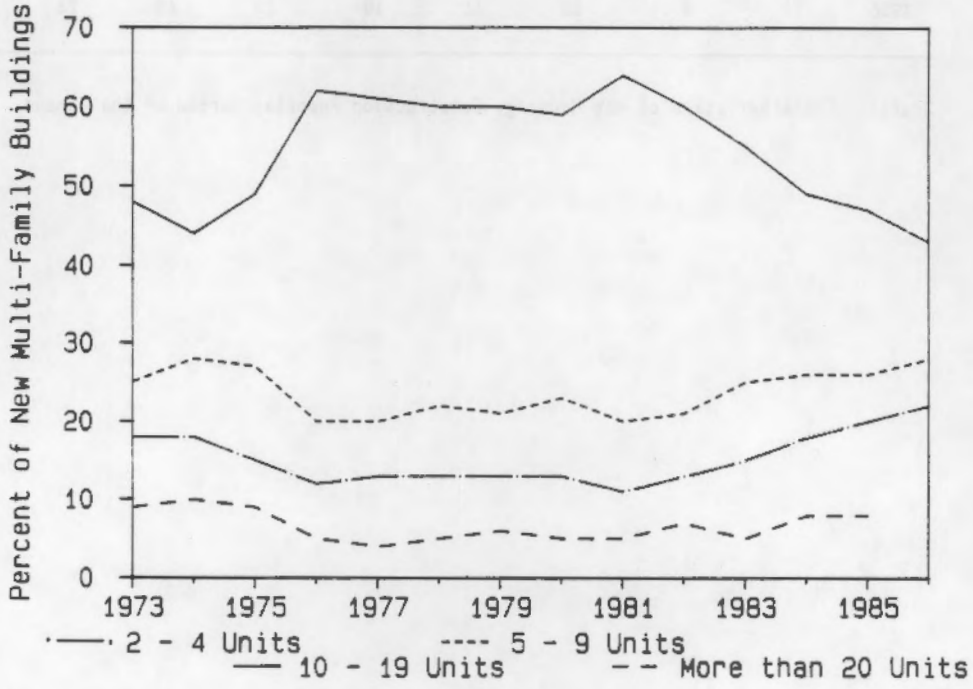

FIGURE 4.2 Building Size As A Percentage of Total Buildings

4.2 REGIONAL DISTRIBUTION OF NEW MULTI-FAMILY BUILDINGS

TABLE 4.2 Number of Multi-Family Buildings, by Census Region
(Thousands of Buildings)

Year	United States	Northeast Region	Percent of US	Midwest Region	Percent of US	Southern Region	Percent of US	Western Region	Percent of US
1971	74	9	13	14	20	28	38	22	29
1972	86	13	15	17	20	32	37	24	28
1973	90	13	15	17	19	35	39	24	27
1974	75	9	12	15	20	31	42	19	26
1975	45	6	13	11	24	15	34	13	29
1976	48	6	13	12	26	13	27	16	34
1977	59	6	10	13	23	16	28	23	39
1978	73	6	8	17	23	24	32	26	37
1979	78	6	8	16	21	29	37	27	34
1980	74	5	7	14	20	31	43	22	30
1981	64	5	8	11	18	32	49	16	25
1982	47	4	8	7	15	25	53	11	23
1983	60	4	7	8	13	34	57	14	22
1984	75	5	7	9	11	43	58	19	25
1985	73	8	11	9	12	34	46	22	30
1986	72	9	13	11	16	29	40	23	30

Source: Characteristics of New Housing, Construction Reports, Bureau of the Census,

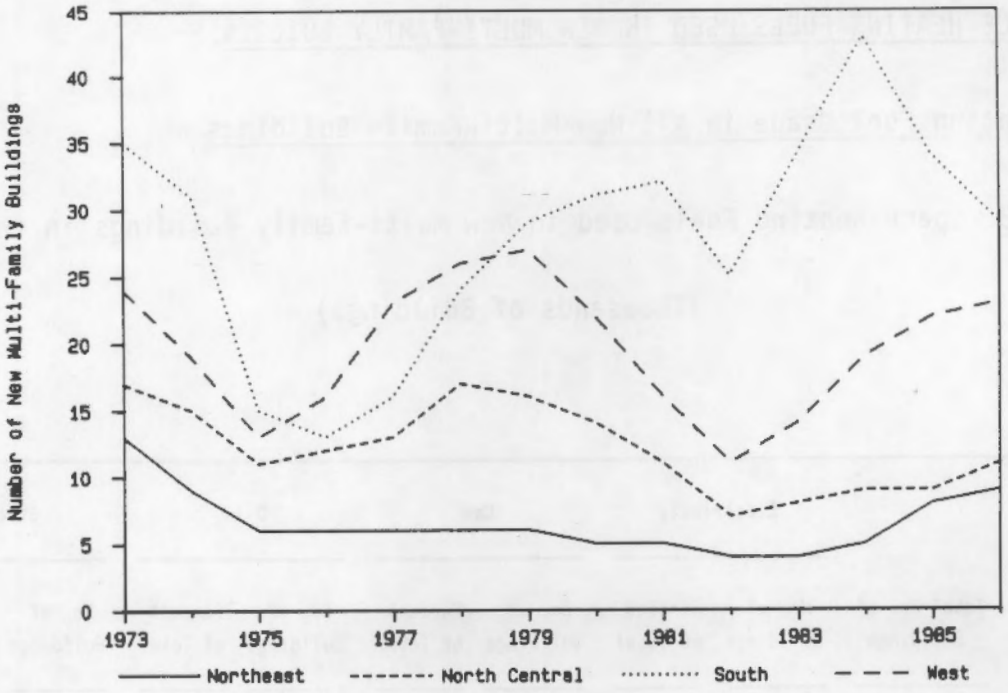

FIGURE 4.3 Number of New Multi-Family Buildings, by Region

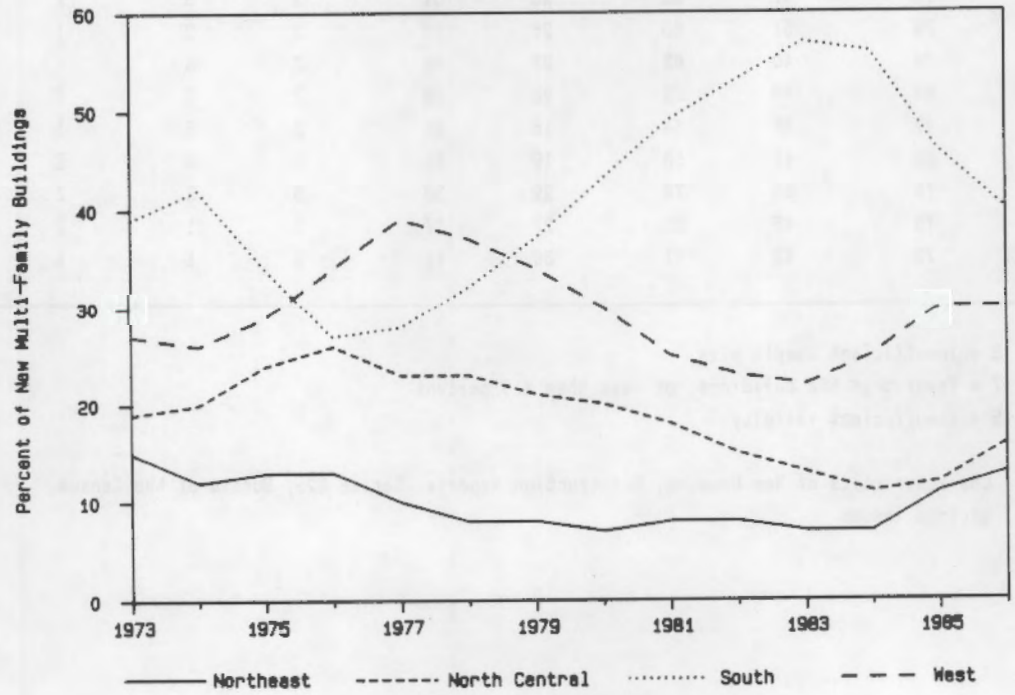

FIGURE 4.4 Regional Shares of Total New Multi-Family Buildings

4.3 SPACE HEATING FUELS USED IN NEW MULTI-FAMILY BUILDINGS

Space Heating Fuel Usage in All New Multi-Family Buildings

TABLE 4.3 Space Heating Fuels Used in New Multi-Family Buildings in the U.S.

(Thousands of Buildings)

		Electricity		Gas		Oil		Other/None	
Year	Total No. of Buildings	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	90	S	S	S	S	S	S	S	S
1974	75	45	60	29	39	1	1	Z	Z
1975	45	26	58	18	40	1	3	Z	Z
1976	48	28	59	17	35	2	5	Z	S
1977	59	38	64	18	32	3	4	Z	S
1978	73	47	65	23	31	2	3	Z	S
1979	78	51	65	25	32	1	2	1	1
1980	74	46	63	27	36	Z	S	1	1
1981	64	40	63	23	36	Z	S	Z	S
1982	47	30	64	16	34	S	S	1	1
1983	60	41	68	19	31	S	S	Z	S
1984	76	53	70	22	30	S	S	Z	S
1985	73	45	61	27	37	1	1	Z	S
1986	72	42	57	30	41	1	1	1	1

Notes: B = insufficient sample size.
Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

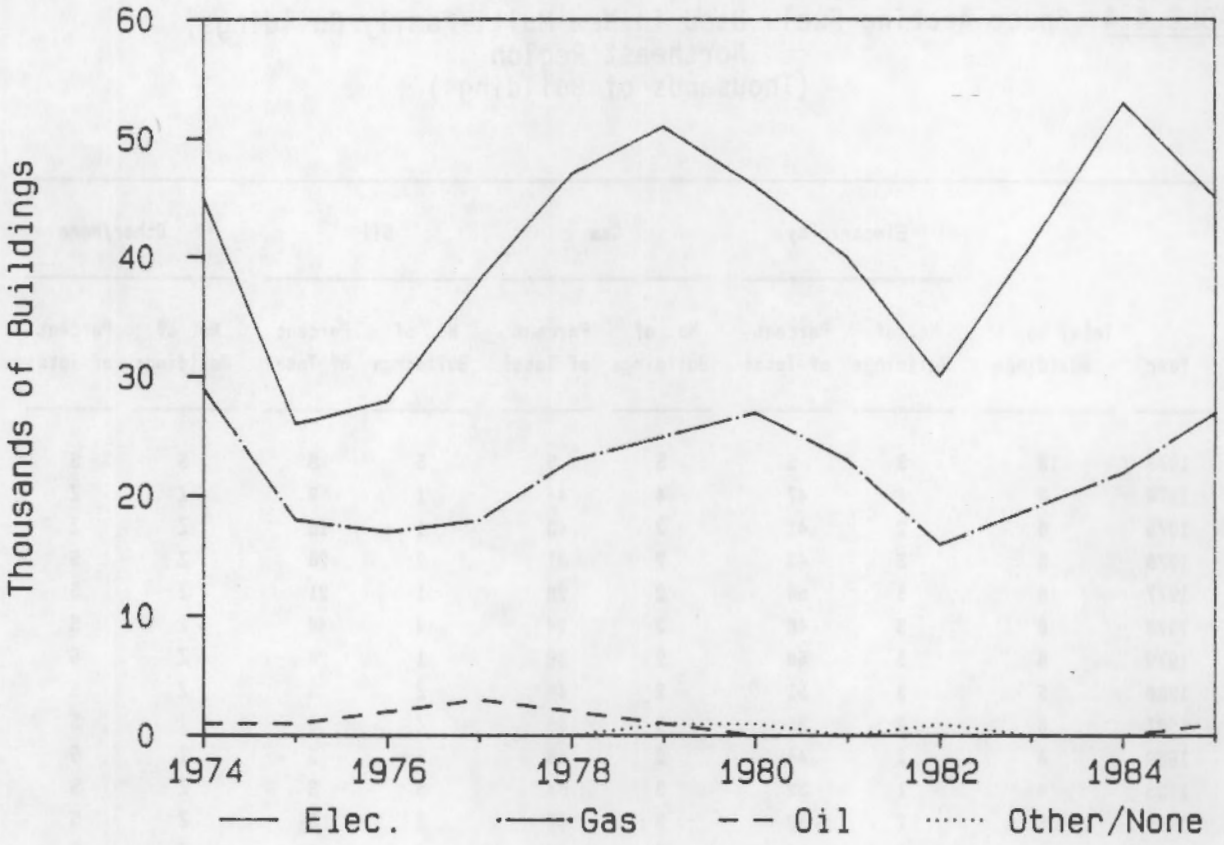

FIGURE 4.5 Space Heating Fuels Used in New Multi-Family Buildings in the U.S.

Space Heating Fuel Usage in New Multi-Family Buildings, Northeast Region

TABLE 4.4 Space heating Fuels Used in New Multi-Family Buildings, Northeast Region (Thousands of Buildings)

Year	Total No. of Buildings	Electricity		Gas		Oil		Other/None	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	13	S	S	S	S	S	S	S	S
1974	9	4	47	4	44	1	9	Z	Z
1975	6	2	41	2	43	1	16	Z	Z
1976	6	3	43	2	31	2	26	Z	S
1977	6	3	50	2	28	1	21	Z	S
1978	6	3	46	2	24	2	30	Z	S
1979	6	3	50	2	30	1	20	Z	S
1980	5	3	51	2	44	Z	S	Z	S
1981	5	2	35	3	56	Z	S	Z	S
1982	4	2	44	2	48	S	S	Z	S
1983	4	1	32	3	64	S	S	Z	S
1984	5	2	38	3	57	S	S	Z	S
1985	8	3	32	5	61	Z	S	Z	S
1986	9	3	28	6	66	Z	S	Z	S

Notes: B = insufficient sample size.
Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuel Usage in New Multi-Family Buildings, North Central Region

TABLE 4.5 Space Heating Fuels Used in New Multi-Family Buildings, North Central Region (Thousands of Buildings)

Year	Total No. of Buildings	Electricity		Gas		Oil		Other/None	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	17	S	S	S	S	S	S	S	S
1974	15	7	45	8	54	Z	Z	Z	Z
1975	11	5	48	5	51	Z	Z	Z	Z
1976	12	7	53	5	44	Z	S	Z	S
1977	13	7	55	5	39	1	8	Z	S
1978	17	10	58	7	40	Z	S	Z	S
1979	16	8	51	8	48	Z	S	Z	S
1980	14	8	54	7	46	Z	S	Z	S
1981	11	4	39	7	61	Z	S	Z	S
1982	7	2	33	5	64	S	S	Z	S
1983	8	3	35	5	65	S	S	Z	S
1984	8	4	46	5	54	S	S	Z	S
1985	9	5	52	4	47	Z	S	Z	S
1986	11	6	55	5	45	Z	S	Z	S

Notes: B = insufficient sample size.
Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuel Usage in New Multi-Family Buildings, Southern Region

TABLE 4.6 Space Heating Fuels Used in New Multi-Family Buildings, Southern Region (Thousands of Buildings)

Year	Total No. of Buildings	Electricity		Gas		Oil		Other/None	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	35	S	S	S	S	S	S	S	S
1974	31	24	78	7	22	Z	Z	Z	Z
1975	15	12	76	3	22	Z	Z	Z	Z
1976	13	10	76	3	21	Z	S	Z	S
1977	17	14	82	3	18	Z	S	Z	S
1978	24	21	88	3	12	Z	S	Z	S
1979	29	25	87	4	13	Z	S	Z	S
1980	31	25	80	6	20	Z	S	Z	S
1981	32	25	80	6	20	Z	S	Z	S
1982	25	21	82	5	18	S	S	Z	S
1983	34	29	85	5	14	S	S	Z	S
1984	43	37	86	6	13	S	S	Z	S
1985	34	28	83	6	16	Z	S	Z	S
1986	29	24	83	5	17	Z	S	Z	S

Notes: B = insufficient sample size.
Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuel Usage in New Multi-Family Buildings, Western Region

TABLE 4.7 Space Heating Fuels Used in New Multi-Family Buildings, Western Region (Thousands of Buildings)

Year	Total No. of Buildings	Electricity		Gas		Oil		Other/None	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	24	S	S	S	S	S	S	S	S
1974	19	9	48	10	52	Z	Z	Z	Z
1975	13	6	51	6	49	Z	Z	Z	Z
1976	16	9	57	7	42	Z	S	Z	S
1977	23	14	60	9	39	Z	S	Z	S
1978	25	14	55	11	44	Z	S	Z	S
1979	27	15	54	12	44	Z	S	Z	S
1980	22	10	46	11	51	Z	S	Z	S
1981	16	9	54	7	44	Z	S	Z	S
1982	11	6	51	5	48	S	S	Z	S
1983	14	7	54	6	44	S	S	Z	S
1984	19	10	52	9	47	S	S	Z	S
1985	22	9	41	13	57	Z	S	Z	S
1986	23	9	38	14	60	Z	S	Z	S

Notes: B = insufficient sample size.
Z = fewer than 500 buildings, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

4.4 AIR CONDITIONING EQUIPMENT IN NEW MULTI-FAMILY BUILDINGS

TABLE 4.8 Air Conditioning in All New Multi-Family Buildings (Thousands of Buildings)

Year	Total No. of Buildings	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	90	S	S	S	S
1974	75	57	76	18	24
1975	45	33	74	11	26
1976	48	32	67	16	33
1977	59	40	69	18	31
1978	73	51	70	22	30
1979	78	59	76	19	24
1980	74	58	79	16	21
1981	64	50	78	14	22
1982	47	39	83	8	17
1983	60	51	85	9	15
1984	76	65	86	11	14
1985	73	59	81	14	19
1986	72	60	83	12	17

Note: S = insufficient validity.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.9 Air Conditioning in New Multi-Family Buildings
Northeast Region
(Thousands of Buildings)

Year	Total No. of Buildings	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	13	S	S	S	S
1974	9	6	62	3	38
1975	6	4	64	2	36
1976	6	4	65	1	35
1977	6	4	66	2	34
1978	6	3	47	3	53
1979	6	4	65	2	35
1980	5	3	57	2	43
1981	5	3	51	2	49
1982	4	2	52	2	48
1983	4	2	48	2	52
1984	5	3	50	3	50
1985	8	4	49	4	51
1986	9	6	66	3	34

Note: S = Insufficient validity.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.10 Air Conditioning in New Multi-Family Buildings, North Central Region (Thousands of Buildings)

Year	Total No. of Buildings	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	17	S	S	S	S
1974	15	12	79	3	21
1975	11	8	78	2	22
1976	12	10	78	3	22
1977	13	10	78	3	22
1978	17	13	76	4	24
1979	16	13	77	4	23
1980	14	12	81	3	19
1981	11	8	75	3	25
1982	7	5	73	2	27
1983	8	6	78	2	22
1984	8	7	85	1	15
1985	9	8	90	1	10
1986	11	10	87	1	13

Note: S = Insufficient validity.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.11 Air Conditioning Equipment in New Multi-Family Buildings, Southern Region (Thousands of Buildings)

Year	Total No. of Buildings	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	35	S	S	S	S
1974	31	31	98	1	2
1975	15	15	96	1	4
1976	13	11	88	2	12
1977	17	16	96	1	4
1978	24	23	97	1	3
1979	29	28	96	1	4
1980	31	29	94	2	6
1981	32	29	93	2	7
1982	25	24	97	1	3
1983	34	33	97	1	3
1984	43	42	97	1	3
1985	34	32	95	2	5
1986	29	28	98	1	2

Note: S = Insufficient validity.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.12 Air Conditioning Equipment in New Multi-Family Buildings
Western Region
(Thousands of Buildings)

Year	Total No. of Buildings	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Buildings	Percent of Total	No. of Buildings	Percent of Total
1973	24	S	S	S	S
1974	19	9	47	10	53
1975	13	6	49	7	51
1976	16	7	43	9	57
1977	23	10	46	12	54
1978	26	12	48	14	52
1979	27	15	56	12	44
1980	22	14	62	8	38
1981	16	10	61	6	39
1982	11	8	70	3	30
1983	14	10	71	4	29
1984	19	14	70	6	30
1985	22	15	67	7	33
1988	23	16	68	7	32

Note: S = Insufficient validity.

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

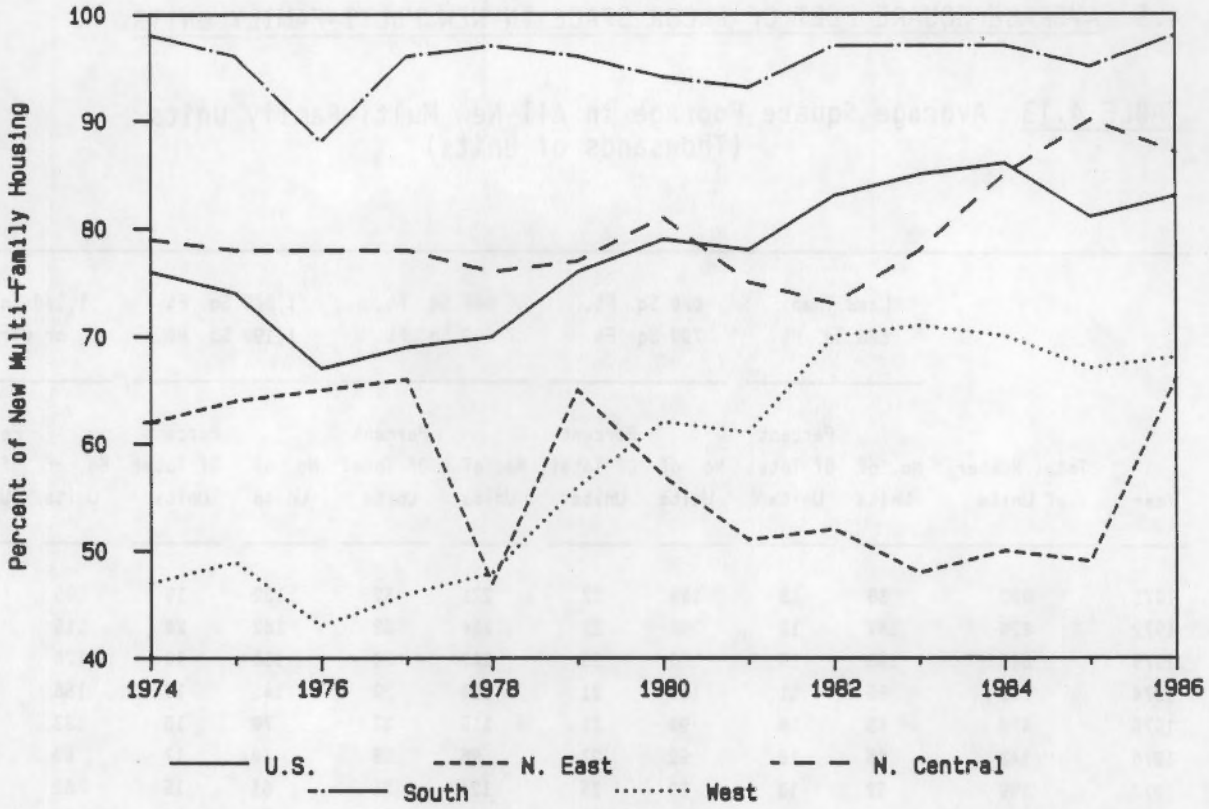

FIGURE 4.6 Air Conditioning in New Multi-Family Buildings, By Region

4.5 AVERAGE SQUARE FEET OF FLOOR SPACE IN NEW MULTI-FAMILY UNITS

TABLE 4.13 Average Square Footage in All New Multi-Family Units
(Thousands of Units)

		Less Than 600 Sq. Ft.		600 Sq. Ft. 799 Sq. Ft.		800 Sq. Ft. 899 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. or more	
Year	Total Number of Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1971	692	88	13	155	22	221	32	132	19	95	14
1972	828	102	12	186	22	264	32	162	20	115	14
1973	840	106	13	196	23	247	29	163	19	128	15
1974	760	85	11	159	21	220	29	141	19	156	21
1975	430	43	10	90	21	115	27	79	18	103	24
1976	343	36	10	92	27	96	28	60	17	59	17
1977	399	52	13	99	25	124	31	61	15	62	16
1978	498	63	13	144	29	144	29	75	15	73	15
1979	570	61	11	146	26	165	29	102	18	96	17
1980	545	53	10	129	24	155	28	102	19	106	19
1981	447	40	9	94	21	138	31	84	19	92	21
1982	374	33	9	75	20	124	33	61	16	80	21
1983	467	50	11	117	25	147	31	78	17	75	16
1984	627	64	10	180	29	194	31	104	17	86	14
1985	631	67	11	165	26	200	32	109	17	89	14
1986	636	64	10	176	28	198	31	113	18	85	13

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.14 Average Square Footage in New Multi-Family Units, Northeast Region (Thousands of Buildings)

Year	Total Number of Units	Less Than 600 Sq. Ft.		600 Sq. Ft. 799 Sq. Ft.		800 Sq. Ft. 899 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. or more	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1971	91	8	9	13	14	20	22	31	33	20	22
1972	132	17	13	23	18	39	29	30	22	24	18
1973	131	17	13	21	16	39	30	31	24	22	17
1974	95	11	11	16	17	29	31	21	22	18	19
1975	69	9	13	8	11	20	28	17	24	17	24
1976	50	5	9	6	12	14	28	13	26	13	26
1977	41	4	10	9	23	12	28	6	14	10	25
1978	41	3	6	17	42	9	22	6	14	7	17
1979	53	4	8	13	25	17	32	9	17	9	18
1980	46	4	8	14	31	12	26	7	15	9	20
1981	40	2	5	6	14	20	49	5	14	7	18
1982	41	5	13	6	14	17	42	5	13	8	18
1983	33	6	18	6	18	9	19	6	18	5	17
1984	40	5	13	10	26	10	24	6	15	9	22
1985	46	7	16	7	16	9	19	10	22	13	27
1986	61	4	7	8	13	13	21	15	25	20	33

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.15 Average Square Footage in New Multi-Family Units, North Central Region (Thousands of Units)

Year	Total Number of Units	Less Than 600 Sq. Ft.		600 Sq. Ft. 799 Sq. Ft.		800 Sq. Ft. 899 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. or more	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1971	148	26	18	32	23	46	33	23	17	13	9
1972	174	28	16	33	19	55	31	36	21	22	12
1973	175	18	10	37	21	53	30	34	20	31	18
1974	152	23	15	31	20	48	32	27	18	23	15
1975	93	8	8	23	25	31	33	15	16	16	17
1976	84	7	8	25	30	26	31	16	19	9	11
1977	99	14	14	23	23	38	38	16	16	9	9
1978	117	16	14	31	27	37	31	18	15	15	13
1979	121	13	11	36	30	32	26	22	18	19	15
1980	104	12	12	19	19	33	31	24	24	15	14
1981	78	9	11	16	20	24	31	17	22	12	16
1982	51	4	8	8	17	19	38	10	19	9	18
1983	59	2	4	14	24	19	31	15	26	9	15
1984	65	4	6	19	29	19	29	13	20	11	16
1985	79	3	4	18	23	24	30	23	29	11	14
1986	100	9	9	31	31	25	25	20	20	15	15

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues

TABLE 4.16 Average Square Footage of New Multi-Family Units, Southern Region (Thousands of Units)

Year	Total Number of Units	Less Than 600 Sq. Ft.		600 Sq. Ft. 799 Sq. Ft.		800 Sq. Ft. 899 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. or more	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1971	260	31	12	52	20	87	33	47	18	43	16
1972	304	33	11	67	32	93	30	61	20	51	17
1973	333	44	13	72	22	94	28	69	21	55	16
1974	344	35	10	70	20	95	28	66	19	78	23
1975	184	14	9	34	21	38	23	32	20	46	28
1976	103	10	10	29	28	27	26	18	17	20	19
1977	125	14	11	30	24	39	31	21	16	21	17
1978	181	21	12	56	31	52	29	28	15	24	13
1979	227	23	10	55	24	67	30	43	19	38	17
1980	242	22	9	58	24	68	28	44	18	50	21
1981	218	17	8	52	24	63	29	40	18	46	21
1982	199	16	8	43	22	65	32	32	16	44	22
1983	270	27	10	70	26	86	32	40	15	47	18
1984	358	39	11	104	29	109	30	58	16	48	13
1985	298	34	11	81	27	91	30	48	16	45	15
1986	259	29	11	71	27	83	32	45	17	31	12

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.17 Average Square Footage of New Multi-Family Units, Western Region (Thousands of Buildings)

Year	Total Number of Units	Less Than 600 Sq. Ft.		600 Sq. Ft. 799 Sq. Ft.		800 Sq. Ft. 899 Sq. Ft.		1,000 Sq. Ft. 1,199 Sq. Ft.		1,200 Sq. Ft. or more	
		No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units	No. of Units	Percent Of Total Units
1971	201	23	17	59	29	68	34	31	15	19	10
1972	218	24	11	62	29	77	36	35	16	19	9
1973	202	27	13	66	33	61	30	29	14	19	10
1974	170	16	9	42	25	48	28	28	16	36	22
1975	103	12	12	25	24	26	25	16	16	25	24
1976	106	13	13	32	30	29	27	14	14	18	17
1977	133	20	15	37	28	36	27	19	15	22	16
1978	160	23	14	40	25	47	29	24	15	27	17
1979	169	20	12	41	25	49	29	28	17	30	18
1980	153	15	10	38	25	42	28	27	17	32	21
1981	111	11	10	20	18	31	28	22	20	26	24
1982	82	8	10	17	21	23	28	14	17	20	24
1983	104	15	15	27	26	33	32	16	16	13	12
1984	164	16	10	46	28	57	34	26	16	19	11
1985	207	24	11	58	28	77	37	28	14	21	10
1986	218	22	10	66	31	76	35	32	15	19	9

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

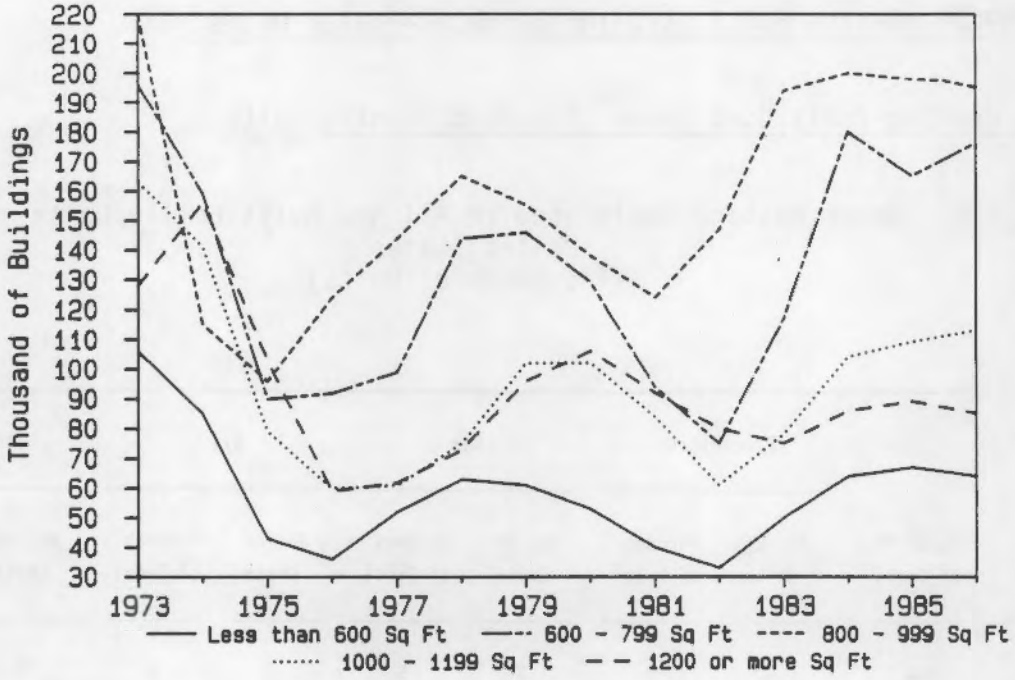

FIGURE 4.7 Number of New Multi-Family Units, by Square Footage Category (Thousands of Units)

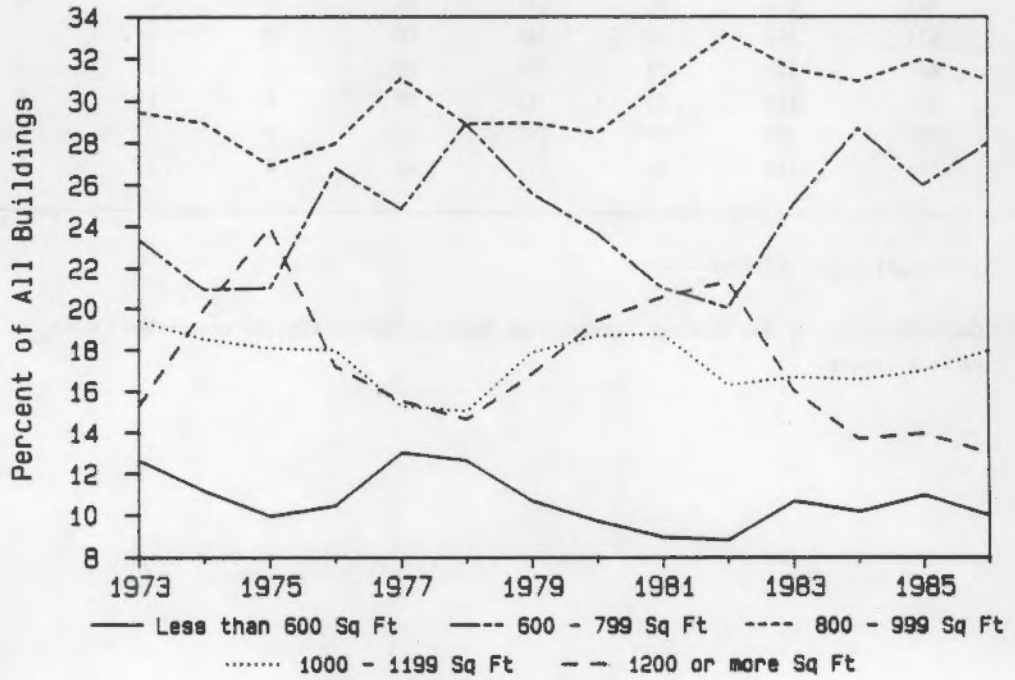

FIGURE 4.8 Units per Size Category as a Percentage of Total Units

4.6 SPACE HEATING FUELS USED IN NEW MULTI-FAMILY UNITS

Space Heating Fuels Used In All New Multi-Family Units

TABLE 4.18 Space Heating Fuels Used in All New Multi-Family Units, United States (Thousands of Units)

		Electricity		Gas		Oil		Other/None	
Year	Total No. of Units	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1973	840	S	S	S	S	S	S	S	S
1974	760	455	60	269	35	29	4	7	1
1975	430	253	59	141	33	29	7	7	2
1976	343	202	59	113	33	24	7	3	1
1977	399	261	66	115	29	18	5	4	1
1978	490	339	68	131	26	24	5	5	1
1979	570	386	68	150	26	27	5	6	1
1980	545	362	66	165	30	12	2	6	1
1981	447	293	66	142	32	7	2	4	1
1982	374	255	68	103	28	9	3	7	2
1983	467	327	70	133	28	3	1	4	1
1984	827	452	72	165	26	5	1	5	1
1985	631	425	67	197	31	3	Z	5	1
1986	635	400	63	221	35	8	1	7	1

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

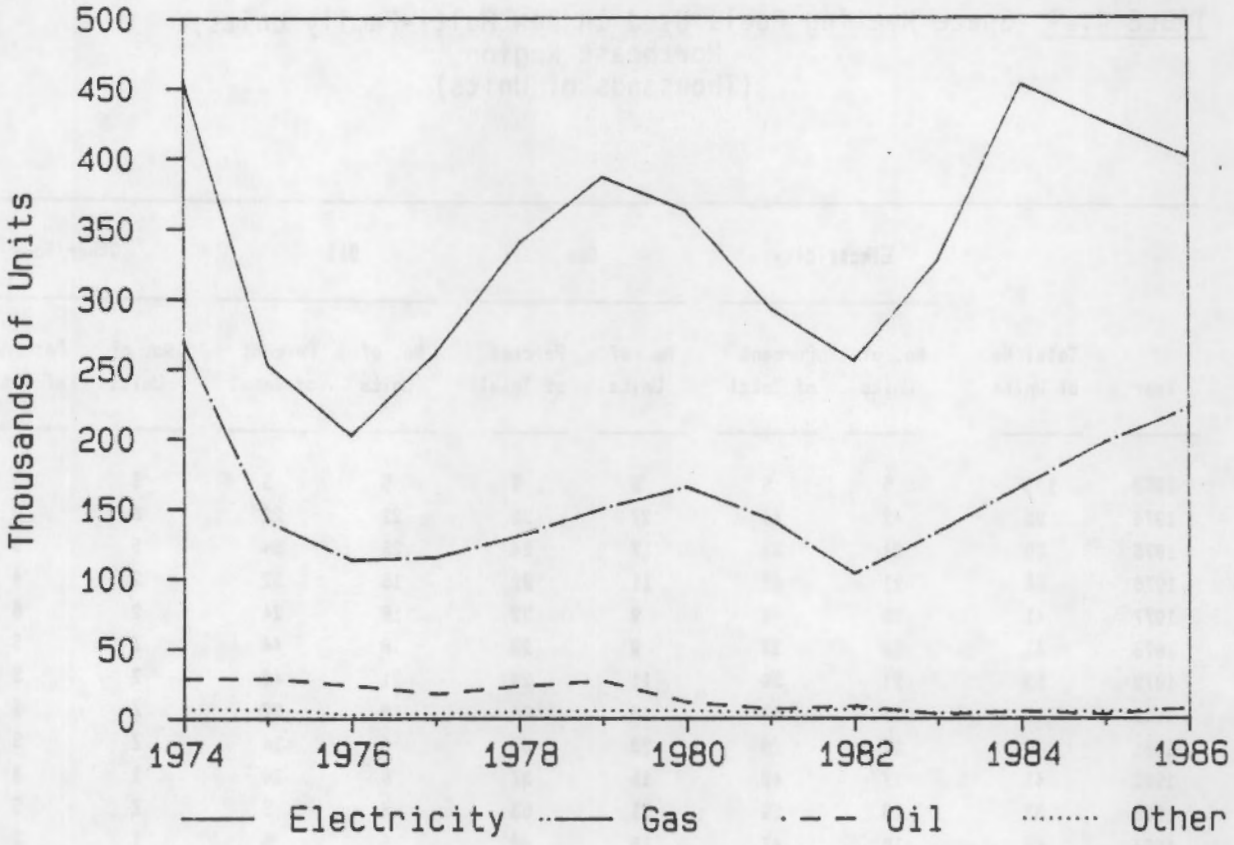

FIGURE 4.9 Space Heating Fuel Use in New Multi-Family Units

Space Heating Fuels Used In New Multi-Family Units, Northeast Region

TABLE 4.19 Space Heating Fuels Used In New Multi-Family Units, Northeast Region (Thousands of Units)

Year	Total No. of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1973	131	S	S	S	S	S	S	S	S
1974	95	42	44	27	28	21	22	6	6
1975	69	24	35	17	24	23	34	5	8
1976	50	21	42	11	22	16	32	2	4
1977	41	20	48	9	22	10	24	2	6
1978	41	13	33	9	23	18	44	Z	S
1979	53	21	39	11	20	21	40	Z	S
1980	46	20	43	16	34	10	22	Z	S
1981	40	11	28	23	58	5	14	Z	S
1982	41	17	40	15	37	8	20	1	3
1983	33	9	29	21	63	S	S	Z	S
1984	40	18	47	16	40	S	S	1	2
1985	46	17	36	25	55	3	6	1	3
1986	61	19	31	33	54	7	6	2	3

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuels Used In New Multi-Family Units, North Central Region

TABLE 4.20 Space Heating Fuels Used in New Multi-Family Units, North Central Region (Thousands of Units)

Year	Total No. of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1973	175	S	S	S	S	S	S	S	S
1974	152	60	39	90	59	1	1	1	1
1975	93	45	49	47	50	Z	Z	1	1
1976	84	44	52	39	46	1	2	Z	S
1977	99	54	55	39	39	6	6	Z	S
1978	117	70	60	44	38	2	2	Z	S
1979	121	69	57	50	41	2	1	1	1
1980	104	57	55	46	45	Z	S	1	1
1981	78	36	46	42	54	Z	S	Z	S
1982	51	17	33	32	63	S	S	2	3
1983	59	22	37	37	62	S	S	1	1
1984	65	32	49	34	51	S	S	Z	S
1985	79	42	53	36	46	Z	S	1	1
1986	100	56	53	43	46	Z	S	1	1

Note: Z = fewer than 500 units, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuels Used in New Multi-Family Units, Southern Region

TABLE 4.21 Space Heating Fuels Used in New Multi-Family Units, Southern Region (Thousands of Units)

Year	Total No. of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1973	333	S	S	S	S	S	S	S	S
1974	344	263	76	73	21	7	2	Z	Z
1975	164	129	78	30	18	5	3	Z	Z
1976	103	78	76	19	18	6	6	1	1
1977	125	106	85	16	13	3	2	Z	S
1978	181	161	89	16	9	3	2	1	1
1979	227	200	88	22	10	4	2	2	1
1980	242	203	84	36	15	2	1	Z	S
1981	218	184	84	33	15	1	1	Z	S
1982	199	176	88	21	11	S	S	1	2
1983	270	238	88	31	12	S	S	1	Z
1984	358	312	87	46	13	S	S	Z	S
1985	298	263	88	34	12	Z	S	1	Z
1986	259	224	87	33	13	Z	S	1	Z

Note: Z = fewer than 500 units, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

Space Heating Fuels Used In New Multi-Family Units, Western Region

TABLE 4.22 Space Heating Fuels Used in New Multi-Family Units, Western Region (Thousands of Units)

Year	Total No. of Units	Electricity		Gas		Oil		Other/None	
		No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total	No. of Units	Percent of Total
1973	202	S	S	S	S	S	S	S	S
1974	170	90	53	79	47	Z	Z	Z	Z
1975	103	55	53	48	46	Z	Z	Z	Z
1976	106	60	57	45	42	Z	S	Z	S
1977	133	81	61	51	38	Z	S	1	1
1978	160	95	59	61	38	Z	S	4	2
1979	169	97	58	68	40	Z	S	4	2
1980	153	81	53	67	44	Z	S	S	3
1981	111	63	56	44	40	Z	S	4	4
1982	82	45	55	34	42	S	S	3	4
1983	104	58	55	44	42	S	S	3	2
1984	164	90	55	70	43	S	S	4	2
1985	207	103	50	101	49	Z	S	3	1
1986	216	101	47	112	52	Z	S	3	1

Note: Z = fewer than 500 units, or less than 0.5 percent
S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

4.7 AIR CONDITIONING IN NEW MULTI-FAMILY UNITS

TABLE 4.23 Air Conditioning in All New Multi-Family Units, United States (Thousands of Units)

Year	Total No. of Units	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1973	840	S	S	S	S
1974	760	653	86	107	14
1975	430	367	85	63	15
1976	343	259	75	84	25
1977	399	319	80	81	20
1978	498	392	79	107	21
1979	570	475	83	95	17
1980	545	460	84	85	16
1981	447	383	86	65	14
1982	374	327	87	47	13
1983	467	414	89	53	11
1984	627	561	89	66	11
1985	631	553	88	78	12
1986	636	558	88	78	12

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.24 Air Conditioning in New Multi-Family Units, Northeast Region (Thousands of Units)

Year	Total No. of Units	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1973	131	S	S	S	S
1974	95	79	84	16	16
1975	69	62	89	11	11
1976	50	39	78	11	22
1977	41	35	84	7	16
1978	41	22	55	18	45
1979	53	43	81	10	19
1980	46	35	77	11	23
1981	40	32	79	8	21
1982	41	29	69	13	31
1983	33	20	60	13	40
1984	40	26	65	14	35
1985	46	31	68	15	32
1986	61	50	68	11	32

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.25 Air Conditioning in New Multi-Family Units, North Central Region (Thousands of Units)

Year	Total No. of Units	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1973	175	S	S	S	S
1974	152	134	88	19	12
1975	93	83	88	12	12
1976	84	71	85	13	15
1977	99	86	86	14	14
1978	117	98	84	19	16
1979	121	98	81	23	19
1980	104	89	85	15	15
1981	78	64	83	14	17
1982	51	41	80	10	20
1983	59	48	81	11	19
1984	65	59	90	7	10
1985	79	75	95	4	5
1986	100	94	95	5	5

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.26 Air Conditioning in New Multi-Family Units, Southern Region (Thousands of Units)

Year	Total No. of Units	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1973	333	S	S	S	S
1974	344	338	98	5	2
1975	164	162	99	2	1
1976	103	96	93	7	7
1977	125	122	98	2	2
1978	181	178	98	3	2
1979	227	224	99	3	1
1980	242	231	96	11	4
1981	218	211	97	7	3
1982	199	195	98	4	2
1983	270	266	99	4	1
1984	358	353	99	5	1
1985	298	292	98	6	2
1986	259	256	99	3	1

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

TABLE 4.27 Air Conditioning in New Multi-Family Units, Western Region (Thousands of Units)

Year	Total No. of Units	Installed Air Conditioning		Uninstalled Air Conditioning	
		No. of Units	Percent of Total	No. of Units	Percent of Total
1973	202	S	S	S	S
1974	170	101	60	69	40
1975	103	61	59	42	41
1976	106	54	51	52	49
1977	133	75	56	58	44
1978	160	93	58	67	42
1979	169	110	65	59	35
1980	153	105	68	48	32
1981	111	75	68	36	32
1982	82	62	75	20	25
1983	104	80	76	25	24
1984	164	123	75	41	25
1985	207	154	74	53	26
1986	216	158	74	58	26

Note: S = insufficient validity

Source: Characteristics of New Housing, Construction Reports, Series C25, Bureau of the Census, various issues.

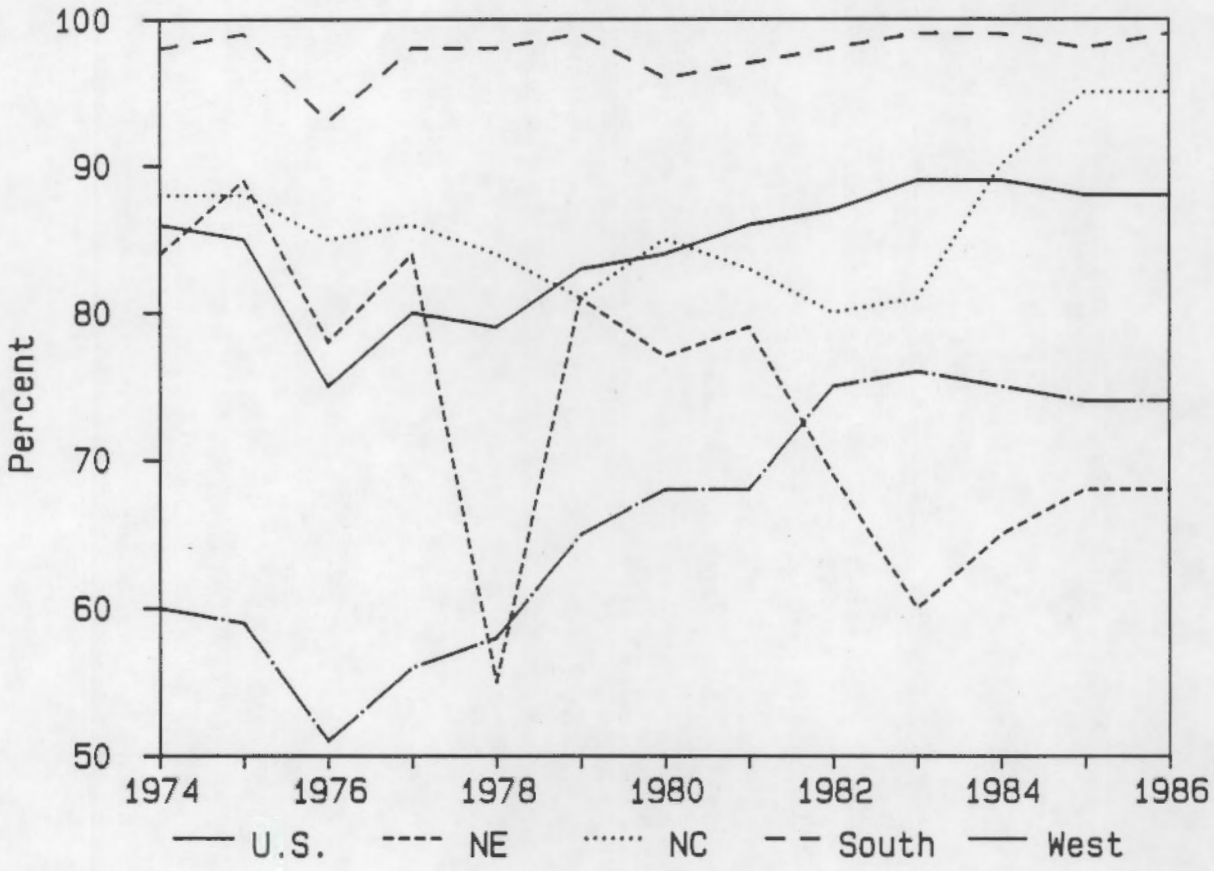

FIGURE 4.10 Air Conditioning in New Multi-Family Units, by Region

CHAPTER FIVE: HOUSEHOLD APPLIANCES

This chapter provides information on the possession and energy efficiency of various household appliances, including heating and cooling equipment. Data for this chapter was taken primarily from the Annual Energy Review, a publication of the Energy Information Administration, Facts on Major Home Appliance Energy Consumption and Efficiency Trends, a publication of the Association of Home Appliance Manufacturers, and The Behavior of Energy Efficiency in the Purchase of Appliances and Home Heating and Cooling Equipment, a publication of Lawrence Berkeley Laboratory. At the time that this edition of the Residential and Commercial Buildings Data Book was produced this was the most current information available.

This chapter is comprised of the following sections:

5.1 HOUSEHOLD APPLIANCE SATURATION LEVELS: 1978 and 1984

TABLE 5.1 Household Appliance Saturation Levels, 1978 and 1984

Appliance	Million Households		Percentage of Households	
	1978	1984	1978	1984
Total Households	76.6	86.3	100	100
Electric Appliances				
Television Set (Color)	N/A	75.9	N/A	88
Television Set (B/W)	N/A	37.3	N/A	43
Clothes Washer	57.4	63.8	75	74
Range (Stove-Top or Burners)	40.7	46.5	53	54
Oven	41.5	54.2	54	63
Microwave	6.0	29.6	8	34
Clothes Dryer	34.5	39.6	45	46
Separate Freezer	27.0	31.7	35	37
Dishwasher	26.5	32.5	35	38
Gas Appliances				
Range (Stove-Top or Burners)	36.9	39.0	48	45
Oven	35.9	35.9	47	42
Clothes Dyer	11.0	13.7	14	16
Refrigerators				
One	66.0	75.8	86	88
Two or more	10.4	10.3	14	12
Air Conditioning (A/C)				
Central	17.6	25.7	23	30
Individual Room Units	25.1	25.8	33	30
None	33.8	34.9	44	40

Source: Annual Energy Review, U.S. DOE/EIA, May 1987.

5.2 BUILDER-INSTALLED APPLIANCES IN NEW HOUSING

TABLE 5.2 Builder-Installed Appliances in New Housing, 1979

New Private Housing Completions in 1979: 1,870,800 (1)

Type of Appliance	% of Total New Housing Units (2)	% of Appliances Installed in New Homes (3) (Thousands)	Total # of Appliances Sold in 1979 (4) (Thousands)	Builder Installed Appliances as a Percent of Total (5)
Refrigerators	35.6	665.7	5301.8	12.6
Freezers	NA	NA	1773.6	0.0
Room Air Conditioners	2.8	51.6	2830.4	1.8
Dryers	7.7	144.5	3475.0	4.2
Elec. Ranges and Ovens	67.9	1270.7	2977.2	42.7
Microwave Ovens	0.1	2.6	2447.0	0.1
Dishwashers	72.2	1350.2	3388.2	39.9
Washers	7.0	131.5	4601.0	2.9

Notes:
1) As published in April, 1982 Economic Indicators prepared by the Council of of Economic Advisors.
2) 1979 Housing Industry Dynamics Survey of Builder Installation Pratices, approximately 4,500 responses.
3) Calculated using the percentages in column 1 and the figure for new private housing completions in 1979.
4) Association of Home Appliance Manufacturers reports of 1979 total industry distributor sales.
5) Data in column 2 divided by data in column 3.

Source: Facts on Major Home Appliance Energy Consumption and Efficiency Trends, Association of Home Appliance Manufacturers, January 1985.

5.3 TRENDS IN HOUSEHOLD APPLIANCE ENERGY EFFICIENCY AND ENERGY CONSUMPTION

TABLE 5.3 Shipment Weighted Energy Factors for Household Appliances

Appliance		Adjusted Volume Per Unit (cu. ft.)	% Change in Volume Since 1972	Energy Consumption Per Unit (kwh/Yr.)	% Change In Consumption Since 1972	Efficiency (Energy Factor, EER)	% Change In Efficiency Since 1972	Capacity Per Unit (BTUs/Hr.)	% Change I Capacity Since 1972
Refrigerators	1972	18.16	--	1726.45	--	3.84	--	--	--
	1978	19.73	8.6	1425.70	-15.9	4.96	29.0	--	--
	1980	19.61	7.9	1277.50	-26.0	5.59	45.6	--	--
	1981	19.86	9.4	1189.54	-31.1	6.09	58.6	--	--
	1982	19.97	10.0	1190.70	-31.0	6.12	59.4	--	--
	1983	20.31	11.8	1160.21	-32.8	6.39	66.4	--	--
Freezers	1972	29.18	--	1460.00	--	7.29	--	--	--
	1978	26.84	-8.0	985.50	-32.5	9.92	36.1	--	--
	1980	26.26	-10.0	883.30	-39.5	10.85	48.8	--	--
	1981	25.53	-12.5	837.14	-42.7	11.13	52.7	--	--
	1982	25.11	-13.9	812.85	-44.3	11.28	54.7	--	--
	1983	25.28	-13.4	813.33	-44.3	11.34	55.6	--	--
Dishwashers	1972	--	--	4.17*	--	--	--	--	--
	1979	--	--	3.23*	22.5	0.24	29.2	--	--
	1982	--	--	2.87*	31.2	0.31	45.8	--	--
	1983	--	--	2.70*	35.3	0.35	54.2	--	--
Clothes Washers	1972	2.44	--	3.81*	--	0.64	--	--	--
	1979	2.56	4.9	2.80*	-26.5	0.91	42.2	--	--
	1981	2.52	3.3	2.59*	-32.0	0.97	51.6	--	--
	1983	2.54	4.1	2.57*	-32.5	0.99	54.7	--	--
Room Air Conditioners	1972	--	--	1281.80	--	5.98#	--	10226.80	--
	1978	--	--	1209.20	-5.7	6.72#	12.2	10827.60	5.9
	1980	--	--	1134.20	-11.5	7.02#	17.3	10606.60	3.7
	1981	--	--	1161.10	-9.4	7.06#	18.1	10924.40	6.8
	1982	--	--	1135.00	-11.5	7.14#	19.4	10801.40	5.6
	1983	--	--	1087.80	-15.1	7.29#	21.9	10566.30	3.3

Note: * = kwh/cycle.
= EER, energy efficiency ratio.

Source: Facts on Major Home Appliance Energy Consumption and Efficiency Trends, Association of Home Appliance Manufacturers, January 1985.

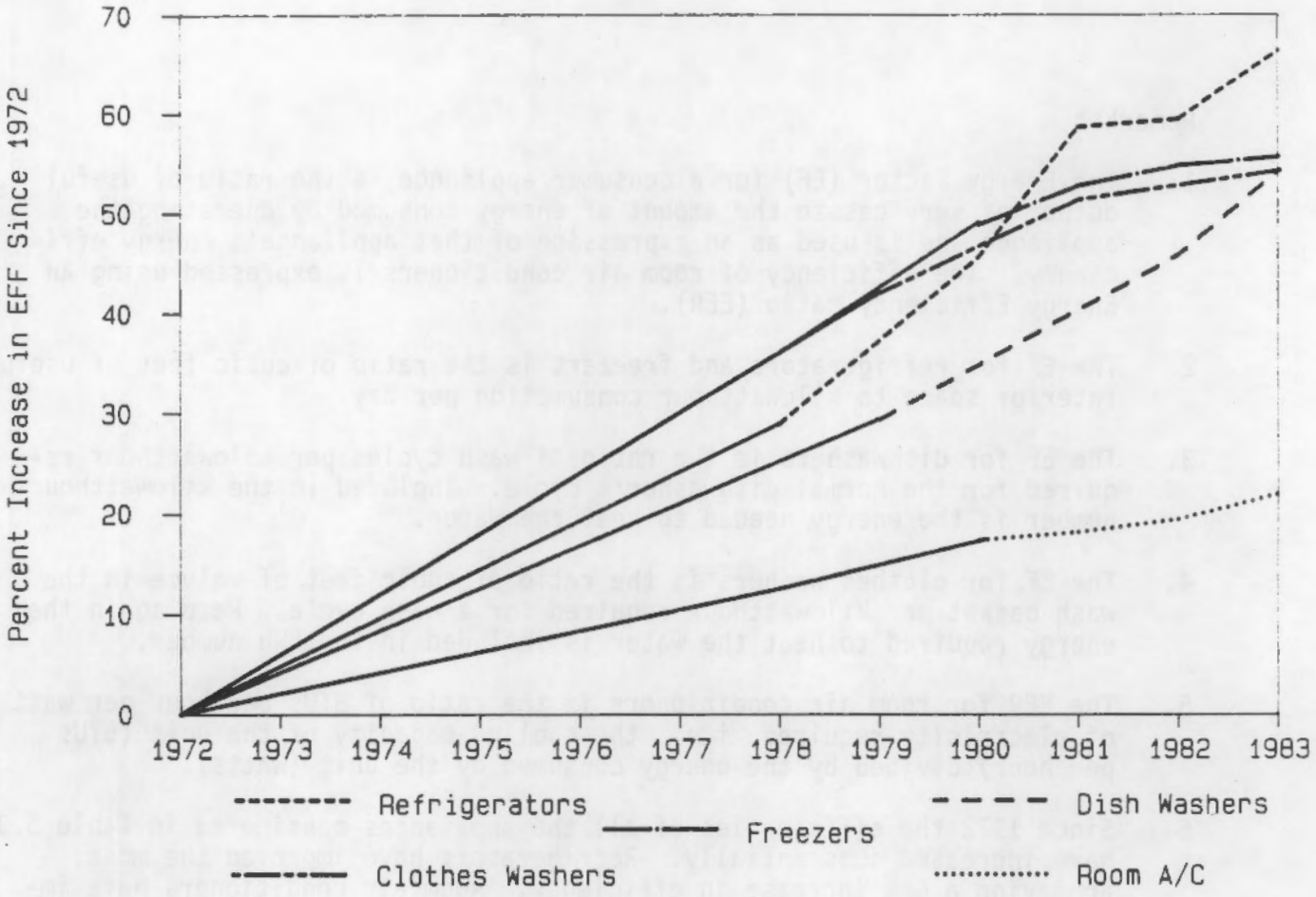

FIGURE 5.1 Percentage Increase in the Efficiency of Major Appliances

Remarks:

1. The Energy Factor (EF) for a consumer appliance is the ratio of useful output of services to the amount of energy consumed by operating the appliance and is used as an expression of that appliance's energy efficiency. The efficiency of room air conditioners is expressed using an Energy Efficiency Ratio (EER).

2. The EF for refrigerators and freezers is the ratio of cubic feet of useful interior space to kilowatthour consumption per day.

3. The EF for dishwashers is the ratio of wash cycles per kilowatthour required for the normal dishwasher's cycle. Included in the kilowatthour number is the energy needed to heat the water.

4. The EF for clothes washers is the ratio of cubic feet of volume in the wash basket per kilowatthour required for a wash cycle. Here again the energy required to heat the water is included in the kWh number.

5. The EER for room air conditioners is the ratio of BTUs per hour per watt of electricity required, i.e., the cooling capacity of the unit (BTUs per hour) divided by the energy consumed by the unit (watts).

6. Since 1972 the efficiencies of all the appliances considered in Table 5.3 have increased substantially. Refrigerators have improved the most, achieving a 66% increase in efficiency. Room air conditioners have improved the least with a 22% gain in efficiency.

7. According to the Association of Home Appliance Manufacturers (AHAM), some reasons for the improvements in efficiency are:

    - Refrigerators and Freezers -- improved insulation, door gaskets, compressors, and evaporator and condensor heat transfer systems.

    - Dishwashers -- reduced hot water usage due to improvements in water circulation, reduced inflow rate of hot water, and the use of built-in water-heating elements.

    - Clothes Washer -- fewer warm rinse options, multiple water level settings, and better water extraction for more efficient drying.

    - Room Air Conditioners -- improved compressors, air circulation, and evaporator and condensor heat transfer systems.

5.4 SHIPMENT WEIGHTED ENERGY FACTORS FOR MAJOR HOUSEHOLD APPLIANCES

TABLE 5.4 Efficiencies of New Appliances and Home Heating & Cooling Equipment Shipment Weighted Energy Factors (SWEF)

Appliance	Source	1972	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
Gas Central	CS-179	82.7	--	--	--	83.8	--	85.9	--	--	--	--
Space Heater	Lennox	--	85.0	85.0	85.1	85.5	86.3	86.6	87.0	--	--	--
(AFEU %)	Carrier	--	--	--	--	85.1	86.3	86.7	86.5	--	--	--
	LBL	--	--	--	--	--	--	--	--	--	89.6	73.0
Oil Central	CS-179	73.8	--	--	--	75.0	--	76.0	--	--	--	--
Space Heater	LBL	--	--	--	--	--	--	--	--	--	78.3	78.6
(AFUE %)												
Room Air Conditioner	CS-179	6.2	--	--	--	6.8	--	7.0	--	--	--	--
(EER)	AHAM	6.0	--	--	--	6.7	--	7.0	7.1	--	7.3	7.5
Central Air Conditioner	CS-179	6.7	--	--	--	7.0	--	7.8	--	--	--	--
(SEER)	Lennox	--	6.2	6.9	7.0	7.0	7.1	7.1	7.7	8.2	--	--
	ARI	--	--	7.0	7.1	7.3	7.5	7.6	7.8	8.2	8.4	8.6
Electric Water Heater	CS-179	79.8	--	--	--	80.7	--	81.3	--	--	--	--
(Percent)	LBL	--	--	--	--	--	--	--	--	--	83.6*	--
Gas Water Heater	CS-179	47.4	--	--	--	48.2	--	51.2	--	--	--	--
(Percent)												
Refrigerator	CS-179	4.2	--	--	--	5.1	--	5.7	--	--	--	--
(Cu. Ft./kwH/Day)	AHAM	3.8	--	--	--	5.0	--	5.6	6.1	--	6.4	6.6
Freezer	CS-179	8.1	--	--	--	10.1	--	10.8	--	--	--	--
(Cu. Ft./kwH/Day)	AHAM	7.3	--	--	--	9.9	--	10.9	11.3	--	11.4	11.6

* Does not include heat pump water heater.

Data Sources: AHAM - Association of Home Appliance Manufacturers
ARI - Air Conditioning and Refrigeration Institute
Carrier - Carrier Corporation
CS-179 - DOE Survey of Manufacturers
Lennox - Lennox Corporation

Source: The Behavior of the Market for Energy Efficiency in Residential Appliances Including Heating and Cooling Equipment, Lawrence Berkeley Laboratory, September 1984.

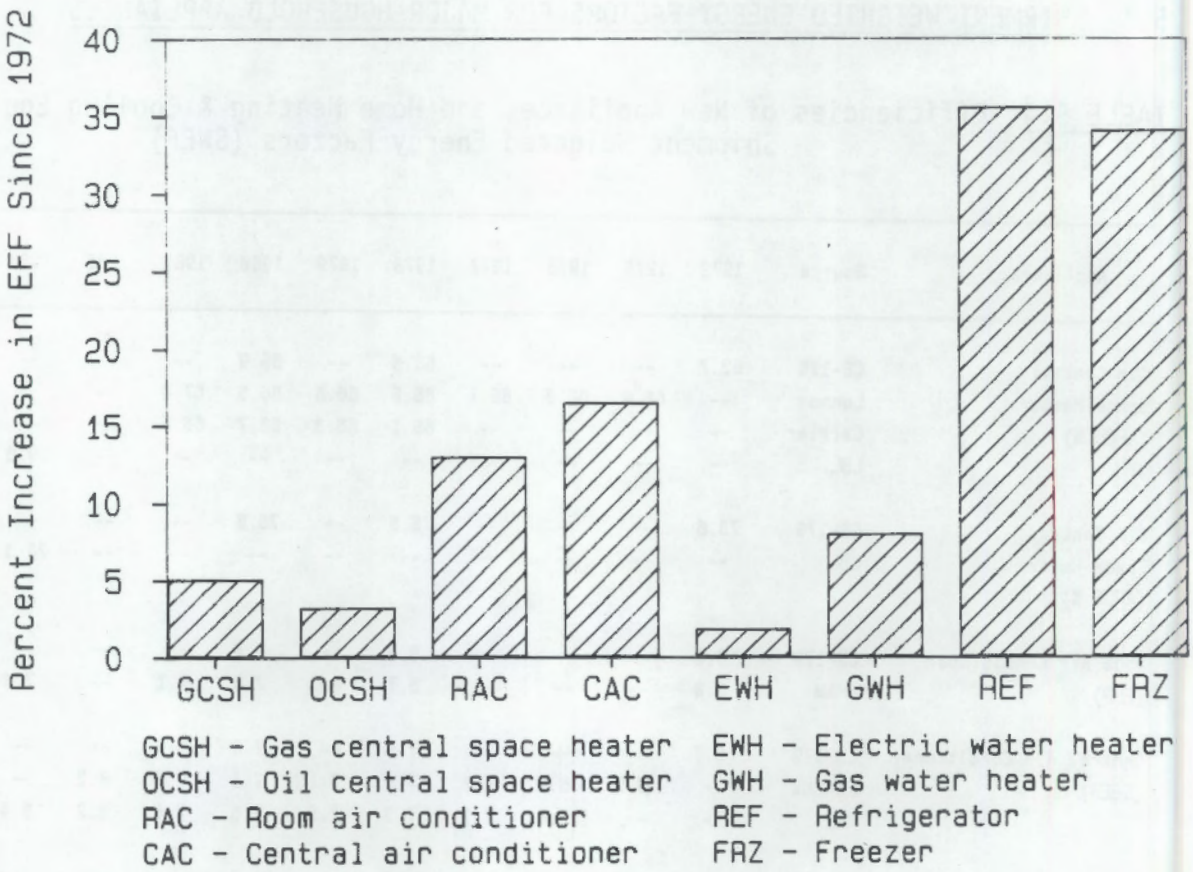

FIGURE 5.2 Percentage Improvements in Appliance Efficiency Between 1972 and 1980

Remarks:

1. Figure 5.2 shows the percentage increase in energy efficiency for certain classes of home appliances between 1972 and 1980. The information is originally from CS-179, a US Department of Energy report.

2. Figure 5.2 demonstrates that there were wide discrepancies in efficiency improvements between the various appliance types. According to CE-179, the efficiency of refrigerators and freezers, as measured by shipment weighted energy factors, increased by 36% and 33%, respectively. On the other hand, the efficiency of electric water heaters increased by only 2% during the same period.

3. The information provided by Lennox, Carrier, AHAM, and ARI, which is also on Table 5.4, varies somewhat from the DOE data. Most significantly, the AHAM data for refrigerators and freezers indicates that their efficiencies increased by 47% and 49%, respectively, for the period of 1972 -1980. The major difference with the DOE data is in the shipment weighted energy factors assigned to the appliances in 1972.

CHAPTER SIX: RESIDENTIAL SECTOR ENERGY CONSUMPTION AND PRICES

This chapter provides information on the amount of energy consumed by the residential sector, the types of fuels consumed, their prices, and total energy- related expenditures made by the sector. Data for this chapter were taken primarily from the Annual Energy Review, a publication of the Energy Information Administration, Facts on Major Home Appliance Energy Consumption and Efficiency Trends, a publication of the Association of Home Appliance Manufacturers, and The Behavior of Energy Efficiency in the Purchase of Appliances and Home Heating and Cooling Equipment, a publication of Lawrence Berkeley Laboratory.

This chapter is comprised of the following sections:

6.1 HISTORIC RESIDENTIAL SECTOR ENERGY CONSUMPTION

TABLE 6.1 Residential Sector Energy Consumption, by Fuel Type, 1960 - 1985 (Trillion BTUs)

Year	Fuel Type				Total End-Use Energy Consumed	Electrical Energy Losses	Primary Energy Consumed
	Coal	Gas	Petroleum	Electricity			
1960	408.3	3,211.8	2,265.3	687.4	6,572.8	1,711.6	8,284.4
1961	372.0	3,362.3	2,331.9	731.7	6,797.9	1,784.2	8,582.1
1962	356.7	3,600.3	2,440.9	794.3	7,192.2	1,910.1	9,102.3
1963	389.6	3,695.3	2,459.4	855.6	7,319.9	2,046.7	9,366.6
1964	272.0	3,899.6	2,375.0	927.5	7,474.1	2,210.3	9,684.4
1965	254.0	4,019.3	2,480.6	992.9	7,746.8	2,371.9	10,118.7
1966	245.8	4,266.5	2,470.7	1,081.2	8,058.2	2,596.8	10,654.0
1967	211.1	4,439.8	2,556.8	1,160.5	8,368.2	2,774.2	11,142.4
1968	191.1	4,578.4	2,685.2	1,301.9	8,756.6	3,108.1	11,864.7
1969	177.7	4,864.4	2,738.7	1,456.0	9,236.8	3,479.9	12,716.7
1970	153.4	4,952.4	2,755.2	1,591.0	9,452.0	3,857.7	13,309.7
1971	144.5	5,092.4	2,777.1	1,704.4	9,718.4	4,123.3	13,841.7
1972	111.0	5,258.9	2,895.4	1,837.7	10,101.0	4,416.7	14,517.7
1973	105.2	5,000.5	2,825.2	1,976.3	9,907.2	4,734.8	14,642.0
1974	103.8	4,898.0	2,573.5	1,972.8	9,548.1	4,813.0	14,361.1
1975	84.7	5,024.1	2,494.9	2,006.7	9,610.4	4,843.0	14,453.4
1976	82.4	5,148.7	2,720.4	2,069.2	10,020.7	4,985.2	15,005.9
1977	83.5	4,914.4	2,695.0	2,201.6	9,894.5	5,317.0	15,211.5
1978	84.6	4,986.9	2,619.9	2,301.3	9,992.7	5,631.9	15,624.6
1979	73.6	5,052.4	2,113.7	2,329.8	9,569.5	5,624.7	15,194.2
1980	60.3	4,855.4	1,747.9	2,448.1	9,111.7	5,955.4	15,067.1
1981	71.3	4,652.1	1,543.4	2,464.4	8,731.2	5,874.7	14,605.9
1982	76.8	4,750.7	1,441.0	2,489.1	8,757.6	5,974.9	14,732.5
1983	76.9	4,514.5	1,362.2	2,562.2	8,515.8	6,128.5	14,644.3
1984	83.5	4,685.0	1,426.5	2,653.4	8,848.4	6,177.7	15,026.1
1985	70.3	4,572.9	1,536.9	2,698.8	8,878.9	6,384.5	15,263.4

Source: State Energy Data Report, U.S. DOE/EIA, April 1987

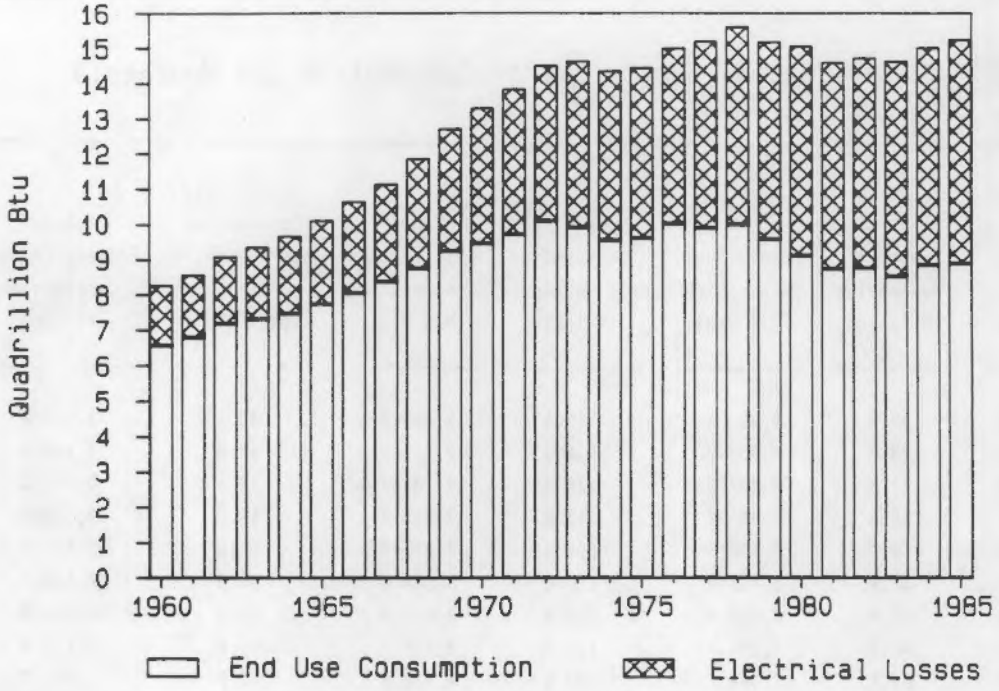

FIGURE 6.1 Total Primary Energy Consumption by the Residential Sector, 1960 - 1984

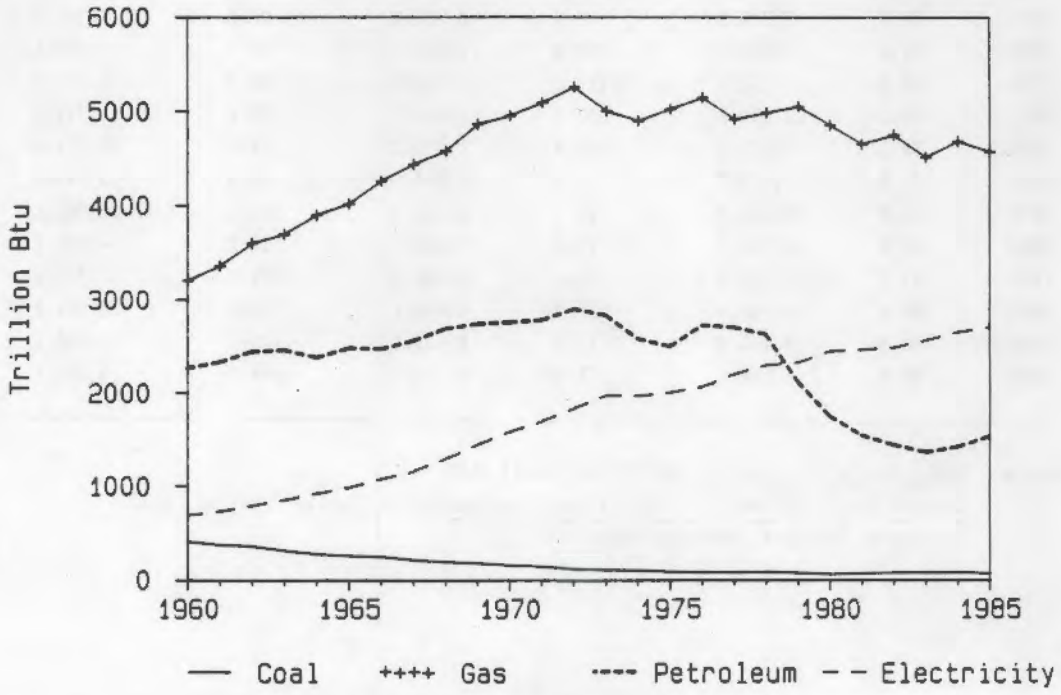

FIGURE 6.2 Residential Sector Energy Consumption by Fuel Type 1960 - 1984

6.2 RESIDENTIAL SECTOR ENERGY CONSUMPTION PER HOUSEHOLD AND PER CAPITA

TABLE 6.2 Residential Sector Energy Consumption per Household

Year	Number of Households (Millions)	Fossil Fuel Consumption (Tril Btu)	Fossil Fuel Consumption per Household (Mil Btu)	Total Electricity Consumption (Mil Btu)	Electricity Consumption per Household Household (Mil Btu)	Total Primary Energy Consumption (Tril Btu)	Primary Energy Consumption per Household (Mil Btu)
1960	52.8	5,885.4	111.5	2,399.0	45.4	8,284.3	156.9
1961	53.6	6,066.2	113.3	2,515.9	47.0	8,582.0	160.2
1962	54.8	6,397.9	116.8	2,704.4	49.4	9,102.3	166.2
1963	55.3	6,464.3	117.0	2,902.3	52.5	9,366.6	169.5
1964	56.2	6,546.6	116.6	3,137.8	55.9	9,684.4	172.5
1965	57.4	6,753.9	117.6	3,364.8	58.6	10,118.7	176.2
1966	58.4	6,977.0	119.4	3,677.0	63.0	10,654.0	182.4
1967	59.2	7,207.7	121.7	3,934.7	66.4	11,142.4	188.1
1968	60.8	7,454.7	122.6	4,410.0	72.5	11,864.7	195.1
1969	62.2	7,786.8	125.1	4,938.9	79.4	12,716.7	204.4
1970	63.4	7,861.2	124.0	5,448.7	85.9	13,309.8	209.9
1971	64.8	8,014.0	123.7	5,827.7	90.0	13,841.7	213.7
1972	66.7	8,263.3	123.9	6,254.4	93.8	14,517.7	217.7
1973	68.3	7,930.9	116.2	6,711.1	98.3	14,642.1	214.5
1974	69.9	7,575.3	108.4	6,785.9	97.1	14,361.2	205.6
1975	71.1	7,603.7	106.9	6,849.7	96.3	14,453.5	203.2
1976	72.9	7,951.5	109.1	7,054.4	96.8	15,005.9	205.9
1977	74.1	7,692.9	103.8	7,518.6	101.4	15,211.5	205.2
1978	76.1	7,691.4	101.0	7,933.2	104.2	15,624.8	205.2
1979	77.3	7,239.7	93.6	7,954.5	102.9	15,194.2	196.5
1980	80.8	6,663.6	82.5	8,403.5	104.0	15,067.1	186.5
1981	82.4	6,266.8	76.1	8,339.1	101.2	14,605.6	177.3
1982	83.5	6,268.5	75.0	8,484.0	101.3	14,732.6	176.4
1983	83.9	5,953.6	70.9	8,690.7	103.6	14,644.3	174.5
1984	85.3	6,195.0	72.6	8,831.1	103.5	15,026.0	176.2
1985	86.8	6,180.1	71.2	9,083.3	104.7	15,263.4	175.9

Source: State Energy Data Report, US DOE/EIA, April 1987.
Current Population Reports, Population Characteristics, Series P-20, No. 412, US Dept of Commerce, November 1986.

TABLE 6.3 Residential Sector Energy Consumption per Capita

Year	Population (Millions)	Fossil Fuel Consumption (Tril Btu)	Fossil Fuel Consumption per Capita (Mil Btu)	Total Electricity Consumption (Mil Btu)	Electricity Consumption per Capita (Mil Btu)	Total Primary Energy Consumption (Tril Btu)	Primary Energy Consumption per Capita (Mil Btu)
1960	180.0	5,885.4	32.7	2,399.0	13.3	8,284.3	46.0
1961	183.0	6,066.2	33.1	2,515.9	13.7	8,582.0	46.9
1962	185.8	6,397.9	34.4	2,704.4	14.6	9,102.3	49.0
1963	188.5	6,464.3	34.3	2,902.3	15.4	9,366.6	49.7
1964	191.1	6,546.6	34.3	3,137.8	16.4	9,684.4	50.7
1965	193.5	6,753.9	34.9	3,364.8	17.4	10,118.7	52.3
1966	195.6	6,977.0	35.7	3,677.0	18.8	10,654.0	54.5
1967	197.5	7,267.7	36.5	3,934.7	19.9	11,142.4	56.4
1968	199.4	7,454.7	37.4	4,410.0	22.1	11,864.7	59.5
1969	201.4	7,780.8	38.6	4,938.9	24.5	12,716.7	63.1
1970	204.0	7,861.2	38.5	5,448.7	26.7	13,309.8	65.2
1971	206.8	8,014.0	38.8	5,827.7	28.2	13,841.7	66.9
1972	209.3	8,263.3	39.5	6,254.4	29.9	14,517.7	69.4
1973	211.4	7,930.9	37.5	6,711.1	31.7	14,642.1	69.3
1974	213.3	7,575.3	35.5	6,785.9	31.8	14,361.2	67.3
1975	215.5	7,603.7	35.3	6,849.7	31.8	14,453.5	67.1
1976	217.6	7,951.5	36.5	7,054.4	32.4	15,005.9	69.0
1977	219.8	7,692.9	35.0	7,518.6	34.2	15,211.5	69.2
1978	222.1	7,691.4	34.6	7,933.2	35.7	15,624.6	70.3
1979	224.6	7,239.7	32.2	7,954.5	35.4	15,194.2	67.7
1980	227.3	6,663.6	29.3	8,403.5	37.0	15,067.1	66.3
1981	229.6	6,266.8	27.3	8,339.1	36.3	14,605.8	63.6
1982	232.0	6,268.5	27.0	8,464.0	36.5	14,732.6	63.5
1983	234.3	5,953.5	25.4	8,690.7	37.1	14,644.3	62.5
1984	236.5	6,195.0	26.2	8,831.1	37.3	15,026.0	63.5
1985	238.7	6,180.1	25.9	9,083.3	38.1	15,263.4	63.9

Source: State Energy Data Report, US DOE/EIA, April 1987.
Annual Energy Review, US DOE/EIA, April 1987.

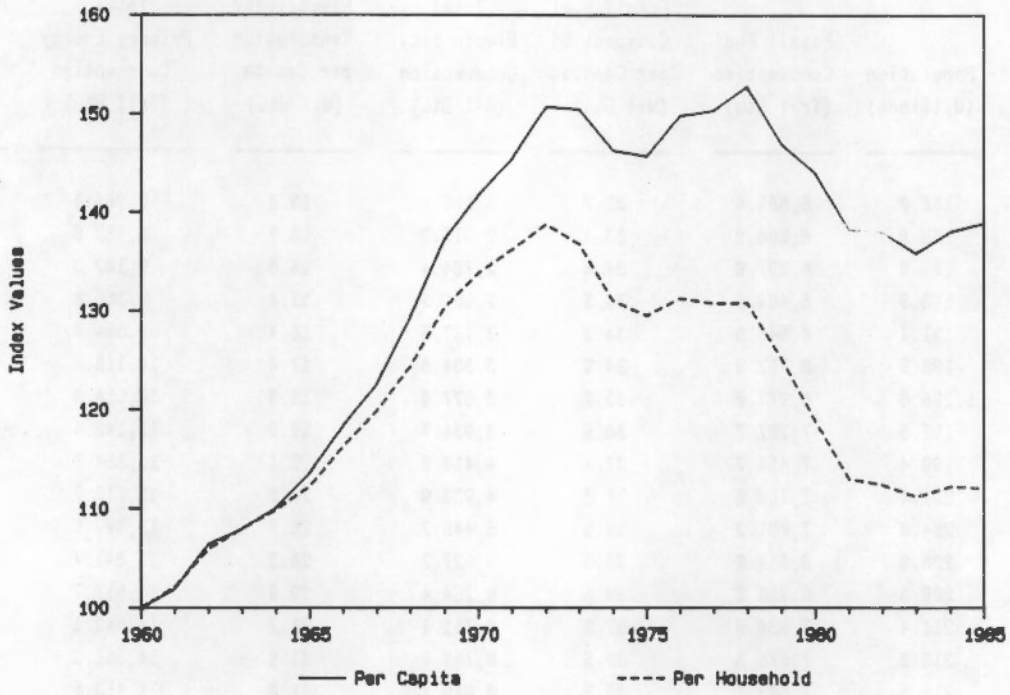

FIGURE 6.3 A Comparison of Energy Consumption per Household and per Capita

6.3 TOTAL RESIDENTIAL SECTOR ENERGY CONSUMPTION, APRIL 1984 - MARCH 1985

TABLE 6.4 Total Residential Sector Energy Consumption for the U.S.,

Housing Characteristics	Number of Households (millions)	Total (Quad Btu)	Fuel Type			
			Natural Gas (Quad Btu)	Electricity (Quad Btu)	Fuel Oil or Kerosene (Quad Btu)	LPG (Quad Btu)
Total Households	86.30	9.04	4.98	2.48	1.26	0.31
Type of Housing Structure						
Single Family	57.60	6.72	3.72	1.91	0.85	0.24
Multi-Family	23.60	1.94	1.15	0.42	0.37	*
Mobile Home	5.10	0.37	0.12	0.15	0.04	0.07
Measured Heating Space of Residence (sq. ft.)						
Less than 999	31.80	2.44	1.31	0.63	0.37	0.12
1,000 to 1,999	36.40	3.90	2.09	1.18	0.48	0.14
2,000 or More	18.10	2.71	1.58	0.67	0.40	0.05
Year House Built						
1949 or Earlier	32.20	3.91	2.31	0.71	0.77	0.12
1950 to 1974	39.00	3.88	2.14	1.20	0.39	0.14
1975 or Later	15.20	1.25	0.53	0.57	0.10	0.05
Main Heating Fuel						
Natural Gas	47.80	5.91	4.78	1.11	0.02	Q
Electricity	14.50	0.80	0.04	0.75	0.01	0.01
Fuel Oil or Kerosene	12.20	1.54	0.09	0.28	1.16	0.02
LPG	3.90	0.35	NC	0.11	*	0.24
Other	7.90	0.44	0.08	0.24	0.06	0.06

Note: * = Data cannot be displayed due to rounding.
Q = RSE greater than 50%, or fewer than 10 houses sampled.
NC = No cases sampled.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, U.S. DOE/EIA, May 1987.

6.4 AVERAGE RESIDENTIAL ENERGY CONSUMPTION

TABLE 6.5 Average Energy Consumption for All U.S. Households, April 1984 through March 1985

Housing Characteristics	All Households		Gas		Electricity		Oil or Kerosene		LPG	
	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)
Total Households	86.3	105	47.8	124	145.8	55	12.2	126	3.9	89
Type of Housing Structure										
Single Family Home	57.6	117	32.3	138	7.9	68	7.6	137	2.6	97
2 or More Units	23.6	82	14.1	92	5.2	37	3.9	113	Q	Q
Mobile Home	5.1	73	1.4	102	1.4	49	0.7	78	1.2	72
Measured Heating Space of Residence (sq. ft.)										
Less than 1000	31.8	77	16.7	91	6.2	40	4.5	99	2.0	89
1,000 to 1,999	36.4	107	20.0	126	6.4	63	4.6	127	1.6	99
2,000 or More	18.1	150	11.1	169	1.9	82	3.0	166	0.3	165
Year House Built										
1949 or Before	32.2	121	19.3	133	1.6	61	6.9	137	1.3	96
1950 to 1974	39.0	99	22.5	119	6.9	53	4.3	112	1.9	82
1975 or After	15.2	83	6.0	110	6.0	56	1.0	115	0.7	92

Note: Q = data withheld because of large variances.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, US DOE/EIA, May 1987.

TABLE 6.6 Average Residential Energy Consumption in the Northeast Region, April 1984 through March 1985

Housing Characteristics	All Households		Gas		Electricity		Oil or Kerosene		LPG	
	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)
Total Households	18.3	125	7.2	136	1.4	58	8.2	137	0.2	96
Type of Housing Structure										
Single Family Home	10.9	141	4.3	158	0.8	75	4.4	158	Q	Q
2 or More Units	6.8	103	2.6	101	0.6	36	3.5	115	Q	Q
Mobile Home	0.7	94	Q	117	Q	Q	0.3	91	NC	NC
Measured Heating Space of Residence (sq. ft.)										
Less than 1000	6.1	94	2.0	94	0.6	36	3.2	100	Q	Q
1,000 to 1,999	6.8	129	2.9	138	0.5	71	2.8	141	Q	Q
2,000 or More	5.4	158	2.2	172	0.2	84	2.3	174	NC	NC
Year House Built										
1949 or Before	10.1	134	4.3	136	0.2	68	4.9	144	Q	Q
1950 to 1974	6.4	120	2.5	140	0.7	55	2.7	120	Q	Q
1975 or After	1.7	92	0.4	100	0.5	59	0.6	120	NC	NC

Note: Q = data withheld because of large variances.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, U.S. DOE/EIA, May 1987.

TABLE 6.7 Average Residential Energy Consumption in the North Central Region, April 1984 through March 1985

Housing Characteristics	All Households		Gas		Electricity		Oil or Kerosene		LPG	
	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)
Total Households	21.6	129	16.4	142	1.3	71	1.2	124	1.3	119
Type of Housing Structure										
Single Family Home	14.6	142	10.6	160	0.8	82	1	127	0.9	126
2 or More Units	5.9	105	5.4	108	0.3	44	Q	123	NC	NC
Mobile Home	1.1	94	0.4	110	Q	Q	Q	Q	0.3	101.0
Measured Heating Space of Residence (sq. ft.)										
Less than 1000	7.8	97	6.0	104	0.6	56	0.3	107	0.5	98.0
1,000 to 1,999	7.8	136	5.6	153	0.4	79	0.6	124	0.5	113.0
2,000 or More	6.0	162	4.8	176	0.3	93	0.2	144	0.3	167.0
Year House Built										
1949 or Before	9.7	145	7.8	156	0.2	73	0.6	131	0.5	124.0
1950 to 1974	8.2	120	6.1	131	0.5	70	0.3	106	0.7	110.0
1975 or After	3.8	100	2.5	122	0.7	70	0.2	129	Q	Q

Note: Q = data withheld because of large variances.
NC = No cases sampled.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, U.S. DOE/EIA, May 1987.

TABLE 6.8 Average Residential Energy Consumption in the Southern Region, April 1984 through March 1985

Housing Characteristics	All Households		Gas		Electricity		Oil or Kerosene		LPG	
	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg Amount Consumed Per Household (millions Btu)
Total Households	29.3	85	13.1	115	8.4	53	2.4	90	2.1	72
Type of Housing Structure										
Single Family Home	21.8	95	10.5	123	4.9	65	1.9	98	1.5	79
2 or More Units	5.2	58	2.3	85	2.8	34	0.2	59	Q	Q
Mobile Home	2.3	54	0.3	90	0.9	43	0.3	59	0.6	55.0
Measured Heating Space of Residence (sq. ft.)										
Less than 1000	11.0	62	4.4	89	3.3	37	1.0	68	1.1	57.0
1,000 to 1,999	14.4	90	6.2	117	4.1	60	1.1	97	0.9	90.0
2,000 or More	4.3	129	2.4	160	1.0	81	0.3	133	NC	NC
Year House Built										
1949 or Before	7.8	94	4.0	114	0.8	54	1.1	107	0.6	81.0
1950 to 1974	16.1	86	8.0	117	4.4	53	1.2	77	1.0	57.0
1975 or After	5.4	70	1.1	112	3.2	53	0.1	75	0.4	95.0

Note: Q = data withheld because of large variances.
NC = No cases sampled.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, U.S. DOE/EIA, May 1987.

TABLE 6.9 Average Residential Energy Consumption in the Western Region, March 1984 through April 1985

Housing Characteristics	All Households		Gas		Electricity		Oil or Kerosene		LPG	
	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)	Number of Households (millions)	Avg. Amount Consumed Per Household (millions Btu)
Total Households	17.1	85	11.2	99	3.4	54	0.5	121	0.4	77
Type of Housing Structure										
Single Family Home	10.4	101	6.9	117	1.5	67	0.4	122	0.2	85
2 or More Units	5.7	57	3.8	66	1.7	41	Q	Q	NC	NC
Mobile Home	1.0	78	0.5	94	0.2	56	Q	Q	0.3	72
Measured Heating Space of Residence (sq. ft.)										
Less than 1000	7.0	60	4.2	71	1.6	41	0.1	94	0.3	64
1,000 to 1,999	7.7	90	5.3	101	1.4	53	0.2	112	Q	Q
2,000 or More	2.4	141	1.6	162	0.4	75	0.2	145	Q	Q
Year House Built										
1949 or Before	4.6	88	3.3	95	0.4	66	0.3	132	Q	Q
1950 to 1974	8.3	89	5.9	102	1.3	47	0.2	112	Q	77
1975 or After	4.3	73	2.0	94	1.6	56	Q	Q	0.2	71

Note: Q = data withheld because of large variances.
NC = No cases sampled.

Source: RECS: Consumption and Expenditures, April 1984 through March 1985, Part 2 - Regional Data, U.S. DOE/EIA, May 1987.

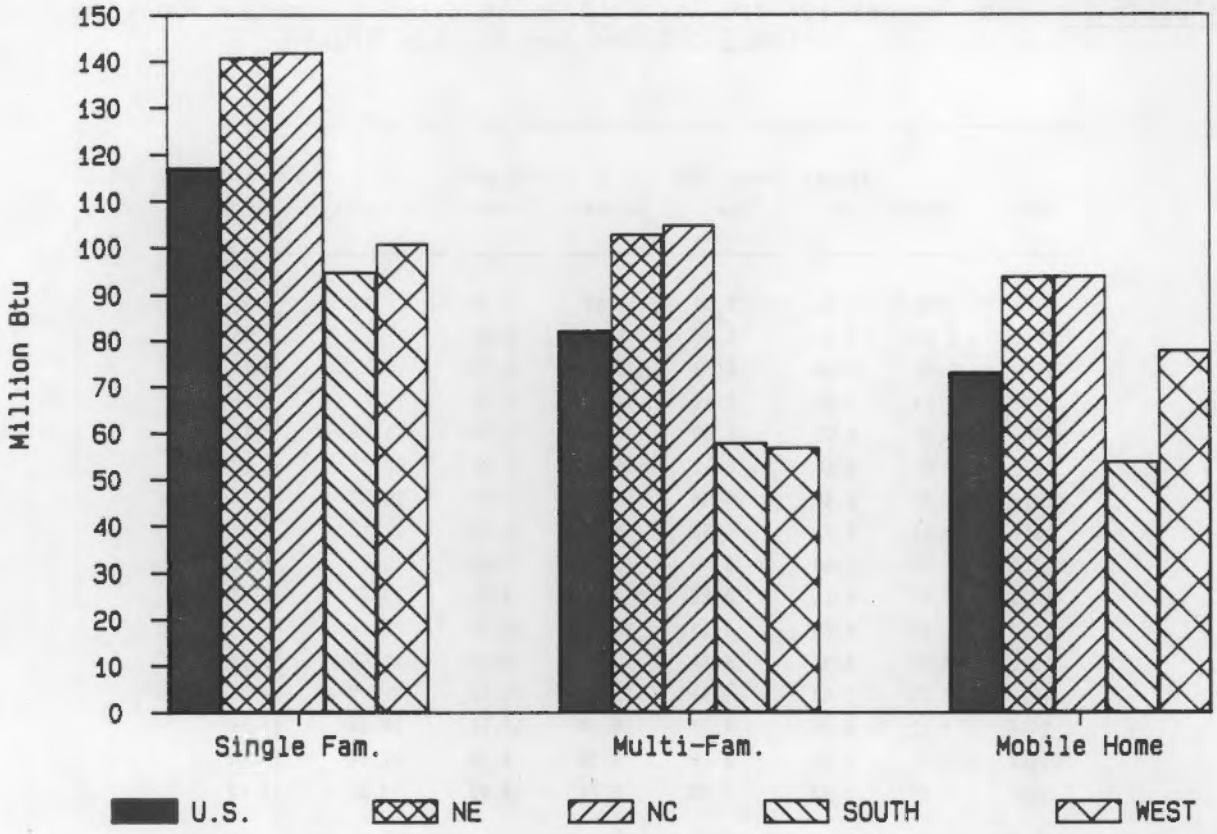

FIGURE 6.4 Average Residential Energy Consumption by Region and Housing Type, 1982

6.5 ENERGY PRICES FOR THE RESIDENTIAL SECTOR: 1970 THROUGH 1985

TABLE 6.10 Fuel Prices for the Residential Sector, in Constant Dollars (1985 Dollars per Million BTUs)

Year	Coal	Natural Gas	Distillate Fuel	Kerosene	LPG and Ethane	Electricity	Residential Average
1970	3.00	2.81	3.69	4.09	5.60	17.36	5.63
1971	2.44	2.81	3.54	3.99	5.15	17.13	5.63
1972	2.52	2.85	3.38	3.81	5.18	17.05	5.71
1973	2.64	2.84	3.69	4.21	8.15	16.78	6.15
1974	4.46	2.93	5.39	6.05	7.70	18.75	7.02
1975	4.64	3.14	5.15	5.90	7.58	19.37	7.22
1976	4.08	3.43	5.20	5.87	7.76	19.38	7.37
1977	4.13	3.83	5.50	6.26	8.13	19.72	7.99
1978	3.95	3.86	5.50	6.24	7.35	19.54	8.02
1979	3.50	4.13	6.85	7.96	9.29	19.34	8.53
1980	3.80	4.68	9.13	10.81	10.30	20.44	9.82
1981	3.94	4.97	10.24	12.49	9.90	21.55	10.58
1982	3.79	5.63	9.34	11.67	10.30	22.42	11.05
1983	3.22	6.31	8.37	10.00	10.16	22.58	11.60
1984	3.31	6.15	8.18	9.35	9.60	22.84	11.52
1985	3.05	5.93	7.63	8.74	8.93	22.63	11.42

Source: State Energy Price and Expenditure Report, 1970-1982, US DOE/EIA, State Energy Price and Expenditure Report, 1985, US DOE/EIA, Annual Energy Review, US DOE/EIA, April 1987.

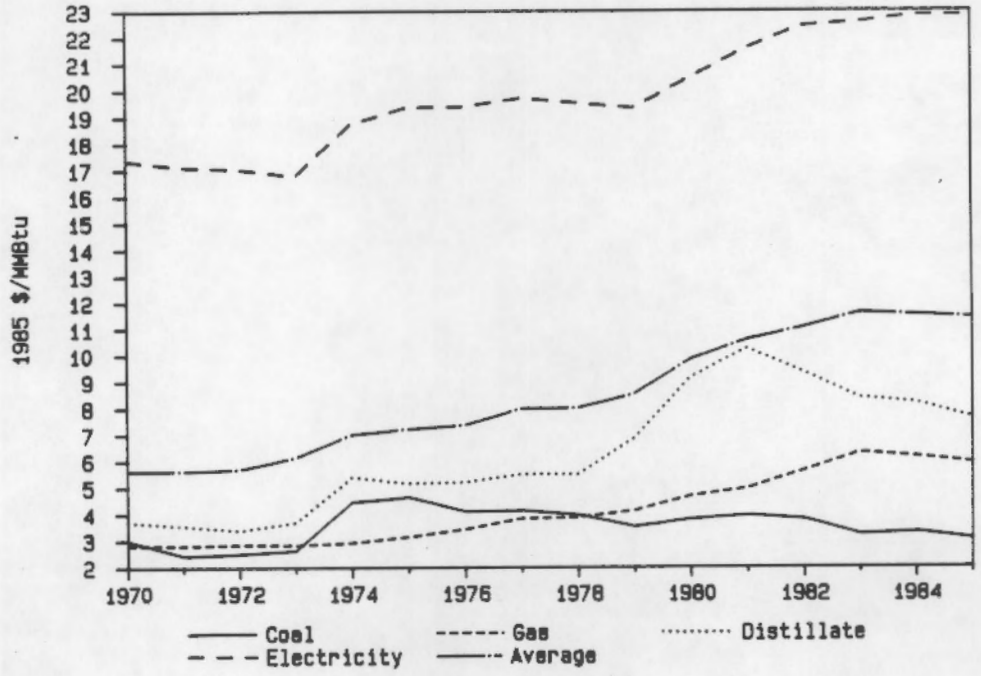

FIGURE 6.5 Fuel Prices for the Residential Sector, in Constant Dollars (1985 Dollars per Million BTUs)

CHAPTER SEVEN: CHARACTERISTICS OF U.S. COMMERCIAL BUILDINGS

This chapter provides general information on energy-related characteristics of all commercial buildings in the U.S.. Data for this chapter was taken primarily from Characteristics of Commercial Buildings 1983, a publication of the Energy Information Administration of the U.S. Department of Energy. The information in that publication was drawn in turn from the 1983 Nonresidential Buildings Energy Consumption Survey.

This chapter is comprised of the following sections:

7.1 TYPES AND SIZES OF COMMERCIAL BUILDINGS IN THE U.S.

TABLE 7.1 Commercial Building Types in the U.S. and the Four Census Regions, 1983 (Thousands of Buildings, Millions of Total Square Feet, and Average Square Feet of Floor Space, in Thousands)

Period of Construction	All Buildings	Assembly	Educational	Food Sales & Service	Health Care	Lodging	Mercantile & Services	Office	Residential	Warehouse	Other	Vacant
United States												
Number of Buildings	3,948	457	177	388	61	186	1,071	575	236	425	179	281
Total Square Footage	52,325	5,483	6,644	2,051	2,277	2,241	10,427	8,454	2,454	6,791	2,769	3,342
Average Square Footage	13.3	12.0	34.2	5.4	37.3	21.1	9.7	14.7	10.4	16.0	15.9	11.9
% of Total Buildings	100.0	11.6	4.5	9.8	1.5	2.7	27.1	14.6	6.0	10.8	4.5	7.1
% of Total Square Footage	100.0	10.5	11.6	3.9	4.4	4.3	19.9	16.2	4.7	13.0	5.3	6.4
Northeast Region												
Number of Buildings	670	61	28	58	11	13	183	97	97	57	20	46
Total Square Footage	11,615	1,053	1,374	392	582	422	2,040	1,774	1,336	1,224	834	664
Average Square Footage	17.3	17.3	49.1	6.8	45.6	32.5	11.1	18.3	13.8	21.5	41.7	14.4
% of Total Buildings	100.0	9.1	4.2	8.7	1.6	1.9	27.3	14.5	14.5	8.5	3.0	6.9
% of Total Square Footage	100.0	9.1	11.8	3.4	4.3	3.6	17.6	15.3	11.5	10.5	7.2	5.7
Midwest Region												
Number of Buildings	1,211	149	39	120	21	12	353	176	78	131	50	80
Total Square Footage	16,059	1,755	1,834	724	1,015	669	3,219	2,178	717	2,130	881	937
Average Square Footage	13.3	11.0	47.0	6.0	48.3	55.0	9.1	12.4	9.2	16.3	17.6	11.7
% of Total Buildings	100.0	12.3	3.2	9.9	1.7	1.0	29.1	14.5	6.4	10.0	4.1	6.6
% of Total Square Footage	100.0	10.9	11.4	4.5	6.3	4.2	20.0	13.6	4.5	13.3	5.5	5.0
South Region												
Number of Buildings	1,493	202	79	145	20	57	383	191	44	170	87	114
Total Square Footage	17,049	1,035	2,002	616	567	003	3,043	2,903	299	2,200	644	1,109
Average Square Footage	11.4	9.1	20.4	4.2	20.4	14.1	10.0	15.2	6.0	13.5	7.4	10.3
% of Total Buildings	100.0	13.5	5.3	9.7	1.3	3.0	25.7	12.0	2.9	11.4	5.0	7.0
% of Total Square Footage	100.0	10.0	12.2	3.0	3.3	4.7	22.5	17.0	1.0	13.4	3.0	0.9
West Region												
Number of Buildings	574	45	31	07	Q	24	151	112	10	00	22	41
Total Square Footage	7,002	Q	754	320	193	340	1,325	1,599	103	1,149	402	571
Average Square Footage	13.2	0.0	24.3	5.0	Q	14.4	0.0	14.3	0.4	10.9	10.3	13.9
% of Total Buildings	100.0	7.0	5.4	9.9	Q	4.2	20.3	19.5	2.0	11.0	3.0	7.1
% of Total Square Footage	100.0	Q	9.9	4.2	2.5	4.0	17.4	21.0	1.4	15.1	5.3	7.5

Note: Q = Data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

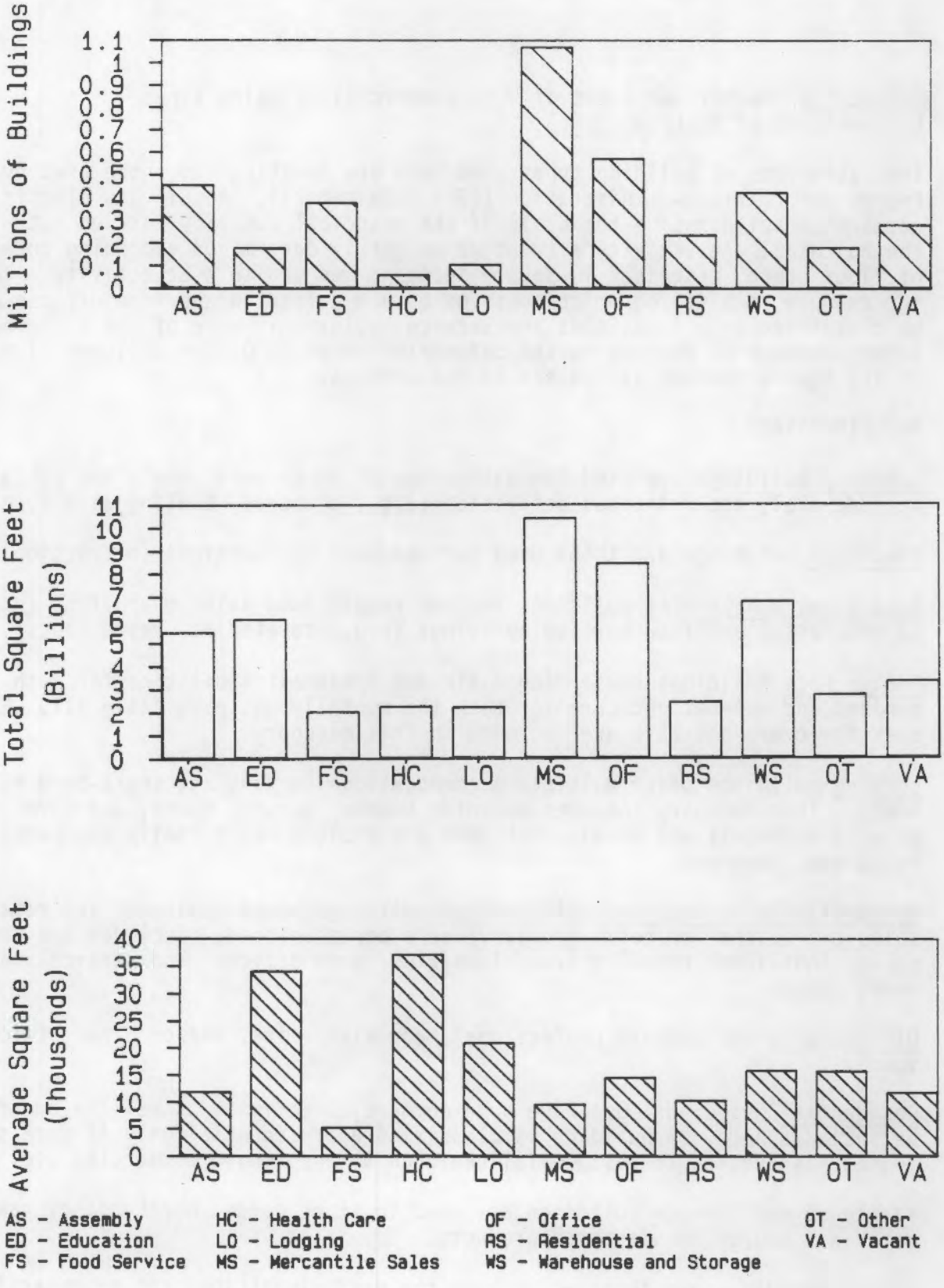

FIGURE 7.1 Number and Sizes of U.S. Commercial Building Types

FIGURE 7.1 Number and Sizes of U.S. Commercial Building Types

EXPLANATIONS OF BUILDING TYPES

The categories of building types used here are identical to those used by the Energy Information Administration (EIA). In general, the EIA has classified commercial buildings on the basis of the principal activity carried out within the building. An activity's relative weight is determined according to amount of floor space, described in square footage, devoted to that activity. Thus, for example, a building which contains both a cafeteria and some offices will be classified as a Food Sales and Service Building if more of the building's square footage is devoted to the cafeteria, or as an Office Building if more of its square footage is devoted to the offices.

BUILDING TYPES

Assembly buildings are used for gatherings of 50 or more people for social, recreational, and religious activities (e.g., churches, bowling alleys, clubs).

Education buildings are those used for academic or technical instruction.

Food Sales and Service buildings include retail food sales operations (e.g., supermarkets) and food service buildings (e.g., cafeterias, restaurants).

Health Care buildings house diagnostic and treatment facilities for both in-patient and out-patient care for both the mentally and physically ill. Facilities for overnight care are included in this category.

Lodging buildings offer multiple accommodations to long and short-term residents. This category includes boarding houses, nursing homes, and dormitories as well as hotels and motels. It does not include multi-family apartment buildings, however.

Mercantile Sales and Personal Services buildings house wholesale and retail sales operations for goods and services other than food. Included are shopping malls, individual retail stores, laundries, post offices, and service stations, among others.

Office buildings contain professional, administrative, and/or other office space.

Residential buildings must have some commercial activity as well in order to be included here. A building is classified as residential only if more square footage is devoted to residential use than to any single commercial use.

Warehouse and Storage buildings are used to store goods, merchandise, raw materials and/or manufactured products.

Vacant buildings are those which have the predominant (but not necessarily entire) proportion of their floor space unused at the time of the EIA survey.

Other buildings constitute a residual category. Included here are such things as crematoria, parking garages, police stations, and reformatories.

Remarks:

1. In 1983 there were a total of 3,948,000 commercial buildings with a total floor space of 52.3 billion square feet. By comparison there were 57.7 million single family homes, 29.9 million multi-family buildings, and 4.0 million mobile homes in the U.S.

2. Mercantile and Services Buildings were the single most common type of commercial building, comprising 27% of all commercial buildings. They also had the single largest percentage of total commercial floor space, 20%, although this is considerably lower than their percentage for the number of buildings. Retail and Service Building rank next to last in average square feet per building (9,700 ave. sq. ft.).

3. Office Buildings were the second most common type of commercial building (15%). They also comprised the second largest share of commercial floor space (16%), giving them an average of 14,700 square feet per building.

4. Seven percent of the buildings, representing 6% of total commercial sector floor space was categorized as vacant.

5. Over half of all commercial buildings fall into the smallest square footage category -- less than 5,000 square feet. Distribution is fairly standard over most of the building types. The largest buildings -- those over 100,000 square feet -- tend to be Education, Health Care, Mercantile and Services, Office, and Warehouse Buildings.

TABLE 7.2 Commercial Building Types by Period of Construction (Thousands of Buildings, Millions of Total Square Feet, and Thousands of Average Square Feet)

Period of Construction	All Buildings	Assembly	Educational	Food Sales & Service	Health Care	Mercantile Lodging	Mercantile & Services	Office	Residential	Warehouse	Other	Vacant
Total Number of Buildings	3,948	457	177	386	61	186	1,071	575	236	425	179	281
Number of Buildings												
1900 or Before	288	51	Q	24	Q	Q	71	35	54	29	Q	22
1901 to 1920	388	66	11	43	Q	Q	95	41	45	41	Q	31
1921 to 1945	726	89	24	55	8	15	194	107	69	88	28	75
1946 to 1960	946	102	58	78	19	35	311	97	38	98	48	70
1961 to 1970	721	87	45	76	18	27	187	121	Q	81	34	38
1971 to 1973	269	19	6	23	Q	12	52	45	Q	22	Q	Q
1974 to 1979	536	58	28	78	12	7	139	108	Q	65	35	22
1980 to 1983	148	14	18	12	3	3	21	28	Q	18	16	14
Percent of Building Type												
1900 or Before	7.3	11.2	Q	6.3	Q	Q	6.6	6.1	22.9	4.7	Q	7.8
1901 to 1920	9.8	14.4	6.2	11.3	Q	Q	8.9	7.1	19.1	9.6	Q	11.0
1921 to 1945	18.4	19.1	13.6	14.5	13.1	14.2	18.1	18.6	29.2	18.8	15.6	27.0
1946 to 1960	24.0	22.3	32.8	20.5	31.1	33.0	29.0	16.9	16.1	23.1	22.3	24.9
1961 to 1970	18.3	19.0	25.4	20.0	18.4	25.5	17.5	21.0	Q	19.1	19.0	13.5
1971 to 1973	6.8	4.2	3.4	6.1	Q	11.3	4.9	7.8	Q	5.2	Q	Q
1974 to 1979	13.4	18.9	11.3	18.4	19.7	6.6	13.0	17.4	Q	15.3	19.6	7.6
1980 to 1983	3.5	3.1	5.0	3.2	4.9	2.0	2.0	4.9	Q	4.2	8.9	5.0
Total Square Footage	52,325	6,483	6,044	2,051	2,277	2,241	10,427	8,454	2,454	6,791	2,760	3,342
Square Footage												
1900 or Before	2,940	373	Q	129	Q	Q	488	429	669	315	Q	263
1901 to 1920	5,453	791	435	249	Q	Q	882	715	517	915	Q	394
1921 to 1945	8,639	799	1,884	286	215	523	1,345	1,388	721	1,696	388	875
1946 to 1960	9,612	1,142	1,623	368	751	381	2,120	966	278	1,348	258	458
1961 to 1970	9,947	896	1,494	396	346	647	1,979	1,773	Q	1,466	472	360
1971 to 1973	3,442	318	357	163	Q	255	736	625	Q	363	Q	Q
1974 to 1979	6,618	654	674	376	585	213	1,485	1,378	Q	797	228	281
1980 to 1983	5,675	Q	274	171	138	154	Q	1,189	Q	552	689	566
Percent of Square Footage												
1900 or Before	5.6	6.0	Q	6.3	Q	Q	4.7	5.1	24.0	4.6	Q	7.9
1901 to 1920	10.4	14.4	7.2	12.1	Q	Q	8.5	8.5	21.1	13.5	Q	11.0
1921 to 1945	16.5	14.0	17.9	10.0	9.4	23.3	12.9	16.4	29.4	16.1	14.1	26.2
1946 to 1960	18.4	20.0	26.9	17.9	33.0	13.4	20.3	11.4	11.3	19.0	9.3	13.7
1961 to 1970	19.0	16.3	24.7	19.0	15.2	20.9	19.0	21.0	Q	20.7	17.1	10.0
1971 to 1973	6.6	5.0	5.9	7.9	Q	11.4	7.1	7.4	Q	5.3	Q	Q
1974 to 1979	12.0	11.9	11.2	10.3	22.2	9.5	14.2	16.2	Q	11.7	0.3	0.4
1980 to 1983	10.0	Q	4.5	0.3	5.7	6.9	Q	14.1	Q	0.1	25.0	16.9
Average Square Footage												
1900 or Before	10.2	7.3	Q	5.4	Q	Q	6.9	12.3	11.3	15.0	Q	12.0
1901 to 1920	14.1	12.0	39.5	5.0	Q	Q	9.3	17.4	11.5	22.3	Q	12.7
1921 to 1945	11.9	11.0	45.2	3.7	26.9	34.9	6.9	13.0	10.4	13.7	13.9	11.5
1946 to 1960	10.2	11.2	20.0	4.7	39.5	0.0	6.0	10.0	7.3	13.0	0.5	0.5
1961 to 1970	13.0	10.3	33.2	5.1	34.0	24.0	10.0	14.7	Q	17.4	13.9	9.5
1971 to 1973	10.5	10.7	59.5	7.1	Q	21.3	14.2	13.9	Q	10.5	Q	Q
1974 to 1979	12.5	13.1	33.7	5.4	42.1	30.4	10.7	13.7	Q	12.3	0.5	12.0
1980 to 1983	40.5	Q	27.4	14.3	43.3	51.3	Q	42.5	Q	30.7	43.1	40.4

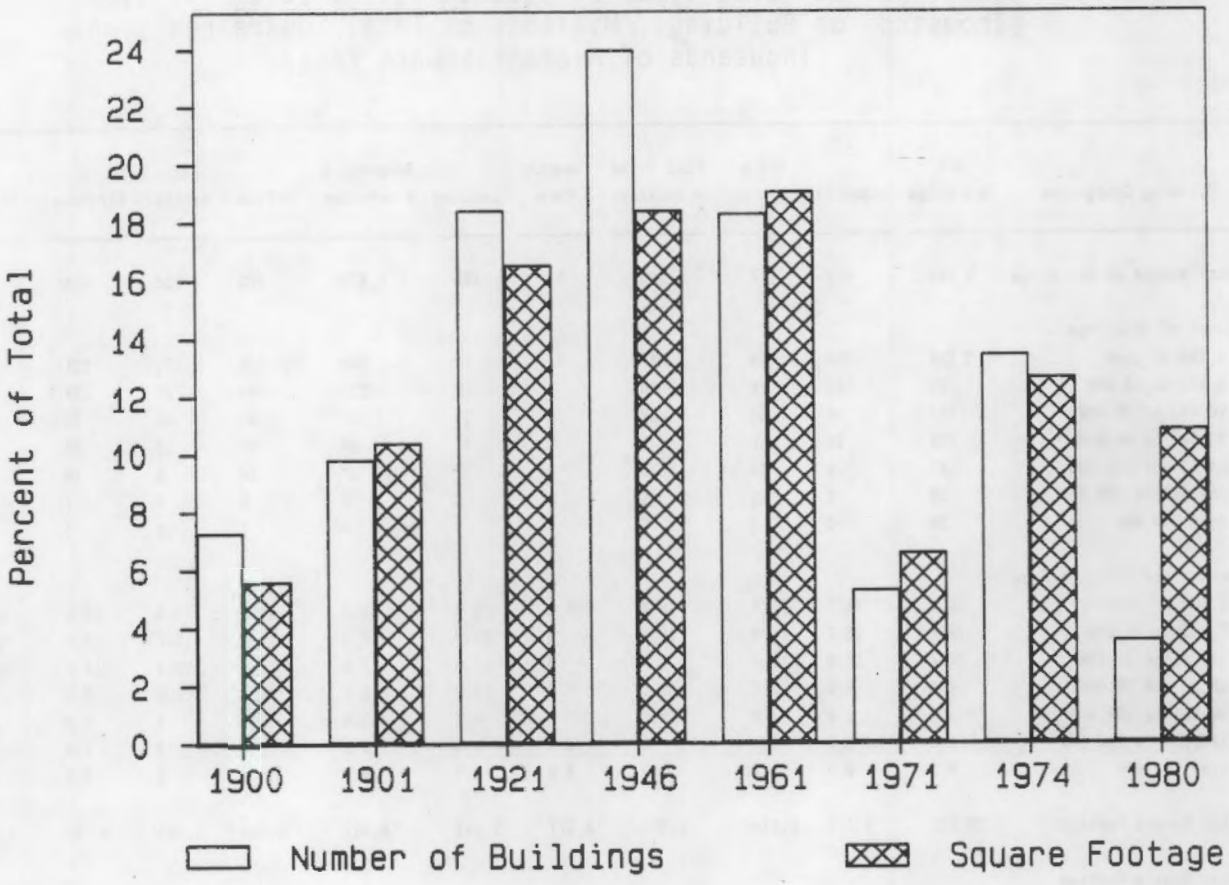

FIGURE 7.2 Commercial Buildings and Total Square Footage, by Period of Construction

TABLE 7.3 Commercial Building Types by Square Footage Category, 1983 (Thousands of Buildings, Millions of Total Square Feet, and Thousands of Average Square Feet)

Building Categories	All Buildings	Assembly	Educational	Food Sales & Service	Health Care	Lodging	Mercantile & Services	Office	Residential	Warehouse	Other	Vacant
Total Number of Buildings	3,948	457	177	388	61	186	1,871	575	236	425	179	281
Number of Buildings												
5,000 or Less	2,248	289	45	287	31	42	868	328	131	221	111	177
5,001 to 10,000	725	122	24	49	Q	23	217	109	37	64	24	43
10,001 to 25,000	567	86	33	35	Q	19	131	81	48	75	25	29
25,001 to 50,000	222	27	37	6	Q	14	38	27	13	36	10	17
50,001 to 100,000	107	9	24	3	Q	5	17	14	Q	18	3	9
100,000 to 200,000	58	3	11	Q	3	2	6	8	Q	7	3	3
Over 200,000	29	1	3	Q	4	1	4	7	Q	4	2	2
Percent for Building Type												
5,000 or Less	56.9	45.7	25.4	75.5	50.8	39.6	62.2	57.0	55.5	52.0	62.0	63.0
5,001 to 10,000	18.4	26.7	13.6	12.9	Q	21.7	26.3	19.0	15.7	15.1	13.4	15.3
10,001 to 25,000	14.4	18.8	18.6	9.2	Q	17.9	12.2	14.1	20.3	17.6	14.0	10.3
25,001 to 50,000	5.6	5.9	20.9	1.6	Q	13.2	2.0	4.7	5.5	8.5	5.0	6.0
50,001 to 100,000	2.7	2.0	13.6	0.8	Q	4.7	1.6	2.4	Q	4.2	1.7	3.2
100,000 to 200,000	1.3	0.7	6.2	Q	4.9	1.9	0.6	1.4	Q	1.6	1.7	1.1
Over 200,000	0.7	0.2	1.7	Q	0.0	0.9	0.4	1.2	Q	0.9	1.1	0.7
Total Square Footage	52,325	5,483	6,044	2,051	2,277	2,241	10,427	8,454	2,454	6,791	2,760	3,342
Total Square Footage												
5,000 or Less	4,960	485	113	836	80	95	1,433	749	325	448	176	368
5,001 to 10,000	5,240	901	182	343	Q	166	1,562	883	265	446	186	314
10,001 to 25,000	8,912	1,390	566	566	Q	310	2,013	1,236	748	1,202	465	410
25,001 to 50,000	7,692	912	1,322	269	Q	495	1,865	976	432	1,203	350	528
50,001 to 100,000	7,160	621	1,619	179	Q	310	1,089	933	Q	1,190	214	514
100,000 to 200,000	8,642	412	1,449	Q	433	303	800	1,866	Q	937	441	467
Over 200,000	11,757	Q	799	Q	1,320	553	Q	2,071	Q	1,350	900	587
Percent of Square Footage												
5,000 or Less	9.4	8.0	1.9	31.0	3.5	4.2	13.7	0.9	13.2	0.6	0.4	11.0
5,001 to 10,000	10.0	16.4	3.0	16.7	Q	7.4	15.0	9.5	10.0	0.6	0.7	9.4
10,001 to 25,000	17.0	25.4	9.3	27.7	Q	13.0	19.3	14.0	30.5	17.7	14.7	12.3
25,001 to 50,000	14.7	16.0	21.9	10.2	Q	22.1	10.2	11.5	17.0	17.7	12.7	15.0
50,001 to 100,000	13.7	11.3	26.0	0.7	Q	14.2	10.4	11.0	Q	17.0	7.0	10.4
100,000 to 200,000	12.7	7.5	24.0	Q	19.0	13.5	7.7	12.0	Q	13.0	10.0	14.0
Over 200,000	22.5	Q	13.2	Q	50.3	24.7	Q	31.5	Q	20.0	35.0	17.5
Average Square Footage												
5,000 or Less	2.2	2.3	2.5	2.2	2.0	2.3	2.2	2.3	2.5	2.0	1.0	2.1
5,001 to 10,000	7.2	7.4	7.0	7.0	Q	7.2	7.2	7.4	7.2	7.0	7.0	7.3
10,001 to 25,000	15.7	16.2	17.0	16.2	Q	16.3	15.4	15.3	15.6	16.0	16.2	14.1
25,001 to 50,000	34.0	33.0	35.7	34.0	Q	35.4	35.5	36.1	33.2	33.4	35.0	31.1
50,001 to 100,000	67.0	69.0	67.5	59.7	Q	63.0	64.1	66.0	Q	66.0	71.3	60.2
100,000 to 200,000	132.0	137.3	131.7	Q	144.3	151.5	133.3	135.0	Q	133.9	147.0	155.7
Over 200,000	405.4	Q	266.3	Q	332.0	553.0	Q	381.0	Q	339.0	494.0	293.5

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

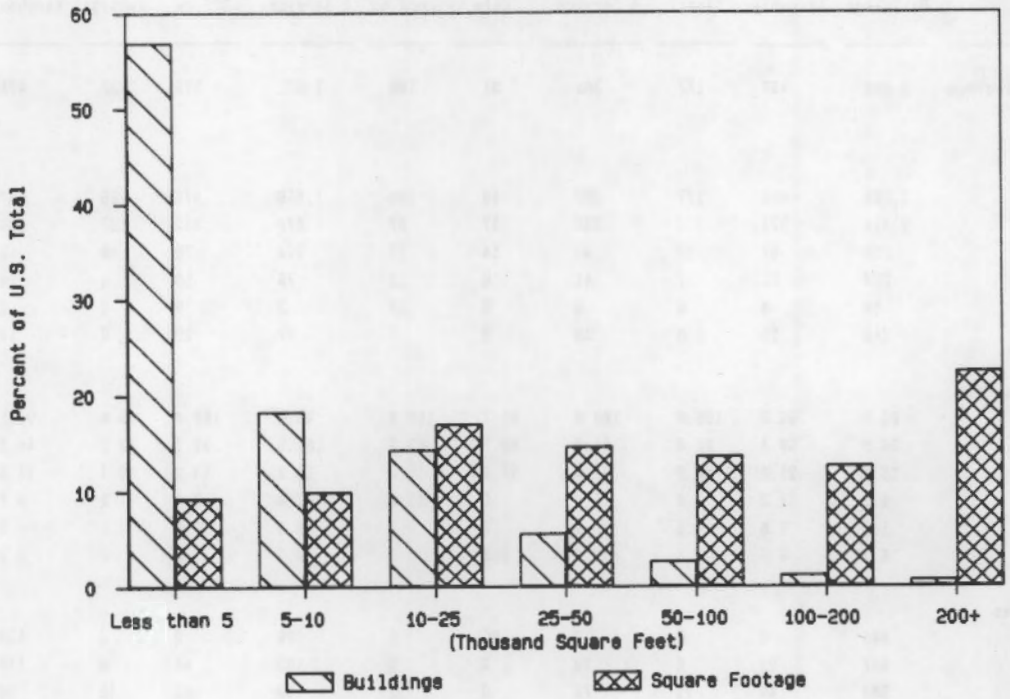

FIGURE 7.3 Number and Total Square Footage of Commercial Buildings, by Square Footage Category

TABLE 7.4 Fuel Usage and Conditioned Space in Commercial Building Types, 1983, (Thousands of Buildings)

Fuel Usage	All Buildings	Assembly	Educational	Food Sales & Service	Health Care	Lodging	Mercantile & Services	Office	Residential	Warehouse	Other	Vacant
Total Number of Buildings	3,948	457	177	388	61	186	1,071	575	236	425	179	281
Fuels Used Alone or in Combination												
Electricity	3,763	452	177	388	59	186	1,059	575	235	387	169	183
Natural Gas	2,314	271	115	235	37	67	674	352	187	198	73	103
Fuel Oil	633	97	37	43	14	17	194	76	66	58	26	Q
Propane	266	51	7	41	Q	12	75	16	Q	20	Q	Q
Purchased Steam	66	8	6	Q	Q	10	3	9	Q	Q	6	5
Other	245	25	8	38	2	7	77	22	Q	14	25	10
Percentage of Fuels Used												
Electricity	95.8	98.9	100.0	100.0	96.7	100.0	98.9	100.0	99.6	91.1	94.4	65.1
Natural Gas	58.6	59.3	65.0	61.8	60.7	63.2	62.9	61.2	79.2	46.6	40.8	36.7
Fuel Oil	16.0	21.2	20.9	11.3	23.0	16.0	18.1	13.2	28.4	11.8	14.5	Q
Propane	6.8	11.2	4.0	10.8	Q	11.3	7.0	2.8	Q	4.7	Q	Q
Purchased Steam	1.6	1.8	4.5	Q	Q	9.4	0.3	1.6	Q	Q	3.4	1.8
Other	6.2	6.5	4.5	10.0	3.3	6.6	7.2	3.0	Q	3.3	14.0	3.6
Heated Building Area												
Not Heated	448	Q	Q	Q	NC	Q	89	Q	Q	126	39	144
1% to 50%	517	23	Q	39	Q	Q	165	44	Q	148	34	45
51% to 99%	564	49	22	76	Q	11	190	105	43	24	16	20
100%	2,427	370	149	251	49	88	627	417	186	127	90	72
Percentage Distribution												
Not Heated	11.1	Q	Q	Q	NC	Q	8.3	Q	Q	29.6	21.8	51.2
1% to 50%	13.1	5.0	Q	10.3	Q	Q	15.4	7.7	Q	34.8	19.0	15.0
51% to 99%	14.3	10.7	12.4	20.0	Q	10.4	17.7	10.3	18.2	5.6	8.9	7.1
100%	61.5	81.0	84.2	66.1	80.3	83.0	58.5	72.5	78.0	29.9	50.3	25.6
Cooled Building Area												
Not Cooled	1,384	161	47	66	Q	20	412	50	72	195	81	187
1% to 50%	1,004	81	45	74	20	7	311	100	84	105	30	52
51% to 99%	510	52	27	92	10	21	115	123	24	14	21	12
100%	1,129	103	50	140	25	51	232	297	55	31	39	30
Percentage Distribution												
Not Cooled	33.0	35.2	20.0	17.4	Q	20.4	30.5	0.7	30.5	45.9	45.3	00.5
1% to 50%	25.4	17.7	25.4	19.5	32.0	0.0	29.0	10.4	35.0	43.5	21.2	10.5
51% to 99%	12.9	11.4	15.3	24.2	10.4	19.0	10.7	21.4	10.2	3.3	11.7	4.3
100%	20.0	35.7	32.0	30.9	41.0	40.1	21.7	51.7	23.3	7.3	21.0	10.7

Note: NC = no cases in sample.
Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

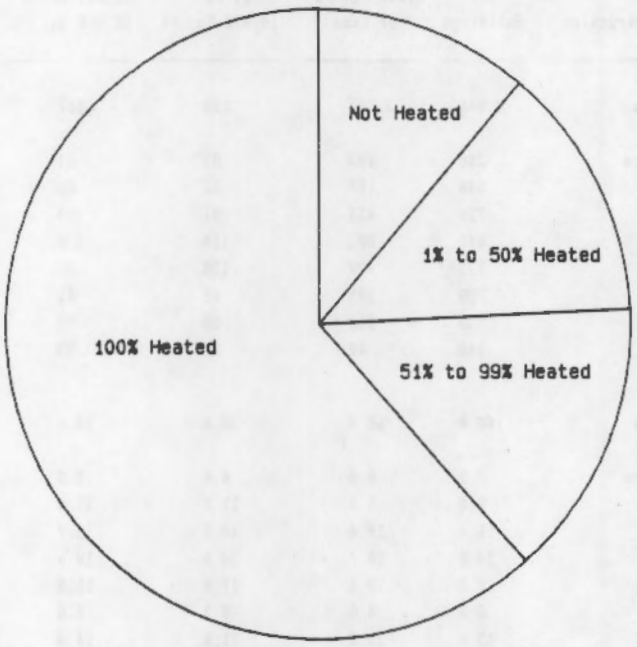

FIGURE 7.4 Percentage of Heated Space in Heated Commercial Buildings

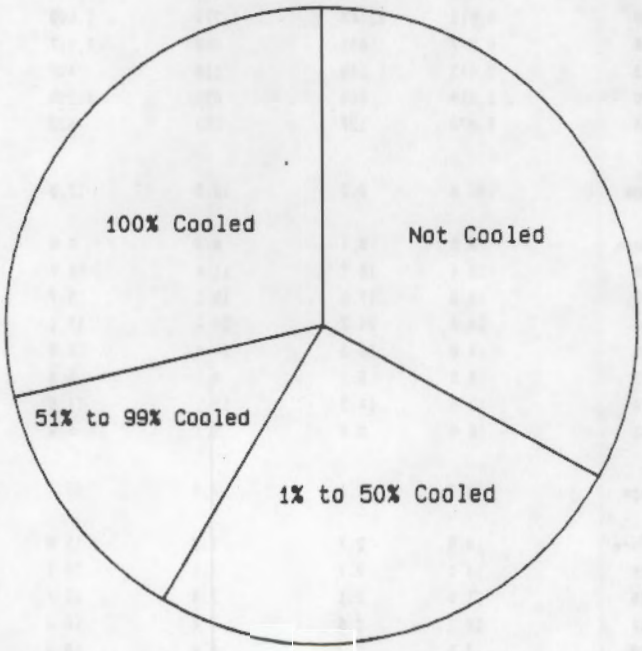

FIGURE 7.5 Percentage of Cooled Space in Cooled Commercial Buildings

TABLE 7.5 U.S. Commercial Buildings: Period of Construction by Amount of Floor Space, as of 1983 (Thousands of Buildings)

	Period of Construction	All Buildings	5,000 Sq. Ft. or Less	5,001 to 10,000 Sq. Ft.	10,001 to 25,000 Sq. Ft.	25,001 to 50,000 Sq. Ft.	50,001 to 100,000 Sq. Ft.	100,001 to 200,000 Sq. Ft.
Total Number of Buildings	All Buildings	3,948	2,248	725	567	222	107	58
	1900 or Before	288	153	61	51	16	4	Q
	1901 to 1920	388	187	85	65	29	14	5
	1921 to 1945	726	413	131	106	48	14	9
	1946 to 1960	946	601	174	118	28	19	8
	1961 to 1970	721	429	126	87	39	23	12
	1971 to 1973	299	183	43	32	18	8	4
	1974 to 1979	536	313	83	82	36	13	6
	1980 to 1983	146	49	22	33	14	12	4
Percentage of Buildings	All Buildings	100.0	56.9	18.4	14.4	5.6	2.7	1.3
	1900 or Before	7.3	6.8	8.4	9.0	7.2	3.7	Q
	1901 to 1920	9.8	8.3	11.7	11.5	13.1	13.1	10.0
	1921 to 1945	18.4	18.4	18.1	18.7	21.8	13.1	18.0
	1946 to 1960	24.0	26.7	24.0	19.4	12.6	17.8	16.0
	1961 to 1970	18.3	19.1	17.4	15.3	17.8	21.5	24.0
	1971 to 1973	5.3	4.8	5.9	5.6	8.1	7.5	8.0
	1974 to 1979	13.4	13.9	11.4	14.5	13.5	12.1	12.0
	1980 to 1983	3.5	2.2	3.0	5.8	6.3	11.2	8.0
Total Square Footage	All Buildings	52,325	4,809	5,248	8,912	7,692	7,168	6,842
	1900 or Before	2,940	466	440	767	538	281	Q
	1901 to 1920	5,453	514	566	1,049	1,018	942	636
	1921 to 1945	8,639	855	958	1,663	1,656	949	1,251
	1946 to 1960	9,812	1,187	1,279	1,699	964	1,265	1,962
	1961 to 1970	9,947	881	868	1,417	1,371	1,533	1,664
	1971 to 1973	3,442	249	329	496	654	556	559
	1974 to 1979	6,616	588	635	1,298	1,029	848	773
	1980 to 1983	5,675	127	163	523	479	794	590
Percentage of Floor Space	All Buildings	100.0	9.2	10.0	17.0	14.7	13.7	12.7
	1900 or Before	5.6	8.4	8.4	8.6	6.9	3.9	Q
	1901 to 1920	10.4	10.7	11.4	11.8	13.1	13.1	9.0
	1921 to 1945	16.5	17.0	18.1	18.7	21.5	13.2	18.0
	1946 to 1960	18.4	24.7	24.4	19.1	12.5	17.6	16.0
	1961 to 1970	19.0	18.3	16.4	15.9	17.8	21.4	25.1
	1971 to 1973	6.6	5.2	6.1	5.6	6.5	7.8	8.4
	1974 to 1979	12.6	14.3	12.1	14.6	13.4	11.8	11.5
	1980 to 1983	10.8	2.6	3.1	5.9	6.2	11.1	8.9
Average Square Footage:	All Buildings	13.3	2.1	7.2	15.7	34.6	67.0	132.8
	1900 or Before	10.2	2.7	7.2	15.0	33.1	70.3	Q
	1901 to 1920	14.1	2.7	7.1	16.1	34.8	67.3	127.2
	1921 to 1945	11.9	2.1	7.3	15.7	34.5	67.0	139.0
	1946 to 1960	10.2	2.0	7.4	15.4	34.4	66.6	132.8
	1961 to 1970	13.0	2.1	6.8	16.3	35.2	66.7	138.7
	1971 to 1973	10.5	2.4	7.4	15.5	36.3	69.5	139.8
	1974 to 1979	12.5	2.2	7.7	15.8	34.3	65.2	128.8
	1980 to 1983	40.5	2.6	7.4	15.8	34.2	66.2	147.5

Note: Q = Data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.6 The Age and Area of Commercial Buildings in the U.S., by Region, 1983
(Thousands of Buildings, Millions of Square Feet)

Building Characteristics	Total Number of Buildings	Percent of Total	Northeast	Percent of Region	Midwest	Percent of Region	South	Percent of Region	West	Percent of Region
Total Number of Buildings	3,948	100.0	676	17.0	1,211	30.7	1,493	37.8	574	14.5
Total Square Footage	52,325	100.0	11,615	22.2	16,859	30.7	17,049	32.6	7,802	14.5
Period of Construction										
Number of Buildings										
1900 or Before	288	7.3	102	15.2	110	9.1	49	3.3	27	4.7
1901 to 1920	388	9.8	93	13.9	156	13.0	100	6.7	37	6.4
1921 to 1945	726	18.4	160	23.9	225	18.6	227	15.2	114	19.9
1946 to 1960	946	24.0	131	19.6	275	22.7	396	26.5	144	25.1
1961 to 1970	721	18.3	94	14.0	189	15.6	345	23.1	94	16.4
1971 to 1973	209	5.3	26	3.9	59	4.9	90	6.0	35	6.1
1974 to 1979	530	13.4	50	7.5	162	13.4	224	15.0	95	16.6
1980 to 1983	140	3.5	14	2.1	33	2.7	64	4.3	29	5.1
Total Square Footage										
1900 or Before	2,940	5.6	1,209	11.1	1,123	7.0	355	2.1	Q	Q
1901 to 1920	5,453	10.4	1,850	15.9	1,979	11.7	1,173	6.9	550	7.2
1921 to 1945	8,639	16.5	2,390	20.6	2,795	17.4	2,221	13.0	1,225	16.1
1946 to 1960	9,612	10.4	2,503	17.9	3,120	19.5	3,250	19.1	1,143	15.0
1961 to 1970	9,947	19.0	1,790	15.5	3,043	10.9	3,594	21.1	1,512	19.9
1971 to 1973	3,442	6.6	651	5.6	953	5.9	1,290	7.6	542	7.1
1974 to 1979	6,616	12.6	729	6.2	2,160	13.5	2,407	14.0	1,244	10.4
1980 to 1983	5,675	10.0	020	7.1	972	6.1	2,005	15.6	Q	Q
Building Size										
Number of Buildings										
5,000 or Less	2,240	50.9	300	45.7	000	50.0	955	04.0	299	52.1
5,001 to 10,000	725	10.4	131	19.0	234	19.3	230	15.0	124	21.0
10,001 to 25,000	507	14.4	130	19.4	103	13.5	105	12.4	09	15.5
25,001 to 50,000	222	5.0	50	0.7	00	5.0	00	4.0	37	0.4
50,001 to 100,000	107	2.7	27	4.0	31	2.0	32	2.1	17	3.0
100,001 to 200,000	50	1.3	12	1.0	10	1.3	15	1.0	0	1.0
Over 200,000	29	0.7	0	0.9	11	0.9	9	0.0	3	0.5
Total Square Footage										
5,000 or Less	4,900	9.4	704	0.7	1,520	9.5	1,971	11.0	027	0.2
5,001 to 10,000	5,240	10.0	939	0.1	1,005	10.5	1,005	9.9	937	12.3
10,001 to 25,000	0,912	17.0	1,900	10.9	2,010	10.3	2,923	17.1	1,412	10.0
25,001 to 50,000	7,092	14.7	1,915	10.5	2,334	14.5	2,170	12.0	1,207	10.7
50,001 to 100,000	7,100	13.7	1,754	15.1	2,140	13.4	2,199	12.9	1,000	14.0
100,001 to 200,000	0,042	12.7	1,590	13.0	2,132	13.3	2,009	12.1	043	11.1
Over 200,000	11,757	22.5	2,000	23.0	3,010	22.5	4,025	23.0	Q	Q

Note: Q = Data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

7.2 SPACE HEATING FUEL USAGE IN U.S. COMMERCIAL BUILDINGS

TABLE 7.7 Space Heating Fuel Usage in Commercial Buildings, 1983 (Thousands of Buildings)

Building Categories	Total Number of Buildings	Number of Buildings Providing Heat	Energy Source: Electricity	Natural Gas	Fuel Oil	Other
All Buildings	3,948	3,567	1,185	2,611	568	417
Year Constructed						
1900 or Before	288	268	41	177	76	Q
1901 to 1920	388	355	71	236	76	5
1921 to 1945	726	633	146	414	128	16
1946 to 1960	946	813	214	467	147	63
1961 to 1970	721	649	248	361	73	38
1971 to 1973	299	199	81	94	26	Q
1974 to 1979	538	466	242	197	36	29
1980 to 1983	146	125	62	64	3	3
Square Footage Category						
5,000 or Less	2,248	1,963	589	1,020	287	216
5,001 to 10,000	725	686	217	433	114	Q
10,001 to 25,000	567	541	187	322	99	13
25,001 to 50,000	222	207	68	131	33	11
50,001 to 100,000	107	101	29	59	17	8
100,001 to 200,000	56	47	15	30	10	5
Over 200,000	29	28	8	15	6	6
Principal Activity Within Building						
Assembly	457	443	138	245	89	38
Educational	177	177	52	102	34	16
Food Sales/Service	388	367	121	204	42	Q
Health Care	61	61	18	33	7	Q
Lodging	106	102	54	43	13	8
Mercantile/Services	1,071	982	244	663	102	108
Office	575	566	231	309	65	11
Residential	236	235	49	152	53	Q
Warehouse	425	299	104	173	45	13
Other	179	148	58	68	18	6
Vacant	281	136	44	67	Q	4
Census Region						
Northeast	670	627	116	348	241	28
Midwest	1,211	1,113	283	654	105	109
South	1,493	1,279	604	527	179	147
West	574	489	183	281	41	9
Percent Heated						
Not Heated	448	0	0	0	0	0
1% to 50%	517	517	174	285	80	27
51% to 99%	554	554	189	328	93	17
100%	2,427	2,426	742	1,398	393	269

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.8 Space Heating Fuel Usage in Commercial Buildings, 1983 (Percentage Distributions)

Building Categories	Percent of All Buildings	Percent of Buildings That Provide Heat	Percent of All Buildings Providing Heat			
			Electricity	Natural Gas	Fuel Oil	Other
All Buildings	100.0	88.6	31.5	57.3	16.1	11.9
Year Constructed						
1900 or Before	7.3	93.1	15.3	66.0	28.4	Q
1901 to 1920	9.8	91.5	20.0	66.5	21.4	1.4
1921 to 1945	18.4	87.2	23.1	65.4	20.2	2.5
1946 to 1960	24.0	85.9	26.3	57.4	18.1	7.7
1961 to 1970	18.3	90.0	38.2	55.6	11.2	5.9
1971 to 1973	5.3	95.2	40.7	47.2	13.1	Q
1974 to 1979	13.4	87.9	51.9	42.3	7.7	6.2
1980 to 1983	3.5	89.3	49.6	51.2	2.4	2.4
Square Footage Category						
5,000 or Less	50.9	84.7	31.0	53.6	15.1	11.4
5,001 to 10,000	18.4	93.6	31.9	63.7	16.8	Q
10,001 to 25,000	14.4	95.4	34.6	59.5	18.3	2.4
25,001 to 50,000	5.0	93.2	29.0	63.3	15.9	5.3
50,001 to 100,000	2.7	94.4	28.7	58.4	16.8	7.9
100,001 to 200,000	1.3	94.0	31.9	63.8	21.3	10.6
Over 200,000	0.7	96.6	28.6	53.6	21.4	21.4
Principal Activity Within Building						
Assembly	11.0	90.9	31.2	55.3	20.1	8.6
Educational	4.5	100.0	29.4	57.6	19.2	9.0
Food Sales/Service	9.0	96.6	33.0	55.6	11.4	Q
Health Care	1.5	100.0	29.5	54.1	11.5	Q
Lodging	2.7	96.2	52.9	42.2	12.7	7.8
Mercantile/Services	27.1	91.7	24.0	61.4	10.5	11.0
Office	14.0	90.4	40.0	54.0	11.5	1.9
Residential	6.0	99.6	20.9	64.7	22.6	Q
Warehouse	10.0	70.4	34.0	57.9	15.1	4.3
Other	4.5	76.2	35.7	42.9	12.9	4.3
Vacant	7.1	40.4	32.4	64.0	Q	2.9
Census Region						
Northeast	17.0	93.6	10.5	55.5	30.4	4.5
Midwest	30.7	91.9	10.2	76.7	9.4	9.0
South	37.0	85.7	47.2	41.2	14.0	11.5
West	14.5	85.2	37.4	57.5	0.4	1.0
Percent Heated						
Not Heated	11.1	0.0	0.0	0.0	0.0	0.0
1% to 50%	13.1	100.0	33.7	55.1	15.5	5.2
51% to 99%	14.3	100.0	33.5	50.2	10.5	3.0
100%	61.5	100.0	30.6	57.6	10.2	11.1

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1986.

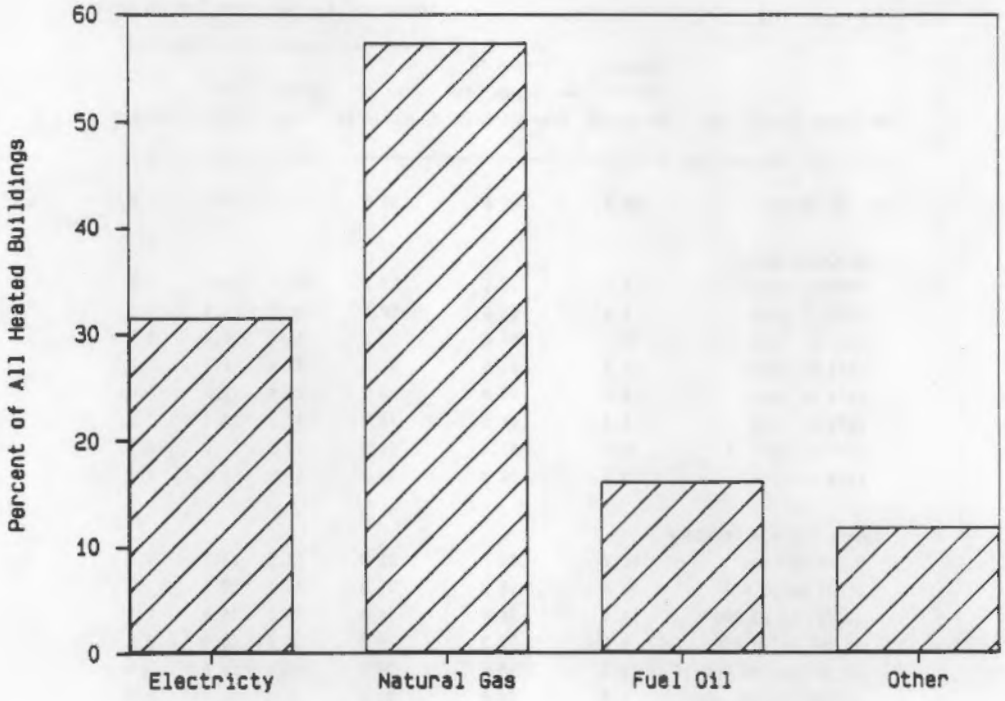

FIGURE 7.6 Space Heating Fuel Usage in Commercial Buildings
Percentage of All Heated Buildings

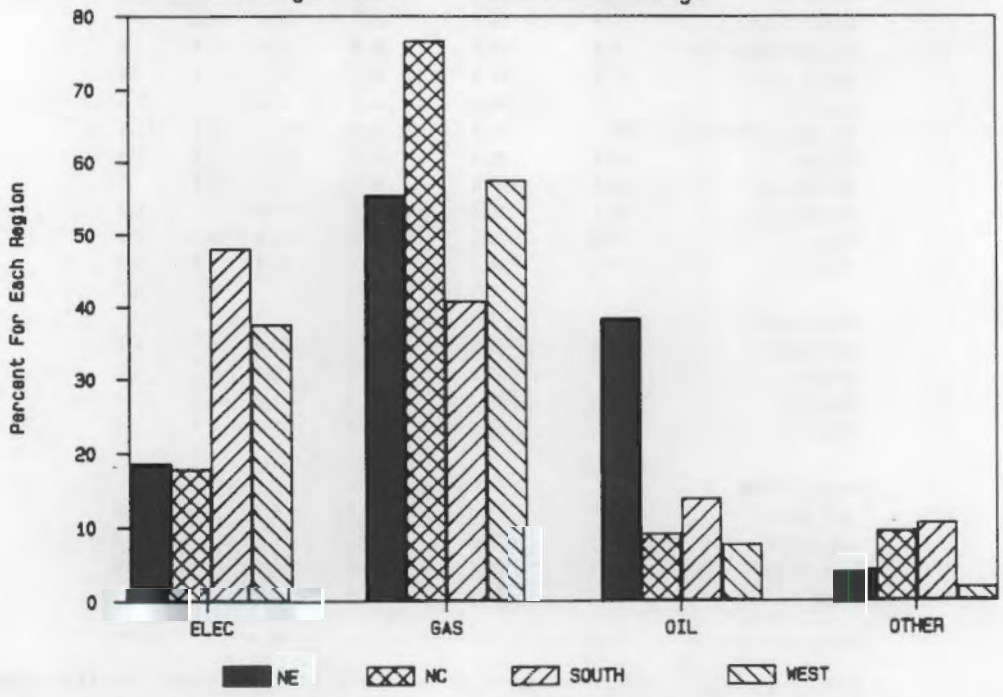

FIGURE 7.7 Space Heating Fuel Usage in Commercial Buildings, by Region

Remarks:

1. Over half of all commercial buildings in the U.S. use natural gas for space heating. Natural gas is most popular in the North Central region, where 77% of all commercial buildings use it. It is least common in the South, where only 41% of the commercial buildings use it. Natural gas is more frequently used in older buildings, although the most recent period (1980 - 1983) showed a marked increase in use.

2. Electricity is used as for space heating in 32% of the commercial buildings in the U.S., making it the second most popular space heating fuel. It is most popular in the South and West; least popular in the Northeast and North Central Regions. The incidence of electricity increases with the newness of the buildings, going from an incidence of only 15% for buildings built before 1900 to 52% in the period of 1974 through 1979. There has been a slight falling off in the incidence of electricity in the most recent period.

3. Fuel oil is used as a space heating fuel in 16% of the U.S. commercial buildings, making it the third most popular fuel. As in the residential sector, fuel oil is most popular in the Northeast Region, where 38% of the buildings use it. It is least popular in the North Central and Western Regions, where 9% and 8% us it, respectively. Surprisingly, 14% of the commercial buildings in the South use fuel oil. Like natural gas, fuel oil is more commonly used in older buildings. It's use declines precipitously in more recently constructed buildings.

7.3 HEATING SYSTEMS USED IN U.S. COMMERCIAL BUILDINGS

TABLE 7.9 Heating Systems Used In Commercial Buildings, 1983 (Thousands of Buildings)

Building Categories	Total Number of Buildings	Number of Buildings Providing Heat	Self-Contained Units Only	Central Systems Only or in Combination with Self-Contained Units		
				Total	Furnace or Boiler	Heat Pumps
All Buildings	3,948	3,588	583	2,984	2,198	169
Year Constructed						
1900 or Before	288	268	22	245	222	Q
1901 to 1920	388	355	49	306	275	Q
1921 to 1945	726	633	116	512	418	Q
1946 to 1960	946	813	159	648	499	26
1961 to 1970	721	649	101	543	381	53
1971 to 1973	299	199	24	176	118	Q
1974 to 1979	538	456	98	356	223	41
1980 to 1983	148	125	15	109	56	19
Square Footage Category						
5,000 or Less	2,248	1,963	385	1,584	1,188	109
5,001 to 10,000	725	680	94	581	449	35
10,001 to 25,000	567	541	65	476	368	18
25,001 to 50,000	222	207	24	183	142	9
50,001 to 100,000	107	101	9	91	69	3
100,001 to 200,000	50	47	8	42	33	2
Over 200,000	29	28	1	27	19	Q
Principal Activity Within Building						
Assembly	457	443	37	405	334	24
Educational	177	177	22	153	131	7
Food Sales/Service	388	367	61	303	214	Q
Health Care	61	61	Q	54	39	Q
Lodging	106	102	29	73	51	Q
Mercantile/Services	1,071	982	232	739	546	26
Office	575	566	58	512	358	45
Residential	236	235	23	213	187	Q
Warehouse	425	299	66	233	161	Q
Other	179	148	30	118	79	Q
Vacant	281	136	28	109	89	Q
Census Region						
Northeast	678	627	66	560	485	6
Midwest	1,211	1,113	107	1,002	893	15
South	1,493	1,279	312	951	547	119
West	574	489	98	388	265	29
Percent Heated						
Not Heated	448	--	--	--	--	--
1% to 50%	517	517	148	364	273	22
51% to 99%	584	584	76	484	365	31
100%	2,427	2,426	360	2,056	1,552	116

Note: Q = Data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.10 Heating Systems Used In Commercial Buildings, 1983 (Percentages for Number of Buildings)

Building Categories	Percent of Total Buildings	Percent of Buildings That Provide Heat	Self-Contained Units Only	Central Systems Only or in Combination with Self-Contained Units		
				Total	Furnace or Boiler	Heat Pumps
All Buildings	100.0	88.9	16.6	82.8	62.4	4.8
Year Constructed						
1900 or Before	7.3	93.1	8.2	91.4	82.6	Q
1901 to 1920	9.8	91.5	13.8	86.2	77.5	Q
1921 to 1945	18.4	87.2	18.3	86.9	65.7	Q
1946 to 1960	24.8	85.9	19.6	79.7	61.4	3.2
1961 to 1970	18.3	90.0	15.6	83.7	58.7	8.2
1971 to 1973	6.3	95.2	12.1	88.4	59.3	Q
1974 to 1979	13.4	87.9	21.0	78.5	47.9	8.6
1980 to 1983	3.5	89.3	12.0	87.2	44.6	15.2
Square Footage Category						
5,000 or Less	56.9	84.7	28.2	79.0	58.2	5.3
5,001 to 10,000	18.4	93.8	13.8	85.4	66.0	5.1
10,001 to 25,000	14.4	95.4	12.0	88.0	68.0	3.3
25,001 to 50,000	5.6	93.2	11.6	88.4	68.6	4.3
50,001 to 100,000	2.7	94.4	6.9	90.1	68.3	3.0
100,001 to 200,000	1.3	94.0	12.0	89.4	70.2	4.3
Over 200,000	0.7	96.6	3.6	96.4	67.9	Q
Principal Activity Within Building						
Assembly	11.6	96.9	8.4	91.4	75.4	5.4
Educational	4.5	100.0	12.4	86.4	74.0	4.0
Food Sales/Service	9.0	96.6	16.6	82.6	58.3	Q
Health Care	1.5	100.0	Q	88.5	63.9	Q
Lodging	2.7	96.2	28.4	71.6	58.0	Q
Mercantile/Services	27.1	91.7	23.6	76.3	55.6	2.6
Office	14.6	98.4	8.8	90.5	63.3	8.0
Residential	6.0	99.6	9.8	90.6	79.6	Q
Warehouse	10.8	78.4	22.1	77.9	53.8	Q
Other	4.6	78.2	21.4	78.6	58.4	Q
Vacant	7.1	48.4	26.6	86.1	65.4	Q
Census Region						
Northeast	17.0	93.6	10.5	89.3	77.4	1.0
Midwest	30.7	91.9	9.6	90.0	86.2	1.3
South	37.6	85.7	24.4	74.7	42.6	9.3
West	14.6	85.2	26.0	79.3	54.2	5.9
Percent Heated						
Not Heated	11.1	--	--	--	--	--
1% to 50%	13.1	100.0	28.6	78.4	52.6	4.3
51% to 99%	14.3	100.0	13.5	85.6	64.7	5.5
100%	61.5	100.0	14.0	84.7	64.0	4.6

Note: Q = Data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1986.

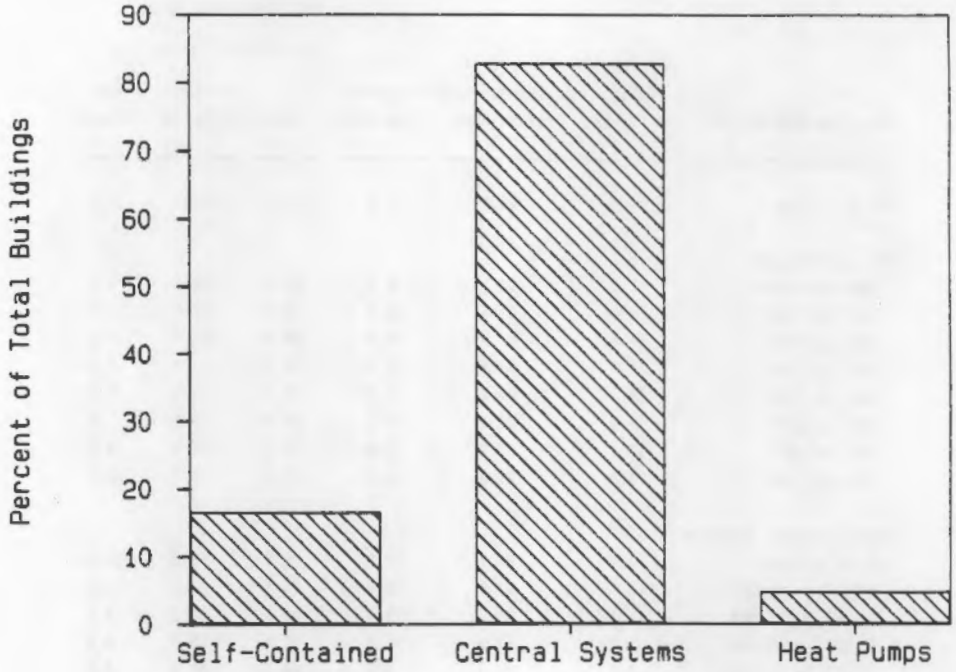

FIGURE 7.8 Heating System Types Used In Commercial Buildings, 1983

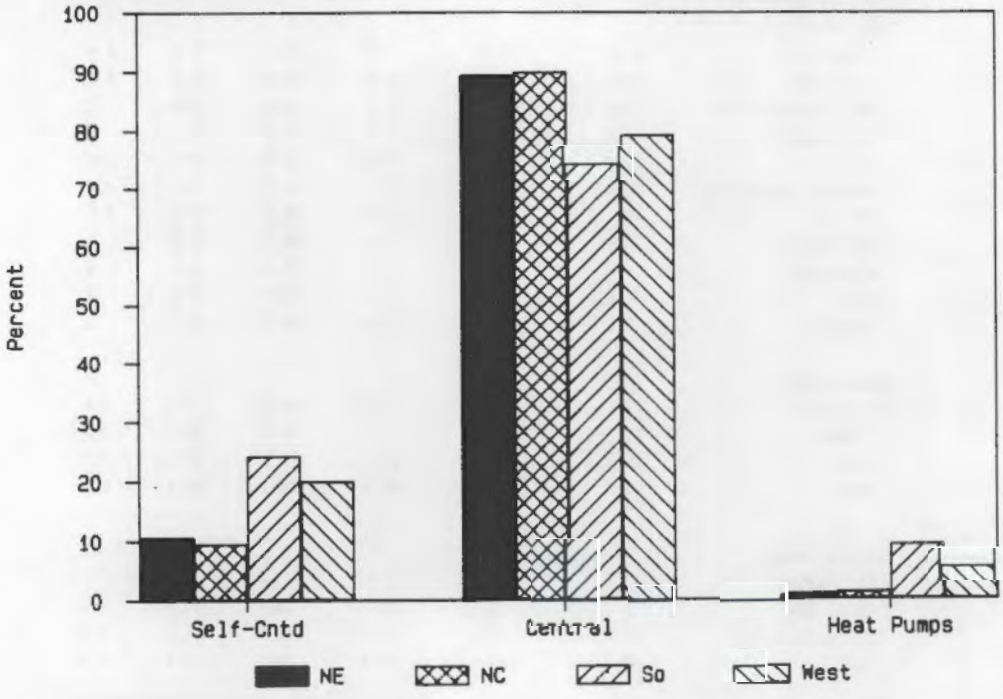

FIGURE 7.9 Heating System Types in Commercial Buildings, by Region, 1983

Remarks:

1. "Self-Contained Heating Units" are units installed in either the building or the roof and which generate and deliver heat only to a local zone within the building. "Central Heating Systems" have a centrally located heating plant, such as a furnace/boiler or an electric resistance unit, which produces heated water or hot air fir distribution throughout the heated portion of the building.

2. Heat pumps are considered separately from both self-contained units and central systems. They may be used for heating either a local zone, like the self-contained units, or the entire conditioned area of the building, like the central systems. They may also be used to simultaneously heat and cool different areas of the same building. The EIA reports that the number of heat pumps estimated in their report is a conservative estimate because counts were obtained from open-ended questions about heating and heat distribution systems, such as heat pumps, which were not specifically mentioned in the survey questionaire.

7.4 HEAT DISTRIBUTION SYSTEMS USED IN U.S. COMMERCIAL BUILDINGS

TABLE 7.11 Heat Distribution Systems Used In U.S. Commercial Buildings, 1983 (Thousands of Buildings)

Building Categories	Total Number of Buildings	Number of Buildings Providing Heat	Air Forced Through Ducts	Baseboards			Radiators, Convectors, or Heating Panels	Other
				Total	Electric	Hot Water or Steam		
All Buildings	3,948	3,588	1,858	538	298	265	59	481
Year Constructed								
1900 or Before	288	268	128	52	20	33	Q	29
1901 to 1920	388	355	165	47	23	25	9	22
1921 to 1945	726	633	239	88	45	47	10	78
1946 to 1960	946	813	414	110	52	64	18	94
1961 to 1970	721	649	406	118	59	62	19	85
1971 to 1973	299	199	131	34	25	Q	Q	32
1974 to 1979	536	466	287	72	57	17	4	45
1980 to 1983	146	125	96	17	9	8	2	15
Square Footage Category								
5,000 or Less	2,248	1,963	928	231	140	86	29	244
5,001 to 10,000	725	688	384	124	68	51	Q	69
10,001 to 25,000	587	541	319	95	52	45	13	53
25,001 to 50,000	222	207	120	47	16	28	5	17
50,001 to 100,000	107	101	59	23	8	15	3	8
100,001 to 200,000	58	47	27	12	4	8	3	7
Over 200,000	29	28	21	8	3	7	2	3
Principal Activity Within Building								
Assembly	457	443	287	89	51	31	Q	49
Educational	177	177	87	39	18	32	9	13
Food Sales/Service	388	387	199	37	38	Q	Q	56
Health Care	61	61	37	15	Q	14	1	Q
Lodging	186	182	38	25	14	12	Q	15
Mercantile/Services	1,071	982	464	81	44	31	Q	128
Office	575	566	389	112	66	51	18	55
Residential	236	235	86	45	19	25	Q	Q
Warehouse	425	299	158	56	32	23	Q	47
Other	179	148	59	23	15	Q	Q	13
Vacant	281	136	71	15	6	7	Q	13
Census Region								
Northeast	678	627	251	167	69	188	13	53
Midwest	1,211	1,113	677	211	88	127	26	84
South	1,493	1,279	678	86	72	16	15	215
West	574	489	268	74	68	Q	Q	58
Fuel Used For Heating								
Electricity	1,195	1,185	598	253	222	44	15	161
Natural Gas	2,811	2,811	1,148	279	115	178	36	198
Fuel Oil	566	566	298	122	45	82	16	44
Propane	181	181	59	Q	Q	Q	Q	39
Purchased Steam	55	55	28	22	Q	21	5	3
Other	178	178	49	25	21	Q	Q	43

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.12 Heat Distribution Systems Used In U.S. Commercial Buildings, 1983
(Percentages for Number of Buildings)

Building Categories	Percent of All Buildings	Percent of Buildings That Provide Heat	Air Forced Through Ducts	Baseboards			Radiators, Convectors, or Heating Panels	Other
				Total	Electric	Hot Water or Steam		
All Buildings	100.0	88.9	53.0	15.3	8.3	7.0	1.7	11.4
Year Constructed								
1900 or Before	7.3	93.1	44.8	19.4	7.5	12.3	Q	10.8
1901 to 1920	9.8	91.5	46.5	13.2	6.5	7.0	2.5	6.2
1921 to 1945	18.4	87.2	37.8	13.9	7.1	7.4	1.6	12.3
1946 to 1960	24.0	85.9	50.9	13.5	6.4	7.9	2.2	11.6
1961 to 1970	18.3	90.0	62.6	18.2	9.1	9.6	1.5	13.1
1971 to 1973	5.3	95.2	65.0	17.1	12.6	Q	Q	16.1
1974 to 1979	13.4	87.9	61.6	15.5	12.2	3.6	0.9	9.7
1980 to 1983	3.5	89.3	76.0	13.6	7.2	6.4	1.6	12.0
Square Footage Category								
5,000 or Less	56.9	84.7	48.0	12.1	7.4	4.5	1.5	12.0
5,001 to 10,000	18.4	93.0	56.5	18.2	10.0	7.5	Q	10.1
10,001 to 25,000	14.4	95.4	59.0	17.0	9.0	8.3	2.4	9.0
25,001 to 50,000	5.6	93.2	58.0	22.7	7.7	13.5	2.4	8.2
50,001 to 100,000	2.7	94.4	58.4	22.0	7.9	15.0	3.0	7.9
100,001 to 200,000	1.3	94.0	57.4	25.5	8.5	17.0	6.4	14.9
Over 200,000	0.7	96.0	75.0	28.0	10.7	25.0	7.1	10.7
Principal Activity Within Building								
Assembly	11.0	95.9	64.0	20.1	11.5	7.0	Q	11.1
Educational	4.5	100.0	49.2	22.0	5.0	18.1	5.1	7.3
Food Sales/Service	9.0	96.0	54.2	10.1	0.2	Q	Q	15.0
Health Care	1.5	100.0	60.7	24.0	Q	23.0	1.0	Q
Lodging	2.7	96.2	29.4	24.5	13.7	11.0	Q	14.7
Mercantile/Services	27.1	91.7	47.3	0.2	4.5	3.2	Q	13.0
Office	14.0	96.4	60.7	19.0	11.7	9.0	1.0	9.7
Residential	0.0	99.0	36.0	19.1	0.1	10.5	Q	Q
Warehouse	10.0	70.4	50.2	10.7	10.7	7.7	Q	15.7
Other	4.5	70.2	42.1	16.4	10.7	Q	Q	9.3
Vacant	7.1	40.4	52.2	11.0	4.4	5.1	Q	9.0
Census Region								
Northeast	17.0	93.0	40.0	26.0	11.0	17.2	2.1	0.5
Midwest	30.7	91.9	60.0	19.0	7.9	11.4	2.3	7.5
South	37.0	05.7	52.4	0.7	5.0	1.3	1.2	15.0
West	14.5	05.2	53.2	15.1	12.3	Q	Q	10.2
Fuel Used For Heating								
Electricity	20.0	100.0	53.4	22.9	20.1	4.0	1.4	14.0
Natural Gas	50.9	100.0	50.7	13.9	5.7	0.5	1.0	9.4
Fuel Oil	14.3	100.0	51.2	21.0	0.0	14.5	2.0	7.0
Propane	4.1	100.0	30.0	Q	Q	Q	Q	24.2
Purchased Steam	1.4	100.0	47.3	40.0	Q	30.2	9.1	5.5
Other	4.3	100.0	20.0	14.7	12.4	Q	Q	25.3

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

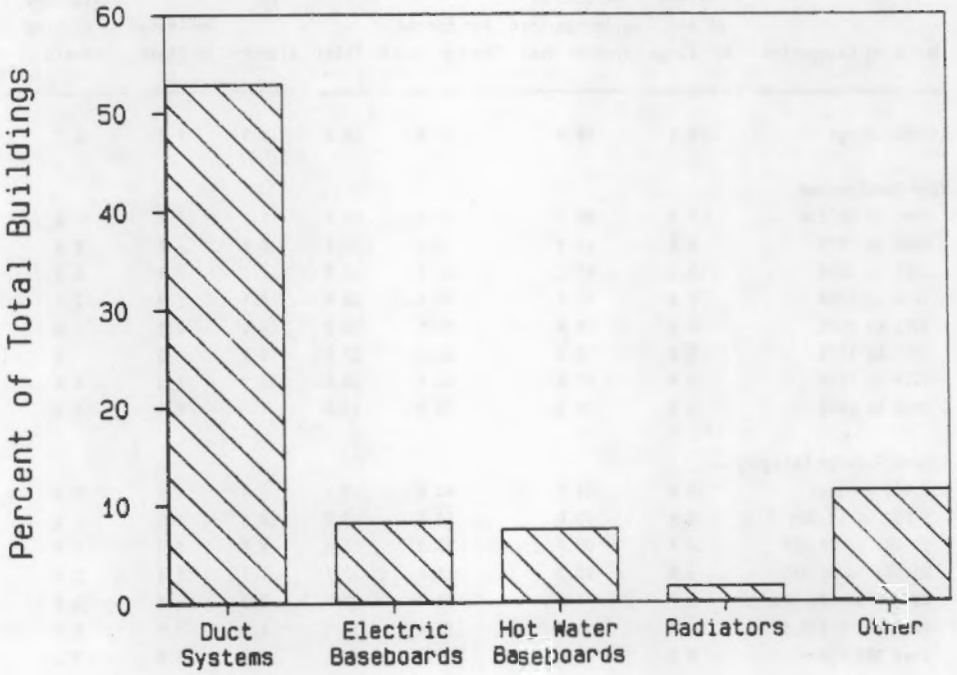

FIGURE 7.10 Heat Distribution Systems in Commercial Buildings, 1983

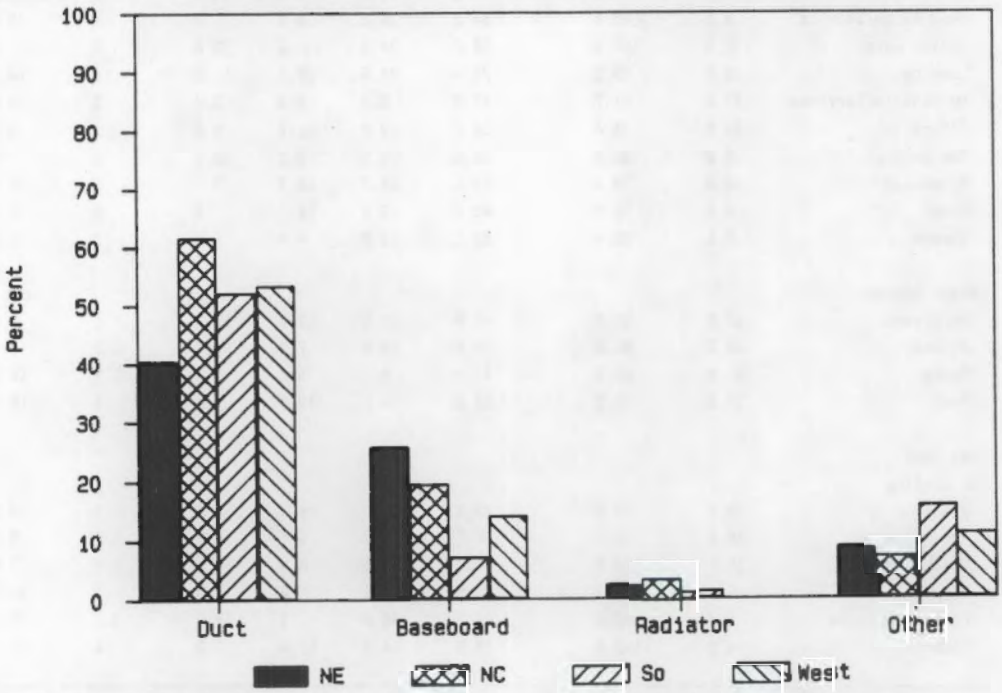

FIGURE 7.11 Heat Distribution Systems in Commercial Buildings, by Region, 1983

Remarks:

1. Heat distribution systems include only central, not self-contained heating systems. The total number of buildings with some kind of heat distribution system (2,856,000), therefore, does not equal the sum of all buildings which provide heat (3,508,000).

2. Warm air heating ducts are used in over half of all commercial buildings in the U.S. Duct-based distribution systems are most common in the North Central Region; least in the Northeast. They are less common in the older buildings, smaller commercial buildings, and in lodging buildings. They are most common in the newest and largest buildings, and in office and assembly buildings.

7.5 COOLING FUELS AND SYSTEMS IN U.S. COMMERCIAL BUILDINGS

TABLE 7.13 Cooling Fuels and Systems for Commercial Buildings, 1983 (Thousands of Buildings)

Building Categories	Number of All Buildings	All Buildings With Cooling	Fuels Used For Cooling		Cooling Equipment			
			Electricity	Natural Gas	Window Units	Wall Units	Central Air Conditioning	Heat Pumps
All Buildings	3,948	2,643	2,515	141	812	486	1,748	169
Year Constructed								
1900 or Before	288	175	166	Q	87	29	86	Q
1901 to 1920	388	247	241	Q	77	39	155	Q
1921 to 1945	726	433	413	26	228	66	224	Q
1946 to 1960	946	599	564	37	241	115	339	26
1961 to 1970	721	536	506	29	100	83	392	53
1971 to 1973	289	150	143	7	22	19	121	Q
1974 to 1979	536	394	377	18	54	44	329	41
1980 to 1983	146	113	104	8	5	11	102	19
Square Footage Category								
5,000 or Less	2,248	1,345	1,282	74	452	222	705	100
5,001 to 10,000	725	521	499	27	148	77	371	35
10,001 to 25,000	567	443	424	18	118	61	334	18
25,001 to 50,000	222	178	166	12	50	26	128	9
50,001 to 100,000	107	68	61	7	28	9	70	3
100,001 to 200,000	58	41	39	2	12	7	35	2
Over 200,000	29	27	24	2	6	4	25	Q
Principal Activity Within Building								
Assembly	457	296	282	Q	86	31	227	24
Educational	177	130	123	7	52	19	82	7
Food Sales/Service	380	314	303	20	59	46	221	Q
Health Care	61	55	53	1	9	13	42	Q
Lodging	106	79	77	Q	30	30	37	Q
Mercantile/Services	1,071	659	640	26	227	104	377	26
Office	575	525	486	42	109	49	428	45
Residential	236	163	154	Q	96	46	62	Q
Warehouse	425	230	200	19	69	39	152	Q
Other	179	98	97	Q	34	12	64	Q
Vacant	201	94	89	Q	37	Q	57	Q
Census Region								
Northeast	670	444	417	26	206	98	227	8
Midwest	1,211	804	755	51	228	99	566	15
South	1,493	1,111	1,079	32	327	100	755	119
West	574	284	264	31	51	28	206	29

Note: Q = data withheld because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.14 Cooling Fuels and Systems in Commercial Buildings, 1983 (Percentages for Number of Buildings)

Building Categories	Percent of All Buildings	Percent of Buildings That Provide Cooling	Percent of All Buildings Providing Cooling: Electricity	Natural Gas	Window Units	Wall Units	Central Air Conditioning	Heat Pumps
All Buildings	100.0	66.9	95.2	5.3	30.7	15.4	66.1	6.4
Year Constructed								
1900 or Before	7.3	66.8	94.9	Q	49.7	16.6	49.1	Q
1901 to 1920	9.8	63.7	97.6	Q	31.2	15.8	62.8	Q
1921 to 1945	18.4	59.6	95.4	6.0	52.2	15.2	51.7	Q
1946 to 1960	24.0	63.3	94.2	6.2	46.2	19.2	56.6	4.3
1961 to 1970	18.3	73.5	95.5	5.5	18.9	15.7	74.0	15.0
1971 to 1973	5.3	71.8	95.3	4.7	14.7	12.7	80.7	Q
1974 to 1979	13.4	74.3	95.7	4.6	13.7	11.2	63.5	10.4
1980 to 1983	3.5	86.7	92.6	7.1	4.4	9.7	90.3	16.6
Square Footage Category								
5,000 or Less	56.9	59.6	95.3	5.6	33.6	16.5	58.4	7.4
5,001 to 10,000	18.4	71.9	95.6	5.2	28.4	14.6	71.2	6.7
10,001 to 25,000	14.4	78.1	95.7	4.1	26.2	13.0	75.4	4.1
25,001 to 50,000	5.6	80.2	93.3	6.7	28.1	14.6	71.9	5.1
50,001 to 100,000	2.7	82.2	92.0	8.0	31.8	10.2	79.5	3.4
100,001 to 200,000	1.3	82.0	95.1	4.9	29.3	17.1	85.4	4.9
Over 200,000	0.7	93.1	88.9	7.4	22.2	14.8	92.6	Q
Principal Activity Within Building								
Assembly	11.6	64.8	95.3	Q	27.0	10.5	76.7	8.1
Educational	4.5	73.4	94.6	5.4	46.0	14.6	63.1	5.4
Food Sales/Service	9.6	82.6	96.5	6.4	22.0	15.3	78.4	Q
Health Care	1.5	90.2	96.4	1.8	10.4	23.6	76.4	Q
Lodging	2.7	74.5	97.5	Q	38.0	38.0	46.6	Q
Mercantile/Services	27.1	61.5	97.1	3.9	34.4	15.6	57.2	3.9
Office	14.6	91.3	93.0	6.0	20.6	9.3	81.5	8.6
Residential	6.0	69.1	94.5	Q	58.9	28.2	38.0	Q
Warehouse	10.8	54.1	90.4	8.3	36.0	17.0	66.1	Q
Other	4.5	54.7	99.0	Q	34.7	12.2	65.3	Q
Vacant	7.1	33.5	94.7	Q	39.4	Q	86.6	Q
Census Region								
Northeast	17.0	66.3	93.9	5.9	46.4	22.1	51.1	1.4
Midwest	30.7	66.4	93.9	6.3	28.4	12.3	69.7	1.9
South	37.8	74.4	97.1	2.9	29.4	15.2	68.0	10.7
West	14.5	49.5	93.0	10.9	18.0	9.9	72.5	10.2

Note: Q = data withheld because RSE was greater than 50%, or fewer than 20 buildings were sampled.

Source: CBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

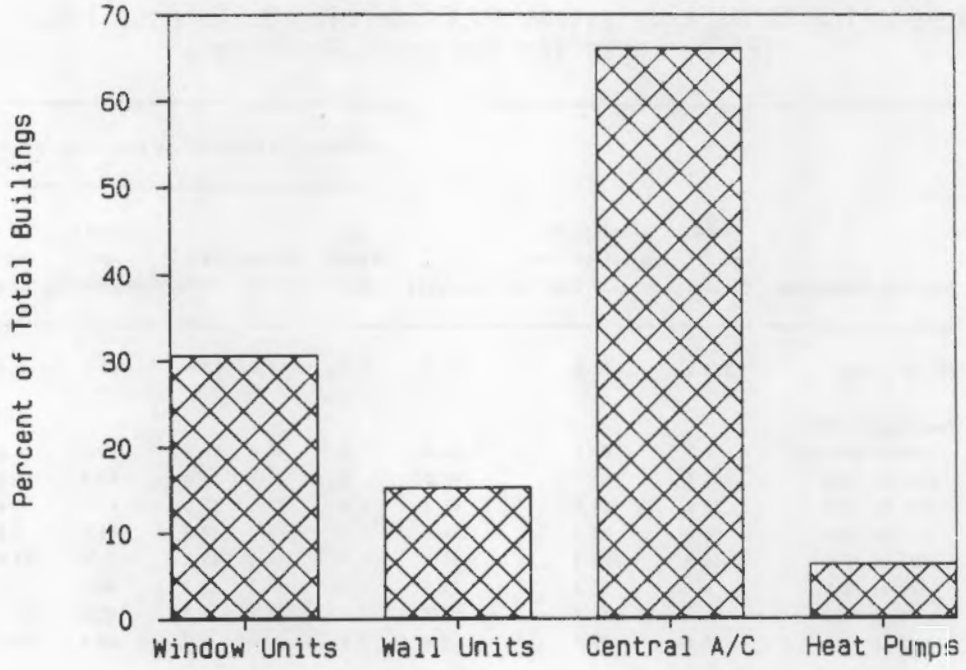

FIGURE 7.12 Air Conditioning Equipment Types in Commercial Buildings, 1983

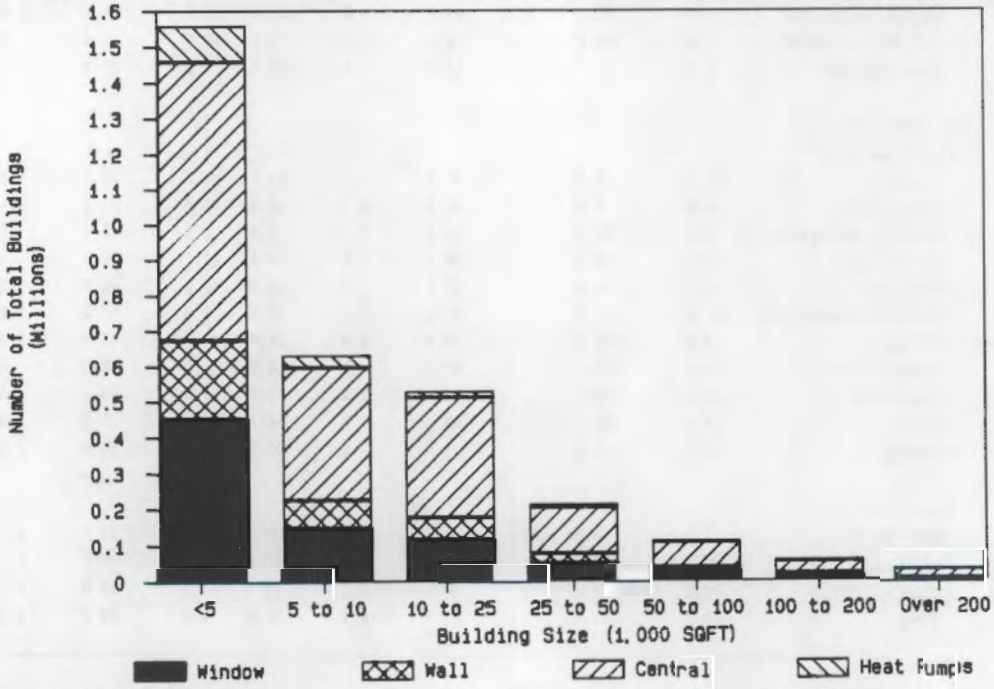

FIGURE 7.13 Air Conditioning Equipment in Commercial Buildings, by Type, 1983

Remarks:

1. Only air conditioning and heat pump technologies are included in Tables 7.13 and 7.14 and their associated figures, which portray cooling fuels and equipment used in U.S. commercial buildings. Not included are cooling technologies which solely make use of fans, blowers, or evaporative cooling systems which are not connected to a refrigeration unit. Air conditioning units not in working order at the time of the survey are included in the data.

2. Central air conditioning is the most common type of air conditioning equipment in commercial buildings. It most frequently found in newer and larger buildings and in buildings in regions other than the Northeast. Window and wall units are more frequently found in older and smaller buildings and are much more common in the Northeast than elsewhere. Heat pumps are most popular in the South and West and in newer buildings.

TABLE 7.15 Energy Conservation In Commercial Buildings, 1983
(Thousands of Buildings)

Building Categories	Number of All Buildings	Buildings Providing Heating or Cooling	Buildings Using Insulation or Special Glass	Special Glass	Roof/ Ceiling Insulation	Wall Insulation	Computerized Heating-Cooling System	Professional Energy Audit	Measures Taken in Response to Audit
All Buildings	3,948	3,556	2,726	1,488	1,984	1,366	185	434	187
Year Constructed									
1900 or Before	288	268	196	184	127	87	Q	23	12
1901 to 1920	388	366	216	124	135	100	9	37	18
1921 to 1945	726	639	441	196	294	176	18	73	35
1946 to 1960	946	833	573	264	423	272	23	83	45
1961 to 1970	721	654	548	292	388	262	19	94	35
1971 to 1973	299	281	171	92	126	96	9	38	15
1974 to 1979	536	473	456	311	312	267	22	65	19
1980 to 1983	148	128	136	104	106	106	12	22	8
Square Footage Category									
5,000 or Less	2,248	1,948	1,456	669	1,029	752	29	151	52
5,001 to 10,000	725	684	545	327	354	263	Q	96	43
10,001 to 25,000	567	544	421	259	297	219	20	76	38
25,001 to 50,000	222	211	163	112	116	78	15	58	27
50,001 to 100,000	107	101	84	54	62	35	13	25	12
100,001 to 200,000	58	47	37	27	27	15	10	18	9
Over 200,000	29	28	25	20	19	12	7	11	5
Principal Activity Within Building									
Assembly	457	444	359	236	246	162	12	52	24
Educational	177	177	136	84	98	58	17	49	24
Food Sales/Service	388	375	288	168	186	153	13	44	15
Health Care	61	61	55	32	46	34	3	18	Q
Lodging	196	194	77	36	61	43	8	24	11
Mercantile/Services	1,071	1,018	665	310	479	298	15	85	36
Office	575	567	488	299	333	274	25	88	39
Residential	236	235	171	108	111	89	Q	20	Q
Warehouse	425	318	223	90	153	112	2	30	14
Other	179	138	110	51	73	63	4	19	Q
Vacant	281	137	102	74	118	89	3	6	3
Census Region									
Northeast	670	628	464	253	310	233	24	81	45
Midwest	1,211	1,115	867	511	661	452	36	120	54
South	1,493	1,317	1,001	486	712	478	27	154	58
West	574	496	395	243	282	203	18	78	30
Fuel Used For Heating									
Electricity	1,105	1,099	873	522	642	517	39	NA	NA
Natural Gas	2,011	2,010	1,463	850	987	710	58	NA	NA
Fuel Oil	566	566	388	191	270	100	12	NA	NA
Propane	101	100	112	42	79	69	Q	NA	NA
Purchased Steam	55	55	41	10	35	12	9	NA	NA
Other	170	100	102	40	05	07	2	NA	NA

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.
NA = Information was not available.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

TABLE 7.16 Energy Conservation In Commercial Buildings, 1983 (Percentages for Number of Buildings)

Building Categories	Percent of All Buildings	Percent of Buildings That Provide Heating or Cooling	Buildings Using Insulation or Special Glass	Special Glass	Roof/ Ceiling Insulation	Wall Insulation	Computerized Heating-Cooling System	Professional Energy Audit	Measures Taken in Response to Audit
All Buildings	100.0	90.1	76.7	41.8	53.5	38.4	3.8	12.2	43.1
Year Constructed									
1900 or Before	7.3	93.1	73.1	38.8	47.4	32.5	Q	8.6	52.2
1901 to 1920	9.8	92.8	68.8	34.4	37.5	27.8	2.5	10.3	48.6
1921 to 1945	18.4	88.8	69.8	36.7	46.8	27.5	1.6	11.4	47.9
1946 to 1960	24.8	88.1	68.8	31.7	56.8	32.7	2.8	10.8	54.2
1961 to 1970	18.3	98.7	83.8	44.6	59.3	46.1	2.9	14.4	37.2
1971 to 1973	5.3	96.2	85.1	45.8	59.7	47.8	4.5	18.9	39.5
1974 to 1979	13.4	89.2	95.1	65.8	66.8	56.4	4.7	13.7	29.2
1980 to 1983	3.5	91.4	101.6	81.3	82.8	62.8	9.4	17.2	36.4
Square Footage Category									
5,000 or Less	56.9	86.3	74.7	35.5	53.8	36.8	1.5	7.8	34.4
5,001 to 10,000	18.4	94.3	79.7	47.8	51.8	36.5	Q	14.8	44.8
10,001 to 25,000	14.4	95.9	77.4	47.6	54.6	40.3	3.7	13.8	50.7
25,001 to 50,000	5.6	95.8	77.3	53.1	55.8	33.2	7.1	27.5	46.6
50,001 to 100,000	2.7	94.4	83.2	53.5	61.4	34.7	12.9	24.8	48.8
100,001 to 200,000	1.3	94.8	78.7	57.4	57.4	31.9	21.3	38.3	58.8
Over 200,000	0.7	96.6	89.3	71.4	67.9	42.9	25.8	39.3	45.5
Principal Activity Within Building									
Assembly	11.6	97.2	88.9	53.2	55.4	36.5	2.7	11.7	46.2
Educational	4.5	100.0	78.8	47.5	55.4	32.8	9.6	27.7	49.8
Food Sales/Service	9.6	98.7	74.7	44.8	49.6	40.8	3.5	11.7	34.1
Health Care	1.6	100.0	98.2	52.5	76.4	55.7	4.9	29.5	Q
Lodging	2.7	98.1	74.8	34.6	58.7	41.3	7.7	23.1	45.8
Mercantile/Services	27.1	94.3	65.8	38.7	47.4	28.7	1.5	8.4	42.4
Office	14.8	98.8	86.1	52.7	58.7	48.3	4.4	15.5	44.3
Residential	6.8	99.8	72.8	46.8	47.2	37.9	Q	8.5	Q
Warehouse	10.8	72.9	71.9	29.8	49.4	36.1	8.8	9.7	46.7
Other	4.5	77.1	79.7	37.8	52.9	45.7	2.9	13.8	Q
Vacant	7.1	48.8	118.2	54.8	86.1	65.8	2.2	4.4	58.8
Census Region									
Northeast	17.8	93.7	73.9	48.3	49.4	37.1	3.8	12.9	55.5
Midwest	30.7	92.1	77.8	45.8	53.9	40.5	3.2	10.8	45.8
South	37.8	88.2	76.8	38.4	54.1	36.3	2.1	11.7	37.7
West	14.5	86.4	79.6	49.8	56.9	48.9	3.6	15.7	38.5
Fuel Used For Heating									
Electricity	28.8	99.5	79.4	47.5	58.4	47.8	3.5	NA	NA
Natural Gas	56.9	100.0	72.8	42.3	49.1	35.7	2.9	NA	NA
Fuel Oil	14.3	100.0	68.6	33.7	49.1	29.3	2.1	NA	NA
Propane	4.1	99.4	79.8	26.3	49.4	43.1	Q	NA	NA
Purchased Steam	1.4	100.0	74.5	32.7	63.6	21.8	16.4	NA	NA
Other	4.3	98.8	68.7	28.8	58.6	39.9	1.2	NA	NA

Note: Q = data withheld either because RSE was greater than 50%, or fewer than 20 buildings were sampled.
NA = Information was not available.

Source: NBECS: Characteristics of Commercial Buildings 1983, US DOE/EIA, July 1985.

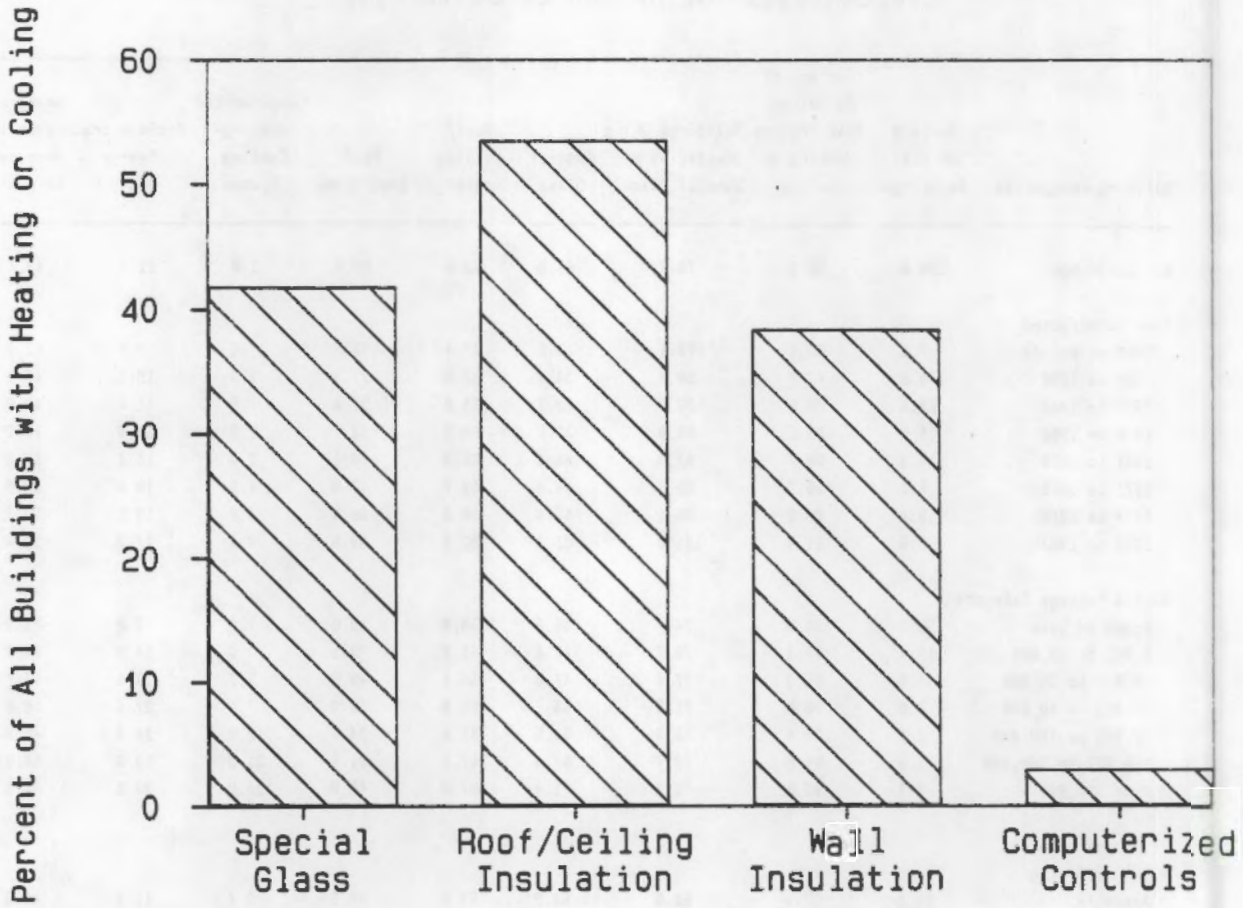

FIGURE 7.14 Energy Conservation Measures in Commercial Buildings, 1983

CHAPTER EIGHT: ENERGY CONSUMPTION, PRICES, AND EXPENDITURES OF THE COMMERCIAL BUILDINGS SECTOR

This chapter provides information on energy consumption by the buildings component of the U.S. commercial end-use sector. The commercial buildings need to be distinguished from the commercial sector as a whole, which includes such nonbuilding energy consumers as streetlights, bridges, and construction sites. The information in this chapter comes from the State Energy Data Report, the Monthly Energy Review, the Nonresidential Buildings Energy Consumption Survey: 1983, Consumption and Expenditures, Part 2, and the Annual Energy Review, all of which are Energy Information Administration publications.

This chapter is comprised of the following sections:

8.1 HISTORICAL ENERGY CONSUMPTION BY THE U.S. COMMERCIAL BUILDINGS SECTOR, 1960 - 1985, BY FUEL TYPE

TABLE 8.1 Historical Energy Consumption by the Commercial Buildings Sector, by Fuel Type, 1960 - 1985
(Trillion BTUs)

Year	Coal	Gas	Petroleu	Electricity	Total End-Use Energy Consumed	Electrical Energy Losses	Primary Energy Consumed
1960	572.1	1,055.9	1,227.5	542.7	3,398.3	1,351.1	4,749.4
1961	521.0	1,114.5	1,247.5	570.7	3,453.8	1,391.7	4,845.5
1962	515.6	1,248.9	1,279.7	619.6	3,663.8	1,490.0	5,153.8
1963	438.8	1,301.8	1,262.2	686.8	3,689.5	1,843.1	5,332.5
1964	374.9	1,412.0	1,246.9	738.0	3,771.8	1,758.7	5,530.6
1965	356.5	1,483.3	1,386.5	789.1	4,015.3	1,885.1	5,900.4
1966	359.4	1,668.7	1,435.7	859.0	4,322.9	2,062.8	6,385.8
1967	307.6	2,014.7	1,483.1	928.0	4,731.4	2,214.1	6,945.5
1968	275.8	2,134.3	1,510.1	1,015.5	4,935.7	2,424.9	7,360.7
1969	260.3	2,315.8	1,519.8	1,109.8	5,205.7	2,652.8	7,858.5
1970	217.1	2,454.6	1,551.1	1,203.2	5,426.1	2,918.0	8,344.1
1971	203.6	2,568.9	1,509.8	1,290.1	5,572.4	3,121.4	8,693.7
1972	156.6	2,674.1	1,530.0	1,409.4	5,770.2	3,387.9	9,158.1
1973	148.1	2,660.0	1,565.5	1,518.6	5,892.3	3,639.6	9,531.9
1974	151.7	2,614.2	1,422.7	1,502.1	5,690.6	3,665.8	9,356.5
1975	123.4	2,556.2	1,309.7	1,597.7	5,587.0	3,855.8	9,442.8
1976	120.4	2,716.8	1,480.9	1,677.6	5,975.7	4,041.6	10,017.3
1977	121.8	2,546.9	1,510.9	1,753.9	5,933.5	4,235.9	10,169.3
1978	129.2	2,642.1	1,449.8	1,814.3	6,035.5	4,440.2	10,475.6
1979	114.9	2,834.0	1,334.1	1,853.8	6,136.8	4,476.3	10,613.1
1980	87.3	2,665.7	1,287.5	1,906.5	5,947.0	4,637.3	10,584.3
1981	98.8	2,577.5	1,090.2	2,033.1	5,799.6	4,845.3	10,644.9
1982	113.8	2,670.8	1,006.4	2,077.2	5,870.1	4,984.9	10,855.0
1983	119.0	2,504.6	1,136.4	2,118.2	5,877.9	5,065.7	10,943.6
1984	128.7	2,593.9	1,156.7	2,240.8	6,122.2	5,217.9	11,340.1
1985	109.1	2,508.1	1,035.8	2,355.4	6,008.2	5,573.4	11,581.6

Source: State Energy Data Report, U.S. DOE/EIA, April, 1987.

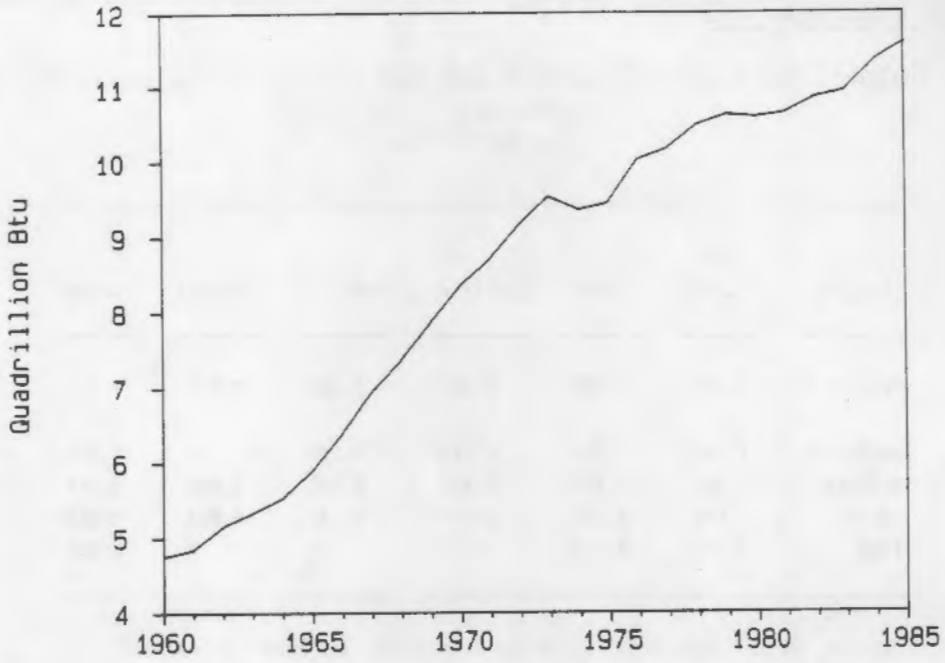

FIGURE 8.1 Total Primary Energy Consumption by the Commercial Buildings Sector 1960 - 1985

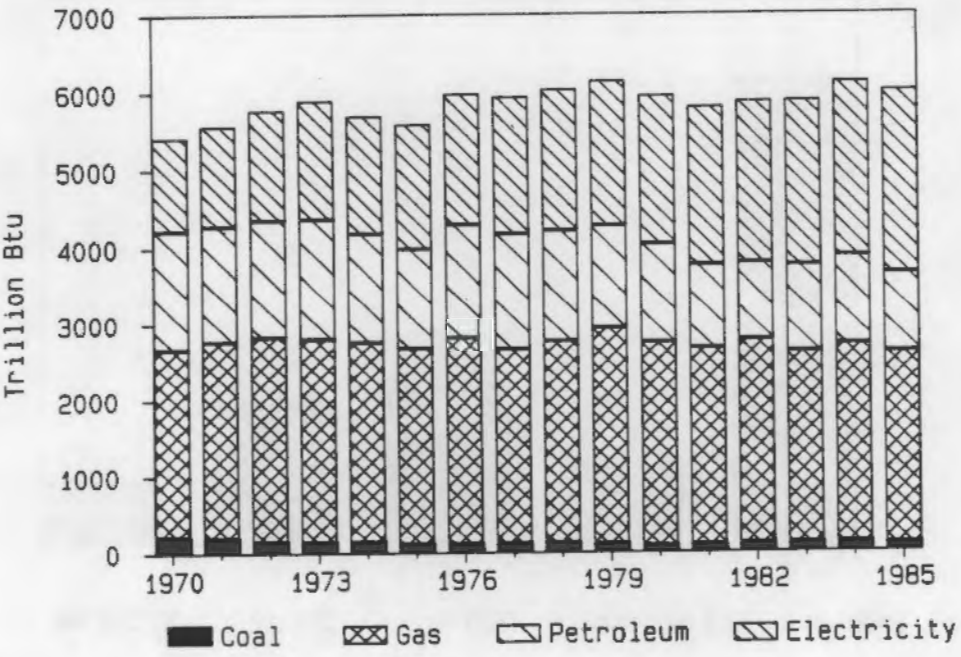

FIGURE 8.2 Commercial Sector Energy Consumption by Fuel Type 1970 - 1985

8.2 COMMERCIAL BUILDING SECTOR END USE ENERGY CONSUMPTION DURING 1983, BY REGION AND FUEL TYPE

TABLE 8.2 Commercial Building Sector End Use Energy Consumption by Region and Fuel Type, 1983
(Quadrillion BTUs)

Regions	All Fuels	Gas	Electricity	Fuel Oil	Propane	Steam
Total U.S.	5.150	2.227	2.237	0.354	0.038	0.294
Northeast	0.954	0.314	0.345	0.208	Q	0.086
Midwest	1.922	1.044	0.697	0.030	0.008	0.144
South	1.563	0.550	0.849	0.107	0.023	0.034
West	0.710	0.319	0.346	Q	Q	0.031

Source: NBECS: Commercial Buildings Consumption and Expenditures 1983, DOE/EIA, September 1986.

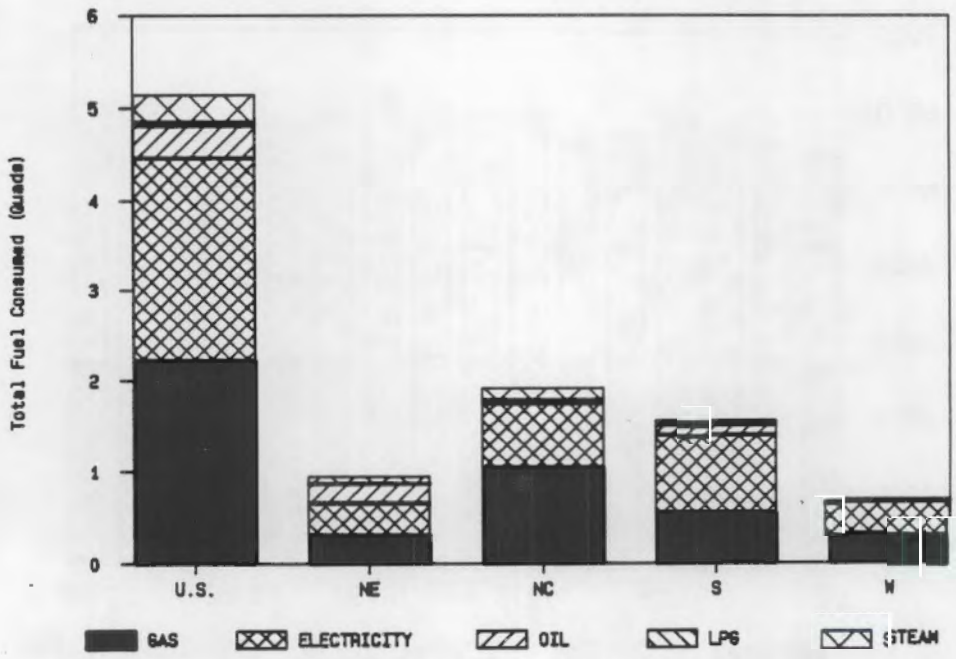

FIGURE 8.3 Commercial End Use Energy Consumption by Region and Fuel Type, 1983

8.3 REGIONAL COMPARISONS OF TOTAL AND AVERAGE ENERGY CONSUMPTION BY THE COMMERCIAL BUILDINGS SECTOR

TABLE 8.3 Total and Average Energy Consumption by the Commercial Buildings Sector During 1983, by Region

Region	Number of Buildings (Thousands)	Total Sq. Ft. (Millions)	Sq. Ft. per Building (Thousands)	Total Consumption (Quad Btu)	Consumption per Building (Million Btu)	Consumption per Square Foot (Thousand Btu)
Total U.S.	3,774	51,280	13.6	5.150	1,364	100
Northeast	653	11,413	17.5	0.954	1,462	84
Midwest	1,157	15,718	13.6	1.922	1,662	122
South	1,415	18,683	11.8	1.563	1,104	94
West	549	7,467	13.6	0.710	1,293	95

Source: NBECS: Commercial Buildings Consumption and Expenditures 1983, DOE/EIA, September 1986

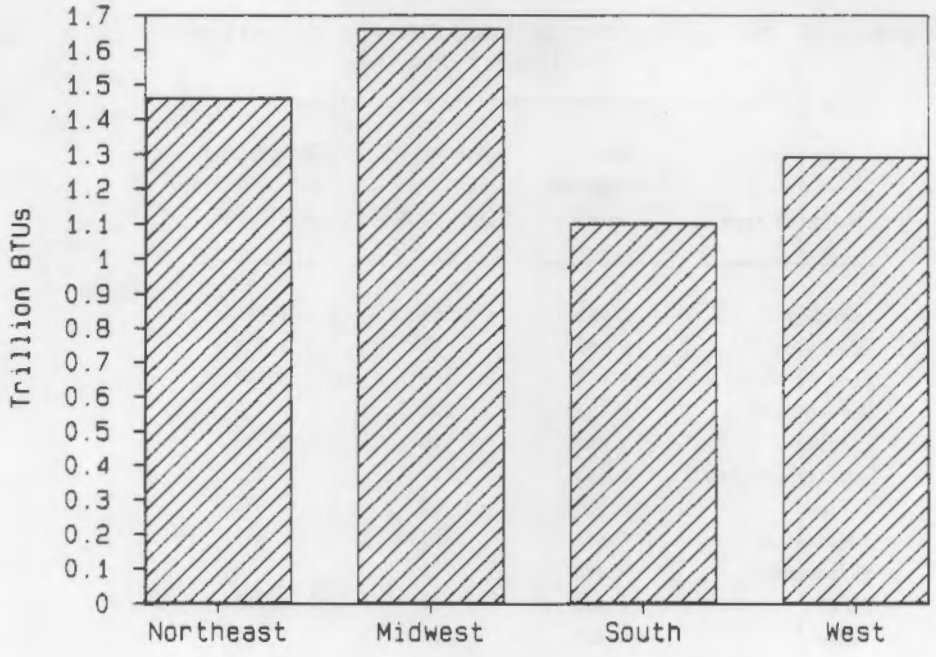

FIGURE 8.4 Average Energy Consumption per Building During 1983, by Region

8.4 COMMERCIAL BUILDINGS SECTOR ENERGY CONSUMPTION DURING 1983 BY BUILDING TYPE

TABLE 8.4 Commercial Buildings Sector Energy Consumption During 1983 by Building Type, U.S. Totals

Building Type	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
Assembly	0.377	69	835
Education	0.484	80	2,737
Food Sales	0.437	213	1,149
Health Care	0.465	204	7,680
Lodging	0.365	163	3,429
Retail/Services	0.838	81	795
Office	1.039	123	1,806
Residential	0.179	73	759
Warehouse	0.506	76	1,309
Other	0.276	101	1,655
Vacant	0.184	73	1,022

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.5 Commercial Building Energy Consumption by Building Type, 1983 Northeast Region

Building Type	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
Assembly	0.061	58	1,001
Education	0.100	73	3,638
Food Sales	0.067	170	1,149
Health Care	0.102	203	Q
Lodging	0.053	126	3,963
Retail/Services	0.143	71	783
Office	0.180	102	1,855
Residential	0.082	61	845
Warehouse	0.088	73	Q
Other	0.053	64	2,727
Vacant	0.026	51	768

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.6 Commercial Buildings Sector Energy Consumption by Building Type, North Central Region, 1983

Building Type	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
Assembly	0.173	98	1,160
Education	0.204	111	5,177
Food Sales	0.195	270	1,821
Health Care	0.174	172	8,369
Lodging	0.089	132	7,209
Retail/Services	0.307	96	885
Office	0.326	150	1,858
Residential	0.071	100	911
Warehouse	0.210	101	1,789
Other	0.109	126	2,345
Vacant	0.063	92	1,271

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.7 Commercial Building Energy Consumption by Building Type, 1983, Southern Region

Building Type	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
Assembly	0.104	57	536
Education	0.132	63	1,679
Food Sales	0.119	194	822
Health Care	0.137	241	6,891
Lodging	0.151	188	2,648
Retail/Services	0.262	69	697
Office	0.366	126	1,926
Residential	0.017	Q	373
Warehouse	0.152	67	986
Other	0.060	94	744
Vacant	0.062	72	865

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.8 Commercial Buildings Sector Energy Consumption by Building Type, Western Region, 1983

Building Type	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
Assembly	0.039	47	Q
Education	0.048	63	1,523
Food Sales	0.056	178	991
Health Care	0.052	269	Q
Lodging	0.072	208	Q
Retail/Services	0.126	95	845
Office	0.166	104	1,489
Residential	Q	Q	Q
Warehouse	0.056	49	887
Other	Q	Q	Q
Vacant	0.032	69	1,335

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1988.

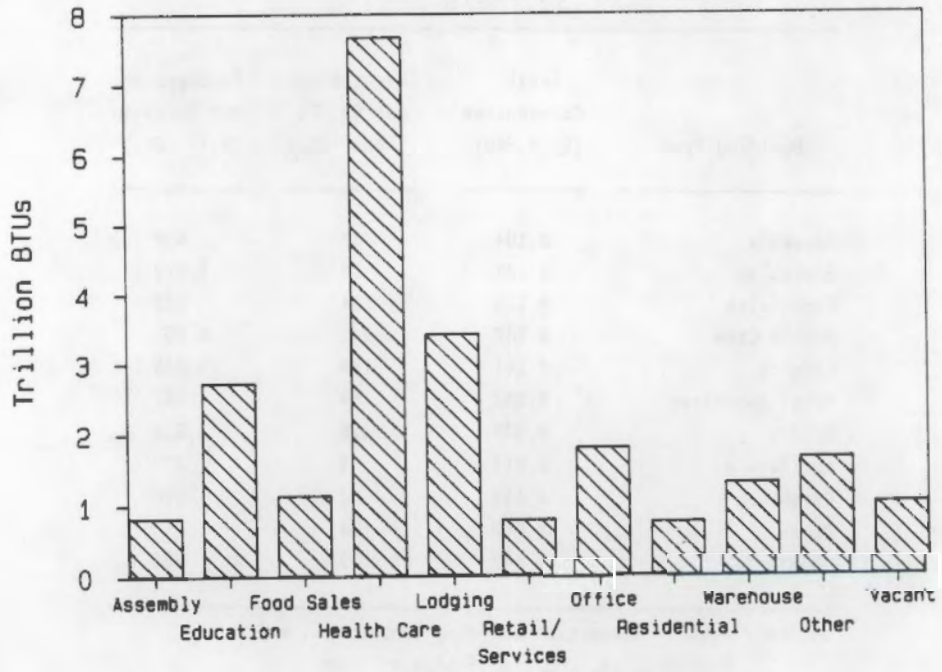

FIGURE 8.5 Average Energy Consumption per Building, by Building Type, 1983

8.5 END USE ENERGY CONSUMPTION OF THE COMMERCIAL BUILDINGS SECTOR BY BUILDING AND FUEL TYPE

TABLE 8.9 End Use Energy Consumption of the Commercial Buildings Sector, by Building and Fuel Type during 1983

Building Type	All Fuels	Gas	Electricity	Fuel Oil	Propane	Steam
Assembly	0.377	0.197	0.121	0.025	Q	0.026
Educational	0.484	0.248	0.155	0.061	0.002	Q
Food Sales	0.437	0.193	0.222	Q	0.008	Q
Health Care	0.465	0.219	0.147	0.029	Q	0.070
Lodging	0.365	0.171	0.151	0.018	Q	0.022
Retail/Services	0.838	0.337	0.434	0.045	0.007	Q
Office	1.039	0.371	0.521	Q	Q	0.068
Residential	0.179	0.095	0.042	0.035	Q	Q
Warehouse	0.506	0.248	0.208	0.033	0.003	Q
Other	0.276	0.078	0.151	0.014	Q	Q
Vacant	0.184	0.073	0.088	0.009	Q	Q

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

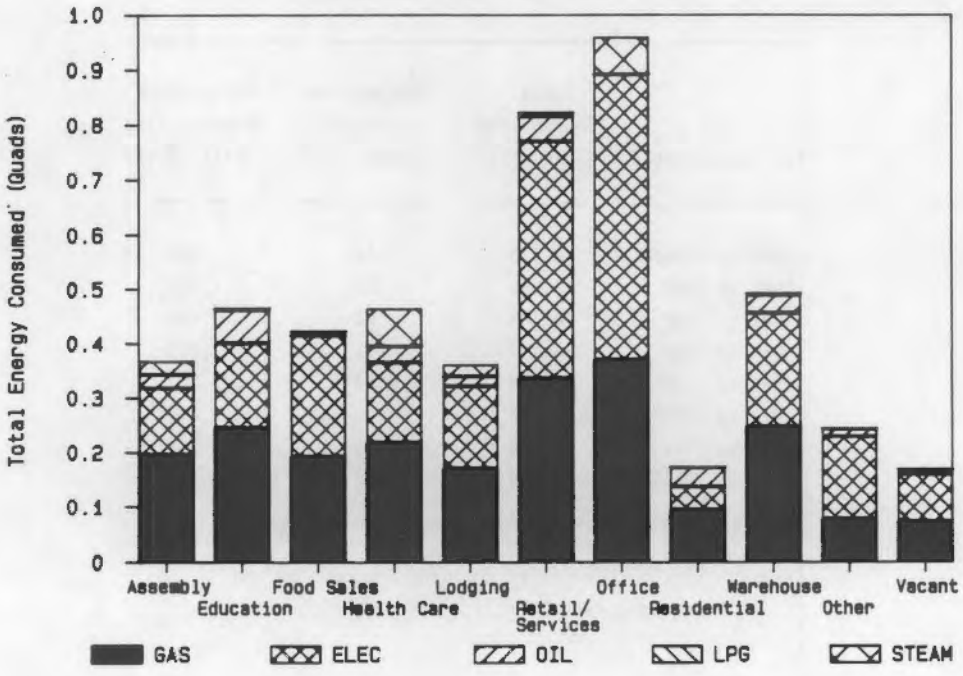

FIGURE 8.6 End Use Consumption by Building and Fuel Type, 1983

8.6 COMMERCIAL BUILDING SECTOR ENERGY CONSUMPTION DURING 1983 BY REGION AND BUILDING AGE

TABLE 8.10 Commercial Buildings End Use Energy Consumption During 1983, by Age of Building, U.S. Totals

Year Constructed	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
1900 or before	0.194	67	696
1901 to 1920	0.354	68	958
1921 to 1945	0.846	102	1,235
1946 to 1960	0.938	99	1,063
1961 to 1970	1.099	111	1,570
1971 to 1973	0.366	107	1,769
1974 to 1979	0.861	131	1,667
1980 to 1983	0.491	87	3,639

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.11 Commercial Building End Use Energy Consumption During 1983, by Age of Buildings, Northeast Region

Year Constructed	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
1900 or before	0.075	60	753
1901 to 1920	0.096	53	1,037
1921 to 1945	0.188	81	1,194
1946 to 1960	0.167	81	1,312
1961 to 1970	0.208	117	2,367
1971 to 1973	0.074	115	2,869
1974 to 1979	0.096	135	2,052
1980 to 1983	0.050	60	3,568

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.12 Commercial Buildings End Use Energy Consumption During 1983, by Age of Building, North Central Region

Year Constructed	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
1900 or before	0.084	75	766
1901 to 1920	0.143	79	953
1921 to 1945	0.363	140	1,761
1946 to 1960	0.372	119	1,435
1961 to 1970	0.387	128	2,108
1971 to 1973	0.124	130	2,120
1974 to 1979	0.318	147	1,982
1980 to 1983	0.134	139	4,384

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.13 Commercial Building End Use Energy Consumption During 1983, by Age of Buildings, Southern Region

Year Constructed	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
1900 or before	0.028	76	563
1901 to 1920	0.083	Q	Q
1921 to 1945	0.173	80	827
1946 to 1960	0.270	85	739
1961 to 1970	0.377	106	1,127
1971 to 1973	0.110	87	1,265
1974 to 1979	0.316	129	1,443
1980 to 1983	0.208	79	3,342

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

TABLE 8.14 Commercial Buildings End Use Energy Consumption During 1983, by Age of Building, Western Region

Year Constructed	Total Consumption (Quad Btu)	Consumption per Sq. Ft (Thous. Btu)	Consumption per Building (Mill. Btu)
1900 or before	Q	Q	Q
1901 to 1920	0.031	59	Q
1921 to 1945	0.123	101	1,091
1946 to 1960	0.129	122	Q
1961 to 1970	0.127	84	1,351
1971 to 1973	0.058	106	1,632
1974 to 1979	0.134	108	1,456
1980 to 1983	0.100	Q	3,524

Source: NBECS: Commercial Building Consumption and Expenditures, DOE/EIA, September 1986.

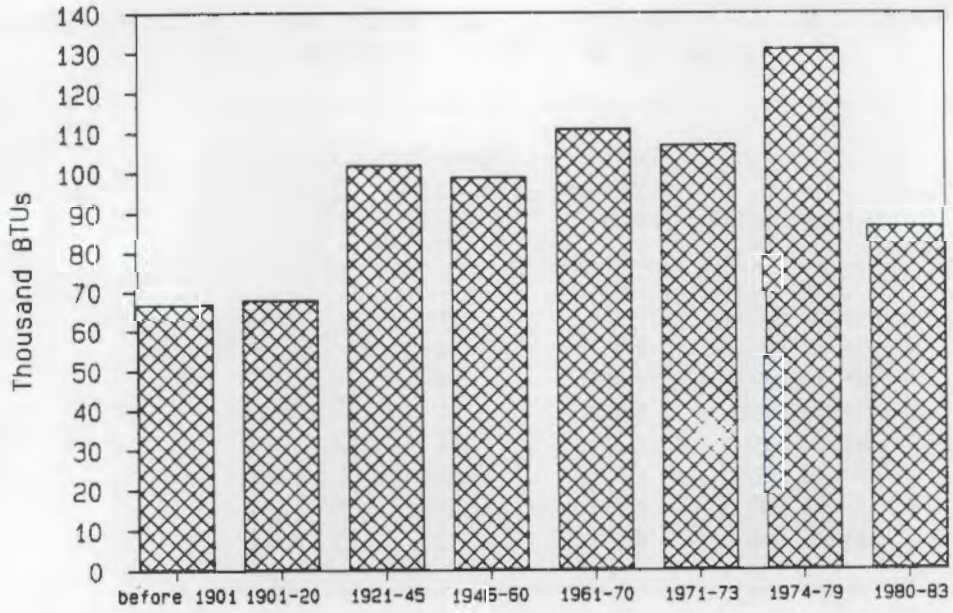

FIGURE 8.7 Average End Use Energy Consumption per Building During 1983, by Building Age, U.S. Totals

8.7 FEDERAL AGENCY ENERGY CONSUMPTION, 1976 TO 1986, BY AGENCY AND FUEL TYPE

TABLE 8.15 Federal Government Energy Consumption by Agency and Fuel Type, Fiscal Years 1976 through 1986
(Trillions of BTUs)

Fuel Source	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986e
Petroleum	1015.8	1041.6	1002.3	1012.7	1011.5	1005.8	1002.5	1000.7	1093.6	1083.1	1082.5
Motor Gasoline	59.9	61.8	59.6	58.6	56.1	52.9	52.9	51.4	51.8	50.3	46.7
Aviation Gasoline	11.6	8.8	6.2	4.7	4.9	4.6	3.6	2.6	1.9	1.9	1.7
Jet Fuel	610.8	619.2	601.1	618.6	638.7	653.3	672.7	673.3	693.7	706.1	711.9
Distillate and Residential Fuel	329.7	348.5	332.4	327.1	307.8	351.3	349.5	329.4	342.9	328.8	298.3
Liquified Petroleum Gases	4.6	4.1	3.8	3.7	4.0	3.7	3.8	4.0	4.1	4.0	3.9
Electricity	473.5	479.7	479.2	479.8	482.2	491.5	501.6	515.2	530.1	544.5	540.0
Natural Gas	151.6	141.1	144.7	148.9	147.3	142.2	145.9	147.7	157.4	146.3	139.5
Coal	71.3	68.4	66.0	65.1	63.6	65.1	68.6	62.4	65.3	64.3	63.8
Purchased Steam	6.3	7.7	8.6	9.7	9.1	9.1	8.5	12.3	13.8	15.1	14.5
Total	1718.9	1738.5	1700.8	1716.2	1713.5	1773.7	1807.1	1798.4	1860.2	1853.2	1820.3

Note: e = estimated.

Source: Annual Energy Review 1986, U.S. DOE/EIA, May 1987.

TABLE 8.16 Federal Agency Energy Consumption Fuel Type
Fiscal Years 1976 and 1986
(Trillions of BTUs)

Agency	Petroleum							
	Motor Gasoline	Distillate and Residual Fuels	Other	Total	Electricity	Natural Gas	Coal and Other	Total
1976								
Defense	31.7	292.5	617.1	941.2	287.5	110.5	47.6	1386.8
Energy	1.1	5.2	0.3	6.5	52.3	8.3	20.1	87.2
Postal Service	10.1	4.3	0.6	15.0	39.9	2.7	0.7	58.3
General Services Administration	0.2	2.3	0.0	2.5	29.0	4.3	5.3	41.1
Veterans Administration	0.6	5.7	0.0	6.4	15.7	12.7	1.7	36.5
Transportation	1.5	7.9	5.6	15.0	11.1	1.0	0.3	27.4
NASA	0.4	1.4	1.2	3.0	17.7	3.6	0.9	25.1
Agriculture	5.0	1.0	0.4	6.5	3.3	1.8	0.0	11.6
Interior	2.7	2.6	0.7	6.0	5.2	1.8	0.1	13.1
Health & Human Services	0.8	2.9	0.1	3.8	4.0	1.7	0.1	9.6
Justice	2.1	0.8	0.1	2.9	2.0	1.9	0.4	7.1
Others *	3.7	3.1	0.3	7.0	6.0	1.6	0.4	15.0
Total	59.9	329.7	626.3	1015.9	473.5	151.8	77.7	1718.9
1986e								
Defense	23.6	272.7	707.6	1003.9	336.2	99.8	50.3	1490.3
Energy	1.4	3.4	0.7	5.5	59.5	6.4	20.7	92.0
Postal Service	9.5	3.5	0.2	13.2	32.8	4.5	1.0	51.5
General Services Administration	0.5	2.2	0.0	2.7	23.7	14.2	1.1	41.8
Veterans Administration	0.1	0.1	0.0	0.8	27.3	2.8	3.2	34.1
Transportation	1.3	8.2	5.5	15.1	13.1	1.1	0.3	29.6
NASA	0.3	0.8	1.4	2.6	19.0	2.6	0.5	24.6
Agriculture	3.0	0.5	0.3	3.7	5.6	1.3	0.0	10.6
Interior	2.1	1.4	1.1	4.5	4.3	0.8	0.3	9.9
Health & Human Services	0.3	2.6	0.1	3.0	6.3	1.3	0.1	10.7
Justice	1.7	0.4	0.1	2.3	3.3	2.0	0.4	7.9
Others *	2.8	1.8	0.4	4.3	10.0	2.8	0.5	17.3
Total	46.6	298.2	717.4	1062.6	540.1	140.6	78.4	1820.3

Note: e = Estimated
* Includes Dept. of Commerce, Panama Canal Commission, TVA, Dept. of Labor, National Science Foundation, Dept. of Treas

Source: Annual Energy Review, DOE/EIA, May 1987.

8.8 COMMERCIAL SECTOR ENERGY PRICES, 1970 THROUGH 1985

TABLE 8.17 Fuel Prices for the Commercial Sector in Current Dollars, 1970 - 1985
(Current Dollars per Million BTU)

Year	Coal	Natural Gas	Distillate Fuel	Kerosene	LPG and Ethane	Motor Gasoline	Residual Fuel	Electricity	Commercial Average
1970	0.45	0.75	1.10	0.77	1.24	2.86	0.45	6.10	1.97
1971	0.41	0.80	1.16	0.82	1.36	2.91	0.67	6.52	2.17
1972	0.45	0.86	1.17	0.81	1.36	2.90	0.71	6.76	2.35
1973	0.45	0.92	1.37	0.97	1.47	3.11	0.86	7.14	2.60
1974	0.86	1.05	2.28	2.17	2.60	4.33	1.92	9.02	3.45
1975	1.31	1.32	2.43	2.32	2.60	4.66	1.91	10.22	4.12
1976	1.08	1.62	2.65	2.67	2.93	4.81	1.98	10.98	4.46
1977	1.16	2.00	3.02	2.97	3.44	5.12	2.27	12.17	5.21
1978	1.27	2.20	3.18	3.15	3.53	5.28	2.20	13.12	5.65
1979	1.28	2.69	4.51	4.81	3.99	7.09	3.10	13.49	6.24
1980	1.55	3.32	6.45	6.46	5.15	9.77	4.12	16.06	7.88
1981	1.72	3.91	7.97	7.48	5.95	10.96	5.12	18.44	9.55
1982	1.80	4.70	7.69	7.31	6.32	10.44	4.67	20.11	10.43
1983	1.70	5.44	6.68	6.88	6.82	9.30	4.51	20.57	11.03
1984	1.75	5.40	6.69	7.56	6.78	8.93	4.71	21.48	11.44
1985	1.74	5.33	6.13	6.80	6.55	9.03	4.19	21.89	11.89

Source: State Energy Price and Expenditure Report, 1970 - 1982, US DOE/EIA, April 1985.
State Energy Price and Expenditure Report, 1985, US DOE/EIA, October 1987.

TABLE 8.18 Fuel Prices for the Commercial Sector in 1985 Dollars
1970 - 1985
(1985 Dollars per Million BTU)

Year	Coal	Natural Gas	Distillate Fuel	Kerosene	LPG and Ethane	Motor Gasoline	Residual Fuel	Electricity	Commercial Average
1970	1.19	1.99	2.92	2.04	3.29	7.59	1.19	16.19	5.23
1971	1.03	2.01	2.91	2.06	3.42	7.31	1.68	16.37	5.45
1972	1.08	2.06	2.81	1.94	3.26	6.95	1.76	16.21	5.63
1973	1.01	2.07	3.09	2.18	3.31	7.01	1.94	16.08	5.86
1974	1.78	2.17	4.71	4.48	5.37	8.94	3.96	18.62	7.12
1975	2.46	2.48	4.57	4.36	4.89	8.76	3.59	19.22	7.75
1976	1.91	2.86	4.68	4.72	5.18	8.58	3.56	19.40	7.88
1977	1.92	3.31	5.06	4.92	5.76	8.48	3.76	20.16	8.63
1978	1.96	3.46	4.91	4.86	5.45	8.15	3.48	20.26	8.73
1979	1.79	3.62	6.46	6.82	5.66	10.66	4.48	19.14	8.85
1980	2.02	4.32	8.39	8.48	6.76	12.71	5.36	20.89	10.25
1981	2.04	4.64	9.45	8.87	7.06	13.00	6.07	21.87	11.33
1982	2.01	5.24	8.57	8.15	7.05	11.64	5.21	22.42	11.63
1983	1.82	5.84	7.17	7.38	7.32	9.98	4.84	22.07	11.84
1984	1.81	5.56	6.91	7.81	7.81	9.23	4.87	22.20	11.82
1985	1.74	5.33	6.13	6.80	6.55	9.03	4.19	21.89	11.89

Source: State Energy Price and Expenditure Report, 1970 - 1982, US DOE/EIA, April 1985.
State Energy Price and Expenditure Report, 1985, US DOE/EIA, October 1987.
Annual Energy Review, US DOE/EIA, May 1987.

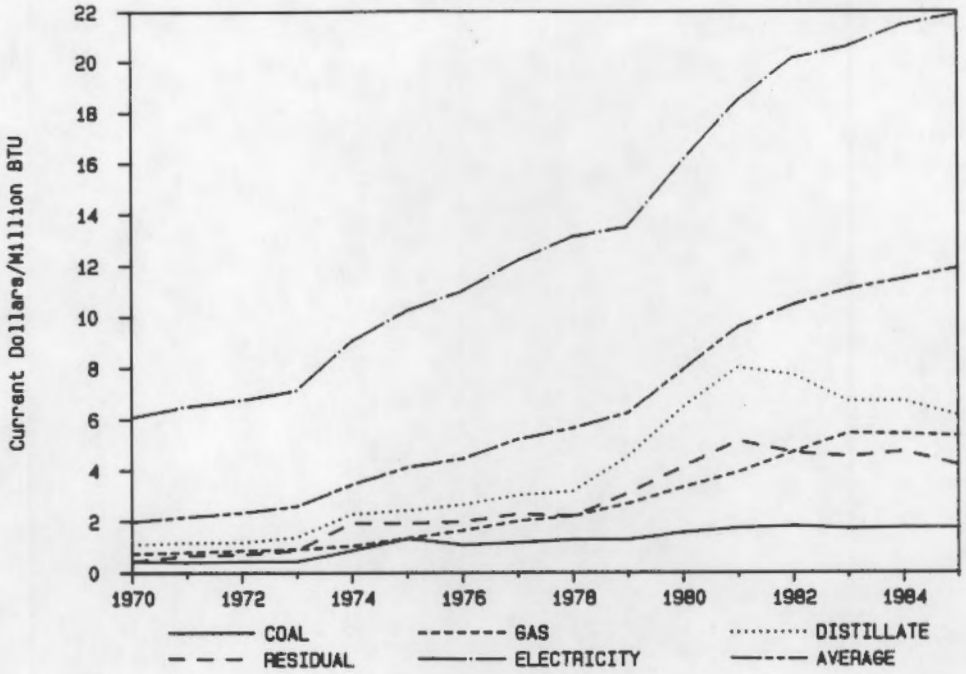

FIGURE 8.8 Commercial Sector Energy Prices in Current Dollars, 1970 - 1985

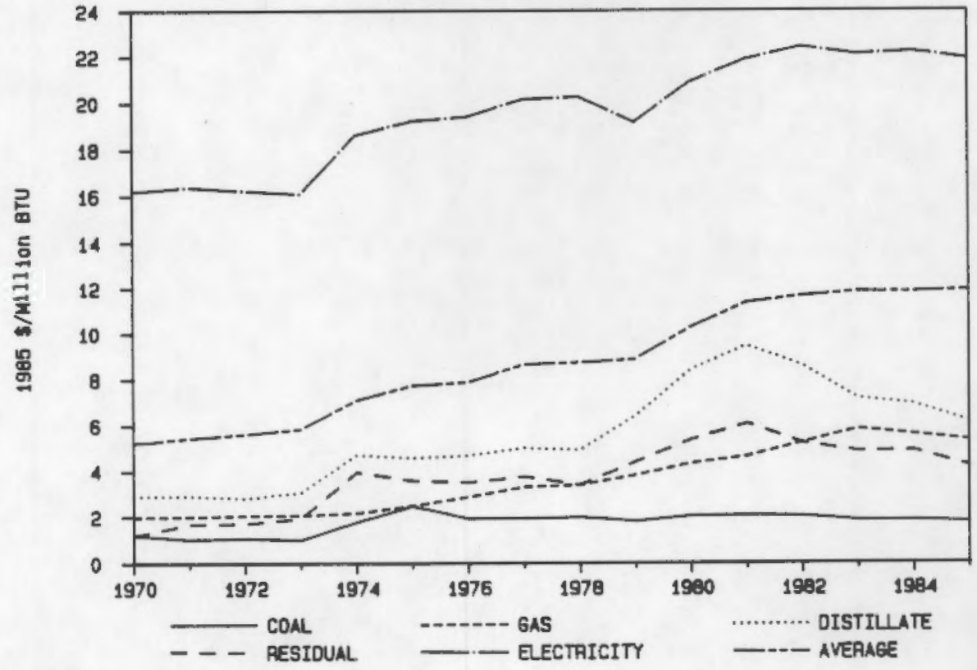

FIGURE 8.9 Commercial Sector Energy Prices in 1985 Dollars, 1970 - 1985

CHAPTER NINE: ADDITIONAL BUILDINGS AND COMMUNITY SYSTEMS INFORMATION

Data is provided to BCS to facilitate R&D and program planning. The data include BEAS (Buildings Energy Accounting System, maintained by Pacific Northwest Laboratory) and BECA (Buildings Energy-Use Compilation and Analysis, maintained by Lawrence Berkeley Laboratory).

BEAS is composed of three databases of information pertaining to energy consumption in the buildings sector. The information is taken from U.S. DOE Energy Information Administration, the U.S. Bureau of the Census, the National Oceanic and Atmospheric Administration, and various trade associations and national laboratories. The information is aggregated into four components within BEAS:

1. the Core Dataset,
2. the Core Database,
3. the Auxiliary database, and
4. the Buildings and Community Systems Data Book.

The BECA database contains information on the actual performance and cost effectiveness of buildings that have been designed or retrofitted to conserve energy. BECA has over 2,200 computerized entries representing thousands of occupied, energy-efficient buildings in the U.S. and abroad.

The following parts of this section provide some of the information contained in BEAS and BECA. The final portion of this section contains a description of the Overview of Building Energy Use and Report of Analyses prepared by Brookhaven National Laboratory. The Overview of Building Energy Use and Report of Analyses summarizes the overall trends in energy consumption in the buildings sector and the ongoing analyses performed by Buildings and Community Systems.

9.1 The Buildings Energy Accounting System (BEAS)

BEAS is composed of four components: the core database, the core dataset, the auxiliary database, and the Buildings and Community Systems Data Book (See Figure 9.1). The Buildings and Community Systems Data Book provides a hard copy of the pertinent files contained in the computerized BEAS core database and core dataset. The Buildings and Community Systems Data Book also contains a copy of the BEAS auxiliary database.

The core database, the largest section of BEAS, provides a compilation of all available data pertinent to energy consumption in the residential and commercial sectors, including all the information in the Buildings and Community Systems Data Book. This information consists of data on energy prices, consumption, building characteristics, major fuel-consuming equipment, and energy savings as a result of BCS projects. These datasets are designed to be detailed and will contain, for example, regional disaggregation of data and historical information that predates 1973.

The core dataset, designed to contain the most frequently referenced data, is essentially a subset of some of the information found in the core database. The core dataset gives only national statistics. Energy consumption and prices by sector and by fuel type are part of the information included in the core dataset. The core dataset is currently available on a disk for the IBM PC using Symphony software and can be obtained by contacting:

George Amols
Battelle, Pacific Northwest Laboratories
2030 M St., NW
Washington, D.C. 20036
(202) 785-8400

The auxiliary database, a component of BEAS, describes pertinent databases not already referenced in the other components of BEAS. The databases referenced in the BEAS auxiliary database tend to be large and highly specialized. For this reason, BEAS provides only a description of and directions for obtaining the actual data from the large and specialized databases in the auxiliary database. The auxiliary database is reviewed in the following paragraphs.

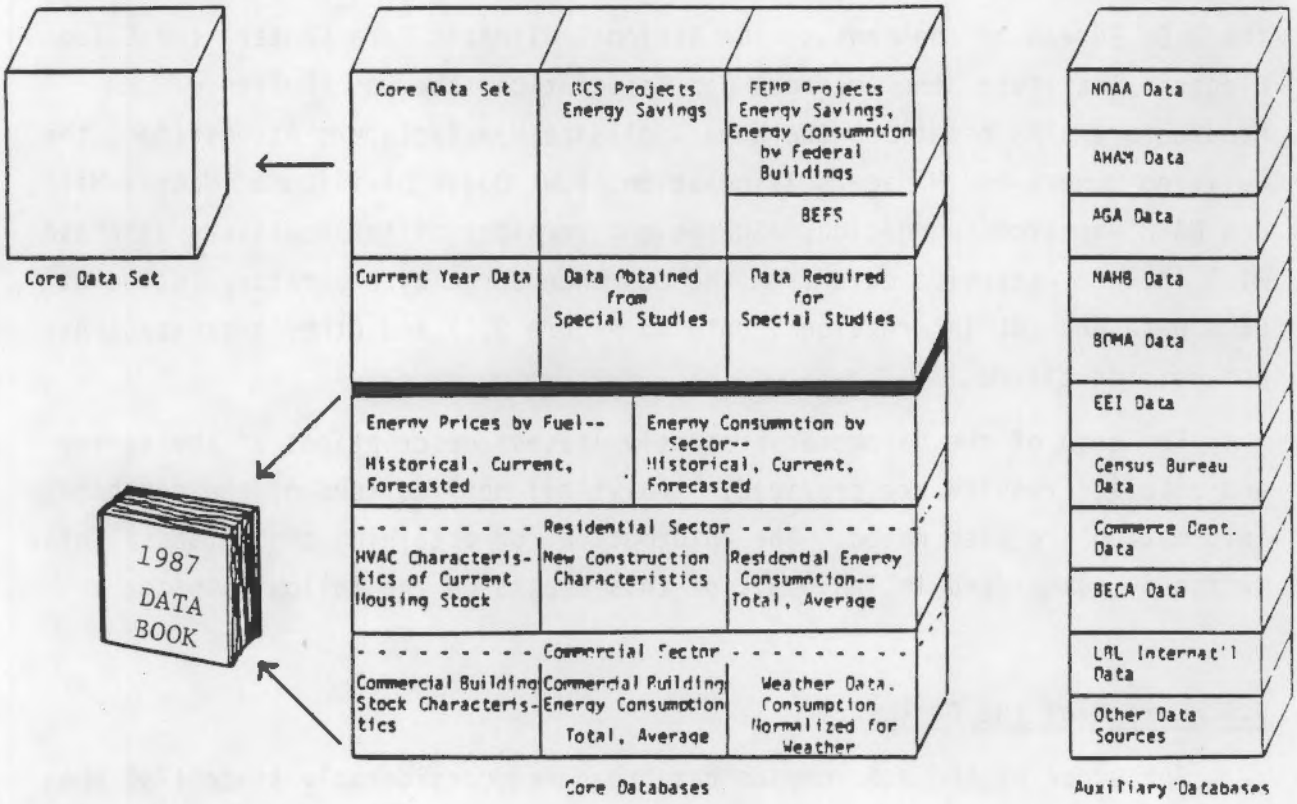

FIGURE 9.1 Building Energy Accounting System

Description of the Auxiliary Database

As depicted in Figure 9.1, the auxiliary database is organized by name of the government agency, trade association or private company. The organizations included in the current version of the auxiliary database include the U.S. Bureau of the Census, the National Climatic Data Center, the Edison Electric Institute, the American Gas Association, the Gas Appliance Manufacturers Association, the Home Appliance Manufacturers Association, the Building Owners and Managers Association, F.W. Dodge Division of McGraw-Hill, and NAHB Research Foundation. Subsequent versions of the auxiliary database will include extensive data from the Lawrence Berkeley Laboratory (noted as BECA Data and LBL International Data on Figure 9.1) and other organizations not yet identified.

For each of the databases presently listed, descriptions of the survey and compiled results are provided. Analytical applications of the database information are also noted. The information for obtaining the database information is summarized in Table 9.1 of this report on the following page.

U.S. Bureau of the Census

The scope of the U.S. census has broadened considerably since 1790 when the first census of the population was taken. Presently, the U.S. Bureau of the Census compiles data on almost every aspect of American life. Statistics from the Bureau's Annual Housing Survey and Characteristics of New Housing are already provided in the BEAS. Other data from the U.S. Bureau of Census may also be useful to researchers analyzing energy consumption and conservation the residential and commercial sectors.

- Building Permits Survey

The number of building permits issued by local jurisdictions are surveyed in order to gauge the type and amount of new building construction. From this survey, statistics for both the residential and commercial buildings are derived.

TABLE 9.1 Instructions for Obtaining Databases Referred in BEAS Auxiliary Databases

Name of Database	Applicable Sector	Organization or Government Agency	Address Phone Number
1. Building Permits Survey (data tape only)	Residential & Commercial	U.S. Bureau of the Census	U.S. Department of Commerce, Bureau of the Census, Washington, D.C. 20233 (202) 763-2546
2. State, Regional, and Monthly and Seasonal Heating (and Cooling) Degree Days, Weighted by Population (documents, data tape)	Residential & Commercial	National Climatic Data Center	National Oceanic and Atmospheric Administration National Climatic Data Center Federal Building Asheville, N.C. 28801 (704) 259-0682
3. Statistical Yearbook (document, data tape)	Residential & Commercial	Edison Electric Institute	Edison Electric Institute 1111 19th Street N.W. Washington, D.C. 20036 (202) 728-6400
4. Gas Facts (document)	Residential & Commercial	American Gas Association	American Gas Association 1515 Wilson Blvd. Arlington, VA 22209 (703) 841-8400
5. Gas HouseHeating Survey (document)	Residential	American Gas Association	(See Above)
6. Commercial Gas Market Survey (document)	Commercial	American Gas Association	(See Above)
7. Statistical Highlights (documents)	Residential & Commercial	Gas Appliance Manufacturers Association	Gas Appliance Manufacturers Association 1901 N. Moore Street Arlington, VA 22209 (703) 525-9565
8. Experience Exchange Report (document)	Commercial	Building Owners Managers Association	Building Owners and Managers Association 1250 Eye Street N.W. Washington, D.C. 20005 (202) 289-7000
9. F.W. Dodge (data tape only)	Residential & Commercial	F.W. Dodge of McGraw-Hill	F.W. Dodge Division of McGraw-Hill 29 Hartwell Avenue Lexington, MA 02173 (617) 863-5100
10. Annual Builder Practices Survey (data tape of diskette)	Residential	NAHB Research Foundation	NAHB Research Foundation Inc. 400 Prince Georges Blvd., Upper Marlboro MD 20772-8731 (301) 249-4000

- Description of the Survey

About 8,000 permit-issuing jurisdictions across the United States are canvassed by the U.S. Bureau of the Census on a monthly and annual basis. The data received from these jurisdictions includes information on the number of buildings, the cost of construction and the number of demolitions. Buildings are identified in terms of residential private housekeeping, nonprivate housekeeping (e.g. motels), and private nonresidential construction.

The data is available on annual basis back to 1970. After 1972, the data is available on a monthly basis.

- Analytical Applications of Database Information

The database on residential and nonresidential building construction permits can be useful to researchers in a number of ways. First, the data can be used to determine the trends in residential and commercial construction on both a regional and national basis. Determination of the trends can be useful in forecasting new construction and the buildings stock for the ultimate purpose of calculating the amount of energy consumed in the residential and commercial sectors.

This data can also be useful to compare with the results of other surveys such as the Characteristics of New Housing generated by the Bureau of the Census and residential and commercial sector data generated by F.W. Dodge. The number of permits issued would be a leading indicator of the number of completions of new housing recorded in the Characteristics of New Housing.

National Climatic Data Center

The National Climatic Data Center in Asheville, NC. is responsible for maintaining databases of information collected from weather bureaus across the country. The National Climatic Data Center is part of the National Oceanic and Atmospheric Administration.

Energy consumption in the residential and the commercial sectors is greatly affected by climatic conditions. The information maintained by the National Climatic Data Center can be useful in measuring the relationship between weather and energy consumption in these sectors.

- State, Regional and National Monthly and Seasonal Heating (Cooling) Degree Days, Weighted by Population

- Description of the Survey

Two similar databases are maintained by the National Climatic Center: one for heating degree days, and the other for cooling degree days. Heating degree days (in degrees Fahrenheit) are calculated by subtracting the mean daily temperature from 65 degrees. Correspondingly, cooling degree days are calculated by subtracting 65 degrees from the mean daily temperature. Negative degree days are interpreted to indicate zero degree days. To calculate state, regional, and national averages, the National Climatic Data Center weights the degree day data by population. The weights currently employed come from the 1980 census.

The databases of heating and cooling degree days extend from 1931 to the present. Monthly and annual averages are calculated.

- Analytical Applications of Database Information

The effects of temperature on energy consumption can be measured by relating changes in energy consumption with changes in the outdoor temperature. The mathematical relationships can then be used to explain an anomalous level of energy consumption or determine the level of energy consumption under an assumption of extreme weather conditions.

- Comparative Climatic Data

In addition to the databases of heating and cooling degree days, the National Climatic Data Center also compiles data on the humidity, highest and lowest temperature record, the number of days per year with .01 inch or more of rain, the average total precipitation, percentage of possible sunshine, and wind speed per year. Each of these characteristics is available for about 70 cities nationwide. Data from the Comparative Climatic Data databases is beneficial in modeling household consumption under specific weather conditions such as snow cover and wind speeds.

Edison Electric Institute

The Edison Electric Institute (EEI) is a trade association of U.S. electric utilities. About 200 investor-owned utilities are members of EEI.

EEI collects data from member and nonmember companies on electricity generation and consumption. Two publications resulting from the surveys, the Statistical Yearbook and the Typical Residential Commercial and Industrial Bills, are of particular interest to analysts researching energy consumption in the residential and commercial sectors.

- Statistical Yearbook

Data collected by EEI is used by their member companies to determine the trends in electricity generation, consumption, and prices for company and industry-wide planning. The main survey conducted by EEI is for the Statistical Yearbook.

- Description of the Survey

The data collected for EEI's Statistical Yearbook includes information on electricity sales, revenues and customers. The sales, revenues and customers data are provided by class of service (residential, commercial, and industrial), by state and region.

Data from the survey conducted for the Statistical Yearbook extend from 1926 to the present. Calculations for average revenue per kilowatt hour (i.e., average electricity end user price) are tabulated by EEI using data from this survey.

- Analytical Applications of Database Information

EEI is the only organization collecting information on the number of electrical customers by sector. This data in combination with electricity consumption data can be used to calculate energy intensities for electricity. From this, the level of energy conservation can be determined by analyzing the change in energy intensities from year to year.

- Typical Residential, Commercial and Industrial Bills

Another supplemental EEI database is available on billing information. The data from this database is intended for an EEI publication entitled Typical Residential, Commercial and Industrial Bills which provides data on consumers bills by sector. The data includes information on the amount of taxes customers paid on electrical service. Only investor owned electrical utilities are surveyed for this information.

American Gas Association

The American Gas Association (AGA) is a trade association composed of over 200 gas utility companies that transmit and distribute natural gas. AGA collects data from member and nonmember gas utilities on a variety of topics.

- Gas Facts

Each year AGA surveys the gas industry for information on natural gas sales, revenues and customers for eventual publication in a document called Gas Facts. This survey process is so similar to the one performed by EEI that AGA and EEI coordinate their surveying activities. Each year a single survey form is sent to all utility companies in an attempt to limit the amount of paperwork required of the utility companies.

- Description of the Survey

In the annual survey, AGA receives data from utility companies representing upwards of 85% of all natural gas sales. The companies are adequately dispersed across the United States.

- Analytical Applications of Database Information

The information available in the AGA Gas Facts database is useful for computing energy intensities of natural gas consumption since data is available for both end use gas sales and customers. The level of natural gas conservation is indicated by trends in energy intensities.

Other data in Gas Facts is useful. The monthly end use sales data allow analysts to determine the seasonal fluctuation in natural gas sales. This data in conjunction with heating degree day information enables an analysis

of the relationship between climatic conditions and natural gas used to be performed.

Much of the AGA information can be used to verify EIA data. Both AGA and EIA collect data on end use natural gas sales and prices. In comparing sales data, EIA's data for end use of natural gas sales should be greater since EIA attempts to include producer sales to end users.

- Gas Househeating Survey

AGA has several other databases pertaining to the residential and commercial sectors. Most of the responses to the surveys for the supplemental databases come from AGA member companies.

- Description of the Survey.

In the Gas Househeating Survey, companies are queried as to the number of househeating customers, the total number of residential customers, the presence of new residential customer hook-up restrictions, the amount of gas consumed per customer for heating and for baseload applications, and the year end price of natural gas and other househeating fuels. Much of this information is available on a company-by-company basis thus allowing an evaluation of the data by city.

- Analytical Application of Database Information

Information from the Gas Househeating Survey is useful for analyzing and comparing residential gas consumption for househeating and baseload applications. AGA's level of detail allows a city-by-city comparison of this type.

The information collected by AGA or residential fuel prices is useful for verifying data is useful for published in EIA's State Energy Price and Expenditure Report. The only definitional difference between the two series of numbers is that the AGA has year ending data while the EIA data is average price information for the entire year.

- Commercial Gas Market Survey

AGA collects data on natural gas use in the commercial sector in part to measure the amount of fuel switching in the commercial sector. The data collected for this survey can also be used to characterize natural gas

consumption for space heating and baseload applications in the commercial sector.

- Description of the Survey

AGA first surveyed member utility companies for specific information pertaining to the commercial sector starting in 1979. The information requested in the annual survey focuses on sales to the commercial sector by SIC code; by applications such as space heating, water heating, cooking, etc.; the number of new commercial customers and the conditions imposed on gas sales (mainly interruptable service). Data is also collected on the percentage of sales to dual fuel capable facilities, the level of consumption as compared to the 1973 usage patterns, and the energy source most competitive to natural gas.

- Analytical Application of Database Information

AGA has one of the few databases of information on energy consumption in the commercial sector by SIC. Although the AGA data pertains only to natural gas consumption, it is instrumental in determining the application for the energy consumed in the commercial sector.

Gas Appliance Manufacturers Association

- Description of Survey

The Gas Appliance Manufacturers Association (GAMA) is composed of over 250 companies which are engaged in the manufacturing of gas appliances. GAMA surveys member companies for information on the number and type of appliances shipped on a monthly basis in order to determine the trend in appliance sales. The information ultimately is published in GAMA's Statistical Highlights.

Gas appliance manufacturers are queried about the number of residential gas ranges, heating systems for recreational vehicles, direct and central heating equipment, water heaters, grills and clothes dryers shipped on a monthly and annually basis. In addition appliance manufacturers are queried as to the number of water heaters, and space heaters and furnaces that are shipped intended for use in the commercial sector.

- Analytical Applications of Database Information

In much the same way that the characteristics of new housing are useful to analysts studying long term trends in the housing sector, the GAMA data on gas appliance sales is useful. Despite the weakness in the data, the GAMA information can provide clues as to the existing and future stock or residential and commercial appliances. The GAMA data is disaggregated enough to allow estimates on the amount of total energy consumption based on the type of appliance shipped (and presumably sold).

Association of Home Appliance Manufacturers

The Association of Home Appliance Manufacturers is a trade association of companies manufacturing approximately 90% of the major home appliances in the United States each year. AHAM surveys the membership on the energy efficiency ratings of the various appliances shipped.

- Analytical Applications of Database Information

AHAM is one of the few organizations documenting the trend in appliance efficiencies. The AHAM information is useful in determining the efficiency of the current and future stock of home appliances. The description of the stock can lead to a more accurate estimation of energy consumption in the residential sector.

Building Owners and Managers Association

The Building Owners and Managers Association (BOMA) is a trade association of over 3,000 building owners and managers. Most of the members are located in the United States with a few located in Canada.

BOMA collects statistics on the income and expenses incurred by building owners and managers for the Experience and Exchange Report. The statistics collected by BOMA can be categorized as commercial sector data.

- Description of the Survey

BOMA has conducted a survey of members and some nonmembers on office building income and operating expenses since the 1920s. In 1934, the report changes significantly to the format that is still currently used.

BOMA collects a multitude of information on various building operating expenses such as cleaning expenses and repair costs. In addition, data on occupancy rates, square footage of floor space per employee and per tenant is compiled. The data most relevant to analysts researching energy conservation in the commercial sector is BOMA's data on energy expenses.

- Analytical Applications of Database Information

The BOMA data is restricted to office buildings only. Despite this restriction, the data is still useful since office buildings represent a significant portion of commercial sector energy consumption.

Trends in the BOMA data for energy expenses indicate, on average, how much energy savings have occurred over time. The trends also indicate the correlation between the change energy prices and energy usage in office buildings.

F.W. Dodge Division of McGraw-Hill

F.W. Dodge Division of McGraw-Hill Information Systems uses a field staff of about 1500 people to collect building information. Since F.W. Dodge of McGraw-Hill is a private company, the statistics collected by the company are proprietary, though some of the aggregate national figures are published in federal government documents.

F.W. Dodge collects information pertaining to residential and nonresidential building construction and therefore is of use to analysts researching the characteristics of the both residential and commercial buildings.

- Description of the Survey

F.W. Dodge collects data from architects, building planners, permit and licensing boards and construction companies. The information collected primarily covers square feet of floor space, the type of construction (i.e. building type), and estimated construction costs.

Dodge limits the data collected to projects valued at over $25,000. Dodge includes a construction project if it is scheduled to begin within 60

days. If the project is delayed, cancelled or modified, the data is adjusted accordingly.

Since 1969, Dodge has collected data from all 50 states and the District of Columbia. Between 1956 and 1968 data was collected from the contiguous 48 states and the District of Columbia. Prior to that, the database lacks information from 13 western states.

- Analytical Applications for Database Information

Although the Dodge data lacks any specific energy-related information, the data can be useful for analyzing construction of buildings. The proprietary information can assist in identifying ongoing on near-term construction projects. This data in combination with other energy usage information such as average consumption by building type, can give an early indication of future energy consumption.

NAHB Research Foundation, Inc.

NAHB Research Foundation, Inc. is a wholly owned subsidiary of the National Association of Home Builders (NAHB). The NAHB is composed of 40,000 home builders across the United States. Statistics collected from home builders pertain to the residential sector.

- Description of Survey

NAHB Research Foundation has conducted a survey of the builder-members of the NAHB since 1974. Fifteen to 20% of the builders typically respond to the survey which currently represents about quarter of a million units constructed. A screening process reduces the number of usable, valid responses to 10% of the number originally distributed.

The general categories of information collected by the Foundation include:

Framing	Bathroom Plumbing
Sheathing	Bathroom Equipment
Siding	Faucets
Foundation	Water Heaters
Roofing	Shutters
Insulation	Fireplaces
Flooring	Water Service
Windows	Electrical
Exterior Doors	Security Systems

Garage Doors	Solar Energy
Interior Doors	Decks and Fencing
Kitchen Sinks	Mirrors
Kitchen Cabinets	Interior Finish
Appliances	Heating/Cooling Equipment

The NAHB Research Foundation collects detailed information. In total over 1,000 characteristics of information are collected; 15 to 20 characteristics pertain just to insulation. The survey to builders of single family detached units is 32 pages long.

- Analytical Applications of Database Information

The NAHB Research Foundation provides the detailed type of information needed to characterize the energy aspects of new residential construction. This information is useful in determining consumer preference purchasing energy conserving homes. Moreover, the data allows an analysis of the future level of energy consumption based on the type of homes being constructed today.

9.2 Buildings Energy Use Compilation and Analysis Project

Background

In 1978, the Lawrence Berkeley Laboratory (LBL) first began to collect and systematically compare measured results from what was then a handful of research projects on energy-efficient houses. Today the "BECA" data base (BECA: Buildings Energy-use Compilation and Analysis) contains over 2200 computerized entries, representing thousands of occupied, energy-efficient buildings in the U.S. and abroad.

The BECA buildings energy data base is the only available source of measured data on the actual performance and cost-effectiveness of buildings that have been designed or retrofitted to save energy. The data have been carefully reviewed and, insofar as possible, expressed in the form of performance indicators that allow comparisons across varying weather and operating conditions.

Measured data are an essential form of feedback to building designers and operating engineers on how well calculations, computer models, and "rules of thumb" actually predict energy performance and dollar savings. Equally

important, the availability of hard data on successes and failures can be crucial in giving building owners, developers, utilities, and lenders the confidence to invest in energy-efficiency.

Objectives

The goal of the BECA project is to improve energy efficiency in new and existing buildings by providing designers, owners, managers, policy-makers, and others with feedback on how well technical measures and operating strategies actually work to save energy or peak electric demand, and how this performance translates into net dollar savings. We provide information that will help decision-makers and practitioners make better-informed choices about building design, operation, financing, energy demand forecasting, and public policy.

Approach

Data are obtained from a variety of published and unpublished sources in the U.S. and overseas, often with the direct help of our collaborators in the research community, private industry, and utilities. We calculate normalized performance indices and "echo" the results to our data suppliers, both to verify accuracy and to provide the individual building owner or manager with results that can be compared with other BECA buildings - or with design energy calculations, baseline values, or standards.

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