SR/EMEU/95-02
Service Report

EIA
Energy Information Administration

November 1995

Federal Buildings Supplemental Survey 1993

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Energy Information Administration
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The EEUISD would also like to acknowledge LaVerne Gilchrist for her desktop publishing expertise in this report.

Support for the FBSS was received from the Office of Federal Energy Management Programs (OFEMP), U.S. Department of Energy.

Public Use Data Diskettes containing FBSS data are available through the Office of Scientific and Technical Information (OSTI) and the National Technical Information Service (NTIS). (See Appendix F, "Related EIA Publications on Energy Consumption," for ordering information.) For questions about the contents of EPUB reports and data availability of this information on CD-ROM, call (202) 586-8800. EIA also maintains a Home Page(http://www.eia.doe.gov) on the Internet.

Preface

The Energy Information Administration (EIA) of the U.S. Department of Energy (DOE) is mandated by Congress to be the agency that collects, analyzes, and disseminates impartial, comprehensive data about energy including the volume consumed, its customers, and the purposes for which it is used. To comply with this Congressional mandate, the EIA conducts a number of energy consumption surveys to provide meaningful, objective, and accurate energy information for a wide audience that includes Congress, Federal and State agencies, industry, and the general public.

The Federal Buildings Supplemental Survey (FBSS) was conducted by EIA in conjunction with DOE's Office of Federal Energy Management Programs (OFEMP) to gain a better understanding of how Federal buildings use energy. This report presents the data from 881 completed telephone interviews with Federal buildings in three Federal regions. These buildings were systematically selected using OFEMP's specifications; therefore, these data do not statistically represent all Federal buildings in the country .

OFEMP requested that the FBSS provide building-level energy-related characteristics for a special sample of commercial buildings owned by the Federal Government. This special sample met the following OFEMP-specified criteria:

- Federal buildings from different areas of the country -- Federal Regions 3, 6, and 9
- Fewer sampled buildings from Department of Defense (DOD) -- Sample selection ratio of 1:10 for DOD buildings in each Federal Region
- Commercial Building Eligibility based on (1) size -- 10,000 square feet or over and (2) building use -- exclude buildings with the majority of the floorspace used for warehouse/storage purposes.

The FBSS was conducted by telephone from July to December 1994 with Federal buildings in the following regions:

Federal Region 3 -- Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia

Federal Region 6 -- Arkansas, Louisiana, New Mexico, Oklahoma, and Texas

Federal Region 9 -- Arizona, California, Hawaii, and Nevada.

Information for Federal commercial buildings is also collected in the Commercial Buildings Energy Consumption Survey (CBECS), which is one of the consumption surveys conducted by EIA. CBECS is conducted on a triennial basis, and is a nationwide survey of approximately 6,500 commercial buildings and their energy suppliers. Government-owned commercial buildings are one type of building that is included in the CBECS sample. In the 1992 CBECS, approximately 15.1 billion square feet (22 percent) of commercial floorspace was government-owned.[2] Of this government-owned floorspace, 8 percent was in buildings owned by the Federal government. The number of Federal buildings that are selected for the relatively small CBECS sample does not allow for in-depth examination of energy use and characteristics of these buildings, which is necessary to meet the Energy Policy Act of 1992 (EPACT). Therefore, the FBSS was conducted to provide more detailed information about Federal buildings.

The purpose of the FBSS was threefold: (1) to understand the characteristics of Federal buildings and their energy use; (2) to provide a baseline in these three Federal regions to measure future energy use in Federal buildings as required in EPACT; and (3) to compare building characteristics and energy use with the data collected in the CBECS.

[1] *Commercial Buildings Characteristics 1992, DOE/EIA-0246(92) (Washington, DC, April 1994).*

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1. Introduction

The EIA conducts two types of surveys: (1) supply surveys and (2) consumption surveys:

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

- Consumption surveys gather information directly from energy end users on the types of energy they consume, along with information on the energy-related characteristics of commercial buildings, households, vehicles, and manufacturing establishments.[2] The results of these surveys are published in energy consumption reports, such as this report, and in special analytical reports.

Respondents to the Federal Buildings Supplemental Survey (FBSS) 1993 were interviewed to collect information about the building, such as the principal building activity, structural characteristics, building use, energy sources, energy-using equipment, and conservation features and programs; as well as to collect billing data on energy consumption and expenditures. These billing data were collected from the Federal building manager because they were expected to have immediate access to their consumption and expenditure account data.

Following are examples of some of the data that were collected about the sampled Federal buildings:

- **Structural characteristics**: size (square feet of floorspace), year constructed, and roof and wall materials

- **Building use:** primary building activity, regular and additional operating hours, number of workers, and personal computers/terminals

- **Energy sources used:** four major sources; (1) electricity, (2) natural gas, (3) fuel oil (including kerosene), and (4) district sources (steam, hot water, or chilled water from a central plant or utility). The use of other energy sources in the building, such as propane, wood, coal, and solar energy, was also collected; however, no consumption statistics were gathered on these energy sources

- **Energy end use:** heating, air-conditioning, hot water heating, commercial cooking and serving, manufacturing, and electricity generation

- **Consumption:** consumption and expenditure estimates for electricity, natural gas, and district sources for Fiscal Year 1993

- **Energy-using equipment:** type of heating and cooling equipment and distribution systems, type of refrigeration, water-heating equipment and lighting

- **Motors**: number of motors with 10 or more horsepower; age, number of energy-efficient motors, and maintenance practices

- **Conservation features and programs:** energy audits, conservation features and programs related to building shell; heating, ventilation and air-conditioning (HVAC) systems (regular HVAC maintenance, variable-air volume, economizer cycles); and lighting (daylighting controls, manual dimmer switches, occupancy sensors, and reflectors).

[2]See Appendix F, "Related EIA Publications on Energy Consumption," for a listing of publications from the Commercial Buildings Energy Consumption Survey and from other EIA consumption surveys.

This report also includes estimates of energy intensities. Energy intensities provide a measure for controlling or adjusting the amount of energy consumed for the effects of various building characteristics, such as size or number of workers. The intensities in this report are all conditional (fuel-specific) intensities; for example, the intensity per square foot for electricity is calculated by dividing electricity consumption by the floorspace of only those buildings that use electricity. The adjustment facilitates comparisons of energy consumption across energy sources and building types.

Many of the questions that were asked in the 1992 CBECS were asked in the FBSS to provide a comparison with the CBECS. Prior to the telephone interview, the energy managers of the sample buildings were contacted by the survey contractor to schedule the telephone appointment and provide advance questions that might require research as follows:

- **Building Square Footage**
- **Motors Data**: Age and number of motors 10 or more horsepower, and maintenance practices
- **Energy Consumption**: Fiscal Year 1993 (October 1992 - September 1993)
- **Energy Expenditures**: Fiscal Year 1993

The statistics published in this report are from a systematically selected sample of Federal buildings in Federal Regions 3, 6, and 9. Interviews were completed at 881 of these sampled Federal buildings. EIA worked closely with the Federal regions to ensure that respondent burden was minimized in the sampled buildings. (See Appendix E, "Outreach Efforts," for more information.)

EIA gratefully acknowledges the cooperation of respondents for providing the information used to produce the estimates in this report.

2. At a Glance - Highlights on Federal Buildings

This section of *Federal Buildings Supplemental Survey 1993* provides synopses of selected energy-related characteristics. Extensive analysis of the data was not conducted because this report represents the 881 responding buildings (buildings for which interviews were completed) and cannot be used to generalize about Federal buildings in each region. Crosstabulations of the data from the 881 buildings are provided in the Detailed Tables section.

- **Energy Consumption:** In FY 1993, the 881 responding Federal commercial buildings in Federal Regions 3, 6, and 9 consumed about 22 trillion Btu of electricity, natural gas, fuel oil, and district heat (Table 2.1).

- **Energy Expenditures:** Expenditures for the 22 trillion Btu of energy consumed in the responding Federal commercial buildings totaled about $308 million dollars (Table 2.1).

- **Energy Intensity:** The major fuel energy consumption intensity was 125.79 thousand Btu per square foot for the 881 buildings (Table 2.1).

- **Principal Building Activity:** Principal building activity, the activity that occupies the most floorspace in the building, indicates the diversity of the Federal commercial building population. In the 881 responding buildings in Federal Regions 3, 6, and 9, office buildings accounted for the greatest number of buildings, 33 percent, and about 48 percent of the floorspace. Although health care buildings were only about 14 percent of the buildings in the sample, they constituted 21 percent of the floorspace (Table 3.7).

- **Selected Characteristics by Agency**: In a commercial building, building size and number of workers impact the consumption, expenditures and the associated energy intensities. Table 2.1 provides these data on an agency level. In FY 1993, of the total Federal expenditures for major fuel consumption in the 881 responding buildings in Federal Regions 3, 6, and 9 ($308 million), the General Services Administration (GSA) spent about $105 million. Overall, the GSA consumed about 27 percent of the total energy consumed in the sampled buildings in Federal Regions 3, 6, and 9 in FY 1993. The Veterans Administration was the next largest consumer of energy among the participating FBSS agencies.

Table 2.1. Selected Energy-Related Statistics by Federal Agency, 1993

Federal Agencies in FBSS - Federal Regions 3, 6, and 9	Number of Buildings	Floorspace (thousand square feet)	Number of Workers	Sum of Major Fuel Consumption (billion Btu)	Major Fuel Intensity (thousand Btu per square foot)	Sum of Major Fuel Expenditures (thousand dollars)	Major Fuel Expenditures per square foot (dollars)
Responding Agencies	881	175,012	492,172	22,014	125.79	308,401	1.76
Department of Agriculture	14	720	1,156	148	205.98	2,008	2.79
Department of Commerce	17	2,390	3,579	682	285.31	9,481	3.97
Department of Defense	122	24,145	60,534	3,192	132.20	43,274	1.79
Department of Education	2	80	131	6	78.88	55	.69
Department of Energy	86	7,990	14,001	2,473	309.53	32,400	4.05
Department of Justice	20	1,212	1,947	231	190.57	3,065	2.53
Department of Labor	7	729	577	54	74.07	666	.91
Department of the Interior	30	971	1,378	63	65.15	963	.99
Department of the Treasury	2	800	1,580	59	73.41	1,003	1.25
Department of Transportation	13	1,426	4,909	189	132.19	2,882	2.02
Environmental Protection Agency	1	50	145	13	251.87	176	3.53
Federal Emergency Management Agency	2	81	103	7	86.68	75	.92
General Accounting Office	1	1,844	2,588	106	57.28	1,827	.99
General Services Administration	157	66,598	220,080	5,919	88.88	105,118	1.58
Government Printing Office	2	1,420	4,100	220	155.22	2,777	1.96
Health and Human Services	23	2,042	4,243	760	372.11	7,940	3.89
National Aeronautics and Space Administration	52	4,180	9,878	913	218.52	11,881	2.84
National Science Foundation	1	23	20	27	1,164.35[a]	476	20.70
United States Postal Service	1 81	24,806	103,458	2,373	95.66	32,732	1.32
Veterans Administration	148	33,504	57,765	4,579	136.67	49,603	1.48

[a]The National Science Foundation building is the National Radio Astronomy Observatory and includes the consumption and expenditures for the observatory as well as the office floorspace.

Notes: • These data are from 881 federally owned buildings having the following criteria: (1) located in Federal Regions 3, 6, or 9; (2) larger than 10,000 square feet; and (3) used for a commercial purpose, other than warehouse and storage. In addition, 9 out of 10 selected buildings were from agencies other than the Department of Defense. • Totals may not equal sum of components due to independent rounding. • Data are for Fiscal Year 1993 (October 1, 1992 through September 30, 1993).

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.

Conservation and Energy Management

In response to OFEMP's request that EIA provide detailed information on energy efficiency and energy management for Federal buildings, the FBSS included a number of questions about energy efficiency features, energy management practices, and the reduction of equipment use during off-hours. Federal agencies have a variety of strategies available for implementation to reduce their energy consumption including energy-efficient equipment retrofits.

There are various sponsors and assistance programs available to retrofit equipment. The following synopsis provides data for retrofitting equipment practices for the FBSS.

- Of the 881 Federal commercial buildings that responded to the FBSS, about 39 percent reported using boilers as their heating equipment and 36 percent reported using district steam. In about 70 percent of the buildings using boilers and 84 percent of buildings using district steam, the equipment was 10 years or older (Table 2.2).

- Less than 10 percent of FBSS buildings reported using heat pumps as their heating equipment, and as might be expected, the majority of the heat pumps were less than 10 years old. Buildings with packaged units for heating were about evenly divided between those less than 10 years old and those 10 years or older.

- In buildings with water heating equipment, approximately 62 percent of that equipment was 10 years or older.

- The vast majority of building respondents reported purchasing new equipment rather than retrofitting existing equipment within the past 10 years.

- Lighting equipment was an overwhelming "favorite" for retrofitting or purchasing (56 percent of the 871 buildings with lighting equipment) followed by retrofits or purchases for heating equipment, water-heating equipment and central chillers. Of the 487 building respondents reporting either the retrofit or purchase of their lighting equipment, about 39 percent reported retrofitting rather than purchasing.

- With the exception of retrofitting lighting equipment, the majority of the 881 Federal buildings that were surveyed did not report the purchase or retrofit of energy-using equipment within the last 10 years.

Table 2.2. Age of Equipment and Whether Retrofitted or Purchased in Past Ten Years, Number of FBSS Buildings, 1993

Type of Equipment (more than one may apply)	All Buildings with Each Type of Equipment	Age of Equipment				Retrofitted or Purchased Equipment in Past Ten Years			
		Less Than Ten Years Old	Ten Years or Older	Some Less Than Ten Years, Some More than Ten Years	Don't Know/Not Ascertained	Retrofitted	Purchased	Both Retrofitted and Purchased	Don't Know/Not Ascertained
Heating (more than one may apply)									
Furnace	59	25	32	0	2	1	16	0	1
Heat Pump	84	55	28	0	1	2	36	0	2
Space Heater	138	70	64	0	4	2	53	0	2
District Steam	320	45	269	3	3	10	25	0	3
Boiler	341	83	238	4	16	13	54	0	17
Packaged Unit	151	66	67	3	15	3	46	0	15
Central Chillers	419	128	257	18	16	15	98	2	20
Water-Heating	857	285	528	4	36	23	199	0	38
Lighting	871	NA	NA	NA	NA	190	288	9	46
Refrigeration	242	90	136	3	13	8	58	1	5

NA= Not Applicable.

Notes: •Only buildings in which the equipment was less than ten years old or the age was unknown were asked whether it was retrofitted or purchased (buildings answering no are not provided). •These data are from 881 federally owned buildings having the following criteria: (1) located in Federal Regions 3, 6, or 9; (2) larger than 10,000 square feet; and (3) used for a commercial purpose, other than warehouse and storage. In addition, 9 out of 10 selected buildings were from agencies other than the Department of Defense. • Data are for Fiscal Year 1993 (October 1, 1992 through September 30, 1993).

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.

Sponsors of programs aimed at assisting buildings in purchasing new equipment or retrofitting existing equipment include utilities, the Federal government (under the Federal Energy Management Program (FEMP)), and third-parties such as an energy service company (ESCO). Buildings can also institute energy-saving programs in-house (Table 2.3).

- Of the buildings that had retrofitted or purchased equipment, the majority did so within programs that were sponsored in-house.
- Of the buildings that reported receiving assistance from FEMP, most reported assistance in the area of lighting equipment.

Table 2.3. Sponsor of Retrofit or Purchase of Equipment, Number of FBSS Buildings, 1993

Type of Equipment (More than one may apply)	Buildings that Retrofitted or Purchased Equipment in Past Ten Years	Sponsor of Retrofit or Purchase (More than one may apply)					
		Electric Utility	In-House	Third Party	Other	FEMP	Don't Know/Not Ascertained
Heating(more than one may apply)							
Furnace	17	0	13	4	0	0	0
Heat Pump	38	0	29	7	0	1	1
Space Heater	55	0	48	5	2	0	0
District Steam	35	0	27	8	0	0	1
Boiler	67	3	45	9	3	3	4
Packaged Unit	49	0	42	5	2	0	1
Central Chillers	115	3	84	18	3	3	8
Water-Heating	222	3	190	24	1	1	4
Lighting	487	46	387	49	5	15	4

Note: • These data are from 881 federally owned buildings having the following criteria: (1) located in Federal Regions 3, 6, or 9; (2) larger than 10,000 square feet; and (3) used for a commercial purpose, other than warehouse and storage. In addition, 9 out of 10 selected buildings were from agencies other than the Department of Defense. • Data are for Fiscal Year 1993 (October 1, 1992 through September 30, 1993).

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.

Federal buildings have access to various types of programs aimed at saving energy. Among the programs that assist in either the purchase of new energy-using equipment or the retrofit of existing equipment are: incentives that offer monetary or non-monetary awards such as low-interest loans, rebates, and direct installation of low-cost measures; the Federal Energy Efficiency Fund (FEEF), sponsored by FEMP, that provides grants to Federal agencies to assist them in meeting energy efficiency and water conservation requirements; and alternative energy rates offered by utilities that are intended to reduce consumer bills and shift hours of operation of equipment from on-peak to off-peak periods (Table 2.4).

- For the most part, those buildings that had purchased or retrofitted equipment did not receive assistance in upgrading their equipment.

- Incentives were the most often reported type of assistance. This was followed by assistance from the FEEF and use of alternatives rates.

Table 2.4. Type of Assistance Received for Retrofit or Purchase of Equipment, Number of FBSS Buildings, 1993

Type of Equipment (more than one may apply)	Types of Assistance (More than one may apply)						
	Buildings that Retrofitted or Purchased Equipment in Past Ten Years	Federal Energy Efficiency Fund	Incentives	Alternative Rates	Fuel Switching	Other/ None	Don't Know/Not Ascertained
Heating(more than one may apply)							
Furnace	17	0	0	0	2	12	3
Heat Pump	38	1	2	2	2	29	5
Space Heater	55	1	0	1	0	52	1
District Steam	35	0	0	0	0	33	2
Boiler	67	2	1	5	1	47	11
Packaged Unit	49	1	0	2	0	44	3
Central Chillers	115	1	1	6	0	98	11
Water-Heating	222	3	2	5	1	191	20
Lighting Equipment	487	24	88	18	1	344	23

Note: •These data are from 881 federally owned buildings having the following criteria: (1) located in Federal Regions 3, 6, or 9; (2) larger than 10,000 square feet; and (3) used for a commercial purpose, other than warehouse and storage. In addition, 9 out of 10 selected buildings were from agencies other than the Department of Defense. • Data are for Fiscal Year 1993 (October 1, 1992 through September 30, 1993).

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.

The FBSS collected detailed data on the number, type, and age of motors in Federal commercial buildings in addition to information about how many were rewound and how many were considered energy efficient (Table 2.5)

- Most buildings reported between one to five motors that were 10 or more horsepower in their equipment.
- With the exception of buildings using motors for their heat pumps, most buildings reported having equipment with motors that were 10 years or older.

Table 2.5. Motor Characteristics by Equipment Type, Number of FBSS Buildings,1993

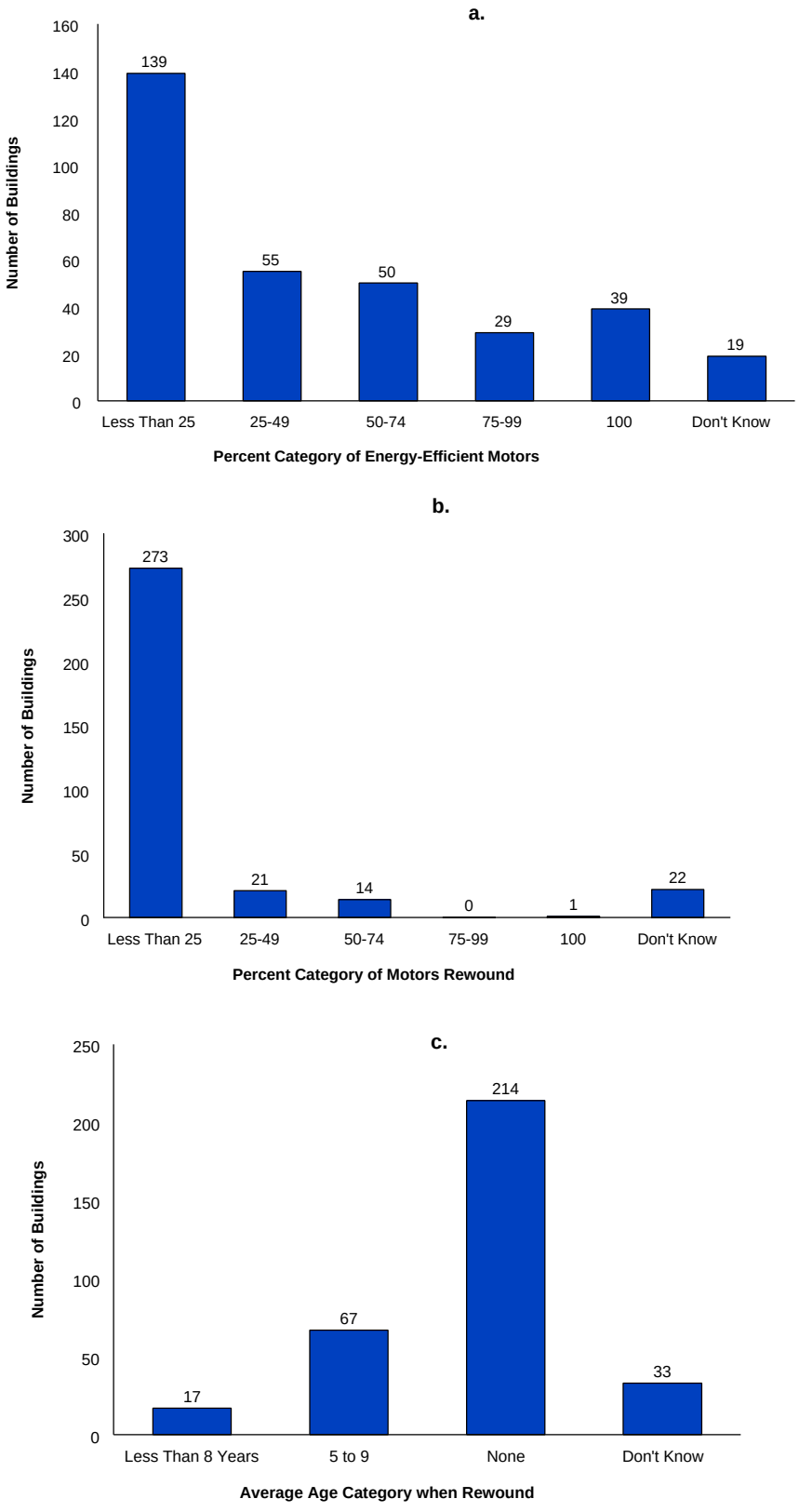
Motors Characteristics	Type of Equipment with Motors 10 or More Horsepower (more than one may apply)							
	Chillers	Heat Pumps	Fans	Air Compressors	Water Pumps	Elevators	Escalators	Refrigeration
All Buildings	381	23	461	294	374	411	35	86
Number of Motors								
One to Five	320	18	201	221	194	280	21	44
Six to Ten	39	2	89	47	92	61	6	16
Ten to 100	16	2	160	18	76	62	4	16
Don't Know/Not Ascertained	6	1	11	8	12	8	4	10
Age of Motors								
Less Than Ten Years Old	127	12	119	109	96	79	6	23
Ten Years or Older	179	8	245	132	192	272	24	41
Some Less Than Ten Years, Some More Than Ten Years	32	0	39	17	33	22	0	11
Don't Know/Not Ascertained	43	3	58	36	53	38	5	11

Notes: • These data are from 881 federally owned buildings having the following criteria: (1) located in Federal Regions 3, 6, or 9; (2) larger than 10,000 square feet; and (3) used for a commercial purpose, other than warehouse and storage. In addition, 9 out of 10 selected buildings were from agencies other than the Department of Defense. • Totals may not equal sum of components due to independent rounding. • Data are for Fiscal Year 1993 (October 1, 1992 through September 30, 1993).

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.

- Forty-two percent of 331 buildings that had equipment with motors less than 10 years old had fewer than 25 percent energy-efficient motors (Figure 2.1a).
- A higher percent (82 percent) of 331 buildings that had equipment with motors less than 10 years old had fewer than 25 percent of their motors rewound (Figure 2.1b). Sixty-five percent or 214 of the 331 building respondents said none of their motors were rewound (Figure 2.1c.) This suggests that Federal buildings could target the purchase of energy efficient motors for future conservation improvement.

Figure 2.1 Selected Characteristics of Motors, 1993



Note: These graphs are based on 331 buildings of the 881 responding buildings that had equipment with motors less than 10 years old.

Source: Energy Information Administration, Office of Energy Markets and End Use, 1993 Federal Buildings Supplemental Survey.