2007 Buildings Energy Data Book

U.S. Department of Energy

Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

This version is dated: September 2007

2007 Buildings Energy Data Book

September 2007

Prepared for the
Buildings Technologies Program and
Office of Planning, Budget, and Analysis
Energy Efficiency and Renewable Energy
U.S. Department of Energy

by
D&R International, Ltd.

under contract to
Oak Ridge National Laboratory

Table of Contents

Table of Contents

Foreword

The U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy has developed this *Buildings Energy Data Book* to provide a current and accurate set of comprehensive buildings-related data, and to promote the use of such data for consistency throughout DOE programs. The following factoids provide some interesting perspective on the energy that powers our nation's buildings.

- Buildings now use 72 percent of all electricity and account for 80 percent of all electric expenditures.
- "Internal gains" account for as much as 27 percent of a home's cooling load.
- There are now 113 million households.
- One-third of all households rent their homes.
- The average new single-family home has increased in size by about 700 square feet since 1980.
- In 2006, 50 percent of all new homes completed were completed in the South. Cooling load management emerges as a priority.
- U.S. buildings carbon dioxide emissions (630 million metric tons of carbon) approximately equal the combined emissions of Japan, France, and the United Kingdom.
- China's projected annual growth rate in carbon dioxide emissions through 2010 is 6.5 times that of the U.S. (5.2 percent vs. 0.8 percent).
- Lighting uses more energy than cooling in the residential sector. This underscores the importance of breakthrough lighting technologies.
- The homebuilding industry shows signs of consolidating. As of 2006, the top five homebuilders hold 20 percent of the total market, the top 20 hold 35 percent, and the top 100 hold 47 percent.
- In 2001, per the *U.S. Lighting Market Characterization Report 2002*, lighting consumed 756 Billion kWh. In 2001, per the *Annual Energy Review 2003*, America's 104 nuclear generating units produced 769 billion kWh, while operating at a capacity factor of 89 percent. It therefore takes our entire nuclear fleet to illuminate America.
- In 2006, 31 percent of all refrigerator sales and 38 percent of all clothes washer sales were ENERGY STAR compliant.

We hope you find the *2007 Buildings Energy Data Book* useful. You are encouraged to comment on errors, omissions, emphases, and organization of this report to one of the persons listed below. Requests for additional copies of this report, additional data, or information on an existing table should be referred to D&R International.

Jordan D. Kelso, PE
D&R International, Ltd.
1300 Spring Street
Suite 500
Silver Spring, Maryland 20910
Telephone: (301) 588-9387
Fax: (301) 588-0854
E-mail: jkelso@drintl.com

The *2007 Buildings Energy Data Book* can be found on the web at:

http://buildingsdatabook.eere.energy.gov/

Acknowledgements

The authors would like to express their thanks to the many individuals who assisted in the preparation of this document. We thank Jerry Dion and the Building Technologies Program along with the Energy Efficiency and Renewable Energy staff for their continued support of the *Buildings Energy Data Book*. We greatly appreciate the input and guidance received over the years from Andrew Nicholls of Pacific Northwest National Laboratory.

Introduction

The *2007 Buildings Energy Data Book* is a statistical compendium prepared and published under contract with the National Energy Technology Laboratory (NETL) with the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE). Pacific Northwest National Laboratory (PNNL) first published the predecessor to the annual *Buildings Energy Data Book* in 1986. PNNL published these through September 2004. The NETL began support of the *Buildings Energy Data Book* this year.

EERE has developed this *2007 Buildings Energy Data Book* to provide a current and accurate set of comprehensive buildings-related data and to promote the use of such data for consistency throughout DOE programs. Additional data (e.g., more current, widely accepted, and/or better-documented data) and suggested changes should be submitted to D&R International, Ltd. Please provide full source references along with all data.

The *Buildings Energy Data Book* is a compilation of data and does not provide original data. Much of the data gathered is from government documents, models, and analyses. All data sources are included with each data table. Tables are organized into seven chapters: 1: Energy Consumption Data; 2: Characteristics Data; 3: Environmental Data; 4: Economic Data; 5: Market Data; 6: Quad Equivalents; and 7: Buildings Profiles.

List of Tables

Buildings Energy Data Summary Sheets

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

List of Tables

Key Terminology

AAMA	American Architectural Manufacturers Association
ACEEE	American Council for an Energy Efficient Economy
AEO	EIA's Annual Energy Outlook
AFEAS	Alternative Fluorocarbons Environmental Acceptability Study
AFUE	Annual Fuel Utilization Efficiency
AHAM	Association of Home Appliance Manufacturers
ARI	Air-Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
BTS	DOE's Office of Building Technology, State and Community Programs
CBECS	EIA's Commercial Building Energy Consumption Survey
CDD	Cooling Degree Days
CF	Cubic feet
CFC	Chlorofluorocarbon
CHP	Combined Heat and Power
CO	Carbon monoxide
CO2	Carbon dioxide (CO_2)
COP	Coefficient of Performance (dimensionless, heating/cooling capacity: (Btu) over electric input (Btu))
CPS	Bureau of the Census' Current Population Survey
Delivered	Refers to energy used on site (including purchased electricity)
DG	Distributed Generation
DOC	U.S. Department of Commerce
DOE	U.S. Department of Energy
EER	Energy Efficiency Ratio (Btu/watt-hour)
EERE	DOE’s Energy Efficiency and Renewable Energy Office
EF	Energy Factor
EIA	DOE's Energy Information Administration
EPA	U.S. Environmental Protection Agency
FEMP	DOE's Federal Energy Management Program
FT2	Square Feet
FY	Fiscal Year
GAMA	Gas Appliance Manufacturers Association

Key Terminology

GDP	Gross Domestic Product
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HHS	U.S. Department of Health and Human Services
HSPF	Heating Season Performance Factor (Btu/watt-hour)
HUD	U.S. Department of Housing and Urban Development
HVAC/R	Heating, ventilating, and air-conditioning/refrigeration
IEA	International Energy Agency
LBNL	Lawrence Berkeley National Laboratory
LIHEAP	HHS' Low Income Home Energy Assistance Program
LPG	Liquid Petroleum Gas
MEF	Modified Energy Factor
MMTCE	Million metric tons of carbon equivalent (includes only energy consumption effects, unless otherwise noted)
NAHB	National Association of Home Builders
NCES	National Center for Educational Statistics
NEMS	National Energy Modeling System
NIST	National Institute of Standards and Technology
NWWDA	National Wood Window and Door Association
NOx	Nitrogen oxide (NO_x)
OBE	BTS's Office of Building Equipment
OBT	DOE's Office of Building Technology, State and Community Programs (formerly the Office of Building Technologies)
ODP	Ozone Depletion Potential
ORNL	Oak Ridge National Laboratory
OWIP	Office of Weatherization and Intergovernmental Program
PM-2.5	Particulate matter of aerodynamic diameter less than 2.5 microns
PM-10	Particulate matter of aerodynamic diameter less than 10 microns
PNNL	Pacific Northwest National Laboratory
Primary	Refers to energy used at the source (including fuel input to electric power plants)
PV	Photovoltaic

Key Terminology

PY	Program Year
Quad	Quadrillion Btu (10^15 Btu)
R-value	Thermal resistance measured in (Btu/Hr-SF-^{o}F)$^{-1}$
RECS	EIA's Residential Energy Consumption Survey
SEDS	State Energy Data System
SEER	Seasonal Energy Efficiency Ratio (Btu/watt-hour)
SEF	Solar Energy Factor
SF	Square feet
SHGC	Solar heat gain coefficient
SIC	Standard Industrial Classification
Site	Refers to energy used on site (i.e., delivered)
SO2	Sulfur dioxide (SO_2)
SRCC	Solar Rating and Certification Corporation
U-Factor	Thermal conductance measured in (Btu/Hr-SF-^{o}F)
VOC	Volatile organic compounds

1. U.S. Residential and Commercial Buildings Primary Energy Consumption (Quads and % of Totals)

Residential Consumption

	Elec		NGas		Oil		Coal		Renew		**Total**
1990	10.5	61%	4.5	27%	1.4	8%	0.0	0%	0.64	4%	**17.0**
2000	13.3	65%	5.1	25%	1.6	8%	0.0	0%	0.50	2%	**20.5**
2005	**14.8**	**68%**	**5.0**	**23%**	**1.5**	**7%**	**0.0**	**0%**	**0.44**	**2%**	**21.8**
2010	16.0	69%	5.2	22%	1.5	7%	0.0	0%	0.47	2%	**23.1**
2020	17.9	71%	5.4	21%	1.5	6%	0.0	0%	0.46	2%	**25.3**
2030	19.4	72%	5.5	20%	1.5	5%	0.0	0%	0.47	2%	**26.8**

Commercial Consumption

	Elec		NGas		Oil		Coal		Renew		**Total**
1990	9.5	71%	2.7	20%	1.0	7%	0.1	1%	0.10	1%	**13.4**
2000	13.0	75%	3.3	19%	0.8	4%	0.1	1%	0.13	1%	**17.2**
2005	**13.7**	**77%**	**3.1**	**18%**	**0.8**	**4%**	**0.1**	**1%**	**0.15**	**1%**	**17.9**
2010	15.0	78%	3.3	17%	0.8	4%	0.1	1%	0.15	1%	**19.4**
2020	17.8	78%	3.9	17%	0.8	3%	0.1	0%	0.15	1%	**22.7**
2030	21.0	79%	4.4	16%	0.8	3%	0.1	0%	0.16	1%	**26.5**

2. U.S. Buildings Primary Energy Consumption (Quads and % of Total)

	Elec		NGas		Oil		Coal		Renew		**Total**
1990	19.9	66%	7.2	24%	2.4	8%	0.2	1%	0.74	2%	**30.4**
2000	26.3	70%	8.4	22%	2.3	6%	0.1	0%	0.62	2%	**37.7**
2005	**28.6**	**72%**	**8.1**	**20%**	**2.3**	**6%**	**0.1**	**0%**	**0.58**	**1%**	**39.7**
2010	31.0	73%	8.5	20%	2.3	5%	0.1	0%	0.62	1%	**42.5**
2020	35.7	74%	9.3	19%	2.3	5%	0.1	0%	0.62	1%	**48.0**
2030	40.4	76%	9.8	18%	2.3	4%	0.1	0%	0.64	1%	**53.3**

3. U.S. Buildings Generic Quad (% of Total)

	Gas	Oil	Coal	Renew	Nuclear
1990	31%	11%	35%	10%	13%
2000	32%	8%	37%	8%	14%
2005	**31%**	**8%**	**38%**	**8%**	**15%**
2010	31%	7%	38%	9%	14%
2020	31%	6%	39%	9%	14%
2030	27%	6%	45%	9%	13%

4. Buildings Share of U.S. Primary Energy Consumption

	Res	Com	**Bldgs**	Indtry	Trans
1990	20%	16%	**36%**	38%	26%
2000	21%	17%	**38%**	35%	27%
2005	**22%**	**18%**	**40%**	**32%**	**28%**
2010	22%	18%	**40%**	32%	28%
2020	21%	19%	**41%**	30%	29%
2030	20%	20%	**41%**	29%	30%

5. Buildings Share of U.S. Electricity Consumption

	Res	Com	**Bldgs**	Indtry	Trans
1990	34%	31%	**65%**	35%	0%
2000	35%	34%	**69%**	31%	0%
2005	**37%**	**35%**	**72%**	**28%**	**0%**
2010	38%	35%	**73%**	27%	0%
2020	38%	37%	**75%**	25%	0%
2030	40%	40%	**80%**	23%	0%

6. U.S. Electricity Net Generation, by Plant Type (Billion Kilowatthours)

	NGas	Petro	Coal	Renew	Nucl.	Total
1990	265	118	1560	324	577	**2901**
2000	399	98	1911	316	754	**3638**
2005	**546**	**111**	**1956**	**323**	**780**	**3883**
2010	658	82	2090	370	789	**4209**
2020	776	89	2418	416	885	**4781**
2030	609	92	3191	434	896	**5402**

7. U.S. Buildings Primary Energy and Expenditure End-Use Splits, 2005

Energy (Quads and % of Totals)

End Use	Residential		Commercial		**Buildings**	
Space Heating	6.7	31%	2.5	14%	**9.2**	**23%**
Lighting	2.4	11%	4.6	26%	**7.0**	**18%**
Space Cooling	2.7	12%	2.3	13%	**5.0**	**13%**
Water Heating	2.7	12%	1.2	7%	**3.9**	**10%**
Electronics	1.6	7%	1.1	6%	**2.7**	**7%**
Refrigeration	1.6	8%	0.7	4%	**2.4**	**6%**
Cooking	1.0	5%	0.4	2%	**1.3**	**3%**
Wet Clean	1.0	5%			**1.0**	**3%**
Ventilation			1.1	6%	**1.1**	**3%**
Computers	0.2	1%	0.6	3%	**0.8**	**2%**
Other	0.8	4%	2.4	13%	**3.2**	**8%**
Adjust to SEDS	1.0	5%	1.0	5%	**2.0**	**5%**
Total	**21.8**	100%	**17.9**	100%	**39.7**	**100%**

Expenditures ($2005 and % of Totals)

End Use	Residential		Commercial		**Buildings**	
Space Heating	76	35%	27	16%	**101**	**27%**
Lighting	21	10%	36	23%	**57**	**15%**
Space Cooling	23	11%	12	8%	**42**	**11%**
Water Heating	28	13%	19	12%	**40**	**11%**
Electronics	14	6%	9	4%	**23**	**6%**
Refrigeration	14	7%	6	6%	**20**	**5%**
Cooking	10	4%	4	2%	**13**	**4%**
Wet Clean	9	4%			**9**	**3%**
Ventilation			9	6%	**9**	**2%**
Computers	2	1%	5	3%	**7**	**2%**
Other	9	4%	20	13%	**29**	**8%**
Adjust to SEDS	9	4%	11	7%	**20**	**6%**
Total	**215**	100%	**155**	100%	**370**	**100%**

8. Buildings Energy Prices and Expenditures

Prices ($2005/10^6 Btu)

	Residential Buildings				Commercial Buildings				Bldgs
	Elec	NGas	Petro	Avg	Elec	NGas	Petro	Avg	Avg
1990	31.72	7.78	12.09	**16.76**	29.29	6.49	8.22	**16.76**	**16.76**
2000	24.49	8.61	13.02	**14.31**	21.86	6.64	5.68	**16.14**	**15.08**
2005	**27.59**	**12.43**	**16.14**	**19.03**	**25.25**	**11.20**	**12.87**	**21.37**	**20.01**
2010	26.91	10.98	17.70	**18.23**	24.50	9.34	12.71	**20.31**	**19.10**
2020	26.37	10.54	16.79	**18.01**	23.95	8.67	11.67	**19.43**	**18.64**
2030	26.76	11.43	18.11	**19.08**	24.27	9.30	12.61	**19.98**	**19.50**

Petroleum includes distillate and residual fuel oils, LPG, kerosene, and motor gasoline.
2005 average electricity cost: resid. $0.094/kWh, comm. $0.086/kWh, and Bldgs. $0.090/kWh.

Expenditures ($2005 Billion)

	Residential Buildings				Commercial Buildings				Bldgs
	Elec	NGas	Petro	Total	Elec	NGas	Petro	Total	Total
1990	100.0	35.2	17.0	**152.2**	83.8	17.5	7.8	**109.1**	**261.3**
2000	110.7	43.9	20.4	**175.0**	96.0	24.1	6.9	**126.9**	**301.9**
2005	**128.5**	**61.9**	**24.8**	**215.2**	**109.1**	**35.2**	**9.9**	**154.3**	**369.5**
2010	136.2	56.9	27.0	**220.1**	116.9	30.9	9.5	**157.4**	**377.5**
2020	153.0	57.2	25.6	**235.9**	138.4	33.5	9.3	**181.2**	**417.1**
2030	173.1	62.5	26.5	**262.1**	170.7	40.6	10.3	**221.6**	**483.7**

Expenditures exclude wood and coal costs. 2005 U.S. energy expenditures were $1.04 trillion

9. Energy Consumption Intensities, by Year

Residential

	Number of Hhold (10^6)	% Post-00 Hholds	Bldgs (10^6)	*Delivered* Energy Use (10^6Btu/Hhold)	Primary Energy Use (10^6Btu/Hhold)
1980	79.6	N.A.	65.5	124.7	198.8
1990	94.2	N.A.	74.2	103.5	181.0
2000	105.7	N.A.	82.6	106.3	193.9
2005	**113.3**	**9%**	**N.A.**	**102.6**	**192.2**
2010	120.7	16%	N.A.	101.5	191.8
2020	134.7	29%	N.A.	98.3	188.0
2030	147.5	39%	N.A.	94.1	181.5

2000 number of buildings actually from 1997.
2001 households 69% single-family, 25% multi-family, and 6% mobile homes.
2001 *delivered* energy use: 80% single-family, 15% multi-family, and 5% mobile homes.

Commercial

	Floorspace (10^9 SF)	% Post-00 SF	Bldgs (10^6)	*Delivered* Energy Use (10^3Btu/SF)	Primary Energy Use (10^3Btu/SF)
1980	50.9	N.A.	3.1	117.8	208.2
1990	64.3	N.A.	4.5	104.7	207.7
2000	68.5	N.A.	4.7	119.4	250.8
2005	**74.3**	**N.A.**	**N/A**	**114.3**	**241.1**
2010	80.4	16%	N/A	113.0	240.8
2020	92.9	29%	N/A	115.1	244.6
2030	108.0	39%	N/A	115.5	245.2

2000 number of buildings actually from 1999.
2003 floorspace: 22% mercantile & service, 17% office, 14% warehouse, and 14% education. 2003*delivered* energy use: 22% mercantile & service, 19% office, 11% education, and 8% health care.

10. Residential (2001) and Commercial (2003) Vintages

Residential	% of Hholds	Commercial	% of SF
1949 or Before	25%	Prior to 1960	25%
1950 to 1959	13%	1960 to 1979	27%
1960 to 1969	13%	1980 to 1989	15%
1970 to 1979	18%	1990 to 1999	25%
1980 to 1989	17%	2000 to 2003	8%
1990 to 2001	14%		

11. Stock Energy Expenditures ($2005)

	Residential ($/Hhold)	Commercial ($/SF)
1980	1,798	1.92
1990	1,615	1.70
2000	1,617	1.85
2005	**1,899**	**2.09**
2010	1,824	1.97
2015	1,729	1.89
2020	1,751	1.96

12. Carbon Dioxide Emissions for U.S. Buildings

(10^6 Metric Tons of Carbon/Year)

	Buildings			Bldgs % of	Bldgs % of
	Elec	*Site* Fossil	Total	U.S. Emiss	Global Emiss
1990	317.2	153.7	470.9	35%	8%
2000	426.2	167.4	593.5	38%	9%
2005	**466.0**	**164.3**	**630.3**	**39%**	**9%**
2010	498.4	168.7	667.1	39%	9%
2020	579.5	180.9	760.4	40%	8%
2030	697.7	187.7	885.4	41%	8%

Buildings emissions equal emissions of Japan, France, and the U. K. combined.
2005 U.S. emissions = 1,623 MMTCE. 2004 Global emissions = 7,348 MMTCE.

13. EPA Emissions for U.S. Buildings, 2002

(10^6 Short Tons)

	Buildings			Bldgs % of
	Wood/*Site* Fossil	Elec	Total	U.S. Emiss
SO2	0.58	7.34	7.919	52%
NOx	0.73	3.35	4.078	19%
CO	2.50	0.36	2.856	3%
VOCs	0.79	0.04	0.828	5%
PM-2.5	0.38	0.42	0.8	12%
PM-10	0.41	0.50	0.901	4%

14. Value of New, Improvement & Repair Building Construction ($2005 Billion)

	Value of New Construction			Bldgs % of	Value of Improvement & Repair			Bldgs % of
	Resid	Comm	Bldgs	U.S. GDP	Resid	Comm	Bldgs	U.S. GDP
1980	149.4	143.9	293.2	5.0%	96.7	N.A.	N.A.	N.A.
1985	192.1	203.7	395.7	5.8%	132.8	126.2	259.0	3.8%
1990	187.8	204.8	392.7	4.9%	159.5	128.3	287.8	3.6%
1995	214.7	185.8	400.6	4.4%	153.0	111.2	264.2	2.9%
2000	303.5	291.1	594.6	5.4%	172.5	180.6	353.1	3.2%
2005	**490.0**	**285.9**	**775.8**	**6.2%**	**215.0**	**177.4**	**392.4**	**3.2%**

2005 U.S. GDP = $12.46 trillion

15. 1998 Cost Breakdown of a 2,150-Square-Foot, New Single-Family Home ($2005)

	Cost	
Finished Lot	62,539	24%
Construction Cost	4,087	2%
Financing	4,985	2%
Overhead & General Expenses	15,139	6%
Marketing	3,716	1%
Sales Commission	8,940	3%
Profit	24,350	9%

16. Residential New Single-Family Homes Completed

	# of Units	Average SF
1980	957,000	1,730
1990	966,000	2,080
2000	1,241,800	2,266
2006	**1,654,000**	**2,469**

1980 SF extrapolated from 1978 and 1981 data.

17. Design and Construction Employment

	Employees (thousands)		Builders	
	Architects	Construction (1)	(companies)	
1980	N.A.	3,065	93,600	
1990	N.A.	3,861	119,300	
2000	215	5,183	134,079	(2)
2005	**235**	**7,277**	**N.A.**	

1) Excludes industrial building and heavy construction.
2) Builders is for 1997. Builders exclude homebuilding establishments without payrolls, estimated by NAHB at an additional 210,000 in 1992.

18. FY 2005 Energy Burdens

	Mean Individual	Median Individual	Mean Group
All Hholds	6.8%	3.7%	2.9%
Fed Elgble Hhold	14.6%	8.6%	9.1%
Fed Ineligible Hhold	3.2%	2.8%	2.3%

Average income of a Federally eligible household was $16,264 in 2004.

19. Construction Waste

2 to 7 tons for each new single-family detached house.
Average of 4 pounds per square foot for new single-family detached house.
30 to 35 million tons of building construction, renovation, and demolition waste each year.
Construction of typical 2,000 sq.ft. home results in 4 tons of waste (wood/paper: 46%, drywall: 25%, masonry: 13%, other: 17%, hazardous material: 1%)

20. Weatherization Facts

5.8 million homes have been weatherized since 1976.
DOE creates an average energy savings of $358 a year with a cost-benefit ratio of 1.53.
DOE Weatherization program requires that states spend no more than an average of $2,885 per household in PY 2007. All states use energy audits to determine the most cost-effective weatherization measures.

21. 2003 U.S. Private Investment into Construction R&D

Sector	Percent of Sales
Average Construction R&D (1)	0.6
Heavy Construction	2.0
Lumber and Wood Products	0.3
Special Trade Construction	0.2
Fans Blowers and Air Cleaning Equip.	1.6
Commercial Buildings Operations	2.2
Building Technology	
Appliances	2.0
Lighting	1.2
HVAC	1.5
U.S. Industry Average	3.6

1) Includes bridges, roads, buildings, dams, etc.

22. 2006 Five Largest Residential Homebuilders

Homebuilder	Home Closings	% of Closings
D.R. Horton	53,410	5.0%
Pulte Homes	49,568	4.7%
Lennar Homes	41,487	3.9%
Centex Corporation	37,539	3.5%
KB Home	32,124	3.0%
Total of Top Five	**214,128**	**20.2%**
Habitat for Humanity	4,862	0.46%

2006 total U.S. new home closings was 1.06 million. 2006 total share of top 100 builders was 47.0%.

The summary tables correspond to the following tables in Chapters 1 through 7 of the Buildings Energy Data Book

1.	1.2.1, 1.3.1	**5.**	1.1.6	**8.**	4.1.1, 4.1.3	**11.**	4.2.2, 4.3.2	**15.**	4.2.8	**19.**	3.4.1, 3.4.2
2.	1.1.1	**6.**	1.5.4	**9.**	1.2.4, 1.2.6, 1.3.4, 1.3.6,	**12.**	3.1.1	**16.**	2.1.6	**20.**	7.1.1, 7.1.4, 7.1.7
3.	1.1.5	**7.**	1.1.4, 1.2.3, 1.3.3,		2.1.1, 2.1.2, 2.2.1, 2.2.2	**13.**	3.3.1	**17.**	4.6.1	**21.**	4.5.4
4.	1.1.3		4.1.4, 4.2.1, & 4.3.1	**10.**	2.1.5, 2.2.6	**14.**	4.5.2, 4.5.3, 5.1.2	**18.**	4.2.7, 7.1.1	**22.**	5.1.1

1.1.1 U.S. Residential and Commercial Buildings Total Primary Energy Consumption (Quadrillion Btu and Percent of Total)

	Natural Gas		Petroleum (1)		Coal		Renewable(2)		Electricity Sales	Electricity Losses	Electricity Total		TOTAL (2)		Growth Rate 2005-Year
1980	7.52	28%	3.04	11%	0.15	1%	0.87	3%	4.35	10.51	14.86	56%	26.43	100%	-
1990	7.22	24%	2.36	8%	0.16	1%	0.74	2%	6.01	13.92	19.93	66%	30.40	100%	-
2000	8.35	22%	2.32	6%	0.10	0%	0.62	2%	8.03	18.26	26.28	70%	37.67	100%	-
2005	**8.13**	**20%**	**2.31**	**6%**	**0.11**	**0%**	**0.58**	**1%**	**8.98**	**19.58** (3)	**28.55**	**72%**	**39.69**	**100%**	-
2010	8.50	20%	2.28	5%	0.11	0%	0.62	1%	9.83	21.17	31.00	73%	42.50	100%	1.4%
2015	8.98	20%	2.34	5%	0.11	0%	0.61	1%	10.71	22.57	33.28	73%	45.33	100%	1.3%
2020	9.29	19%	2.32	5%	0.11	0%	0.62	1%	11.58	24.12	35.70	74%	48.04	100%	1.3%
2025	9.55	19%	2.30	5%	0.11	0%	0.62	1%	12.49	25.47	37.96	75%	50.53	100%	1.2%
2030	9.83	18%	2.28	4%	0.11	0%	0.64	1%	13.51	26.91	40.41	76%	53.26	100%	1.2%

Note(s): 1) Petroleum includes distillate and residual fuels, liquefied petroleum gas, kerosene, and motor gasoline. 2) Includes *site*-marketed and non-marketed renewable energy in Table 1.1.4. 3) 2005 *site*-to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 and Table A17, p. 163 for non-marketed renewable energy.

1.1.2 U.S. Buildings *Site* Renewable Energy Consumption (Quadrillion Btu) (1)

	Wood (2)	Solar Thermal (3)	Solar PV (3)	GHP (4)	Total	Growth Rate 2005-Year
1980	0.8670	0.0000	N.A.	0.0000	0.8670	-
1990	0.6760	0.0560	N.A.	0.0090	0.7410	-
2000	0.5490	0.0610	N.A.	0.0170	0.6270	-
2005	**0.5286**	**0.0513**	**0.0011**	**0.0031**	**0.5840**	-
2010	0.5456	0.0604	0.0041	0.0064	0.6165	1.1%
2015	0.5258	0.0691	0.0045	0.0089	0.6083	0.4%
2020	0.5228	0.0769	0.0052	0.0114	0.6162	0.4%
2025	0.5163	0.0841	0.0079	0.0137	0.6220	0.3%
2030	0.5119	0.0916	0.0163	0.0158	0.6357	0.3%

Note(s): 1) Does not include renewable energy consumed by electric utilities (including hydroelectric). 2) Includes wood and wood waste, municipal solid waste, and other biomass used by the commercial sector to cogenerate electricity. 3) Includes only solar energy. 4) GHP = Ground-coupled heat pumps.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, AEO 2007, Feb. 2007, Table A17, p. 163 for 2005-2030.

1.1.3 Buildings Share of U.S. Primary Energy Consumption (Percent)

	Buildings Residential	Buildings Commercial	**Buildings Total**	Industry	Transportation	Total	Total Consumption (quads)
1980 (1)	20%	14%	34%	41%	25%	100%	78.3
1990	20%	16%	36%	38%	26%	100%	84.7
2000	21%	17%	38%	35%	27%	100%	98.9
2005	**22%**	**18%**	**40%**	**32%**	**28%**	**100%**	**100.2**
2010	22%	18%	40%	32%	28%	100%	106.6
2015	22%	19%	40%	31%	29%	100%	112.4
2020	21%	19%	41%	30%	29%	100%	118.3
2025	21%	20%	41%	30%	29%	100%	124.5
2030	20%	20%	41%	29%	30%	100%	131.3

Note(s): 1) Renewables are not included in the 1980 data.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, AEO 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 data and Table A17, p. 163 for non-marketed renewable energy.

1.1.4 2005 U.S. Buildings Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	Natural Gas	Fuel Oil (1)	LPG	Other Fuel(2)	Renw. En.(3)	*Site* Electric	*Site* Total	*Site* Percent	Primary Electric (4)	Primary Total	Primary Percent
Space Heating (5)	4.86	1.15	0.26	0.23	0.41	0.73	7.65	38.0%	2.32	9.24	23.3%
Lighting						2.19	2.19	10.9%	6.97	6.97	17.6%
Space Cooling	0.02					1.57	1.59	7.9%	4.99	5.02	12.6%
Water Heating	1.71	0.18	0.05		0.05	0.59	2.59	12.9%	1.89	3.88	9.8%
Electronics (6)						0.86	0.86	4.3%	2.73	2.73	6.9%
Refrigeration (7)						0.75	0.75	3.7%	2.38	2.38	6.0%
Cooking	0.45		0.03			0.27	0.75	3.7%	0.86	1.34	3.4%
Ventilation (8)						0.34	0.34	1.7%	1.08	1.08	2.7%
Wet Clean (9)	0.07					0.31	0.38	1.9%	0.98	1.05	2.6%
Computers						0.26	0.26	1.3%	0.83	0.83	2.1%
Other (10)	0.31	0.02	0.26	0.05	0.12	0.77	1.52	7.6%	2.43	3.19	8.0%
Adjust to SEDS (11)	0.71	0.18				0.35	1.24	6.2%	1.10	2.00	5.0%
Total	**8.13**	**1.54**	**0.60**	**0.28**	**0.58**	**8.98**	**20.11**	100%	**28.55**	**39.69**	100%

Note(s): 1) Includes distillate fuel oil (1.45 quad) and residual fuel oil (0.12 quad). 2) Kerosene (0.11 quad) and coal (0.10 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.53 quad), biomass (0.09 quad), solar water heating (0.05 quad), geothermal space heating (less than 0.01 quad), and solar photovoltaics (PV) less than 0.01 quad). 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.18. 5) Includes furnace fans (0.27 quad). 6) Includes color television (0.96 quad) and other office equipment (0.65 quad). 7) Includes refrigerators (1.24 quad) and freezers (0.40 quad). Includes commercial refrigeration. 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 9) Includes clothes washers (0.11 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.79 quad) and dishwashers (0.08 quad). Does not include water heating energy. 10) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 11) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Tables A2, p. 137-139, Table A4, p. 142-143, Table A5, p. 144-145, and Table A17, p. 163; EIA, National Energy Modeling System (NEMS) for AEO 2007, Feb. 2007; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2 and 5-25 - 5-26; EIA, AEO 1998, Dec. 1997, Table A5, p. 108-109 for 1995 ventilation; and BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63;

1.1.5 Shares of U.S. Buildings Generic Quad (Percent) (1)

				Renewables (2)				
	Natural Gas	Petroleum	Coal	Hydroelectric	Other	Total	Nuclear	Total
1980	37%	18%	30%	7%	4%	10%	6%	100%
1990	31%	11%	35%	5%	4%	10%	13%	100%
2000	32%	8%	37%	5%	3%	8%	14%	100%
2005	**31%**	**8%**	**38%**	**5%**	**3%**	**8%**	**15%**	**100%**
2010	31%	7%	38%	5%	4%	9%	14%	100%
2015	32%	7%	38%	5%	4%	9%	14%	100%
2020	31%	6%	39%	5%	4%	9%	14%	100%
2025	29%	6%	42%	5%	4%	9%	14%	100%
2030	27%	6%	45%	4%	4%	9%	13%	100%

Note(s): 1) A generic quad is primary energy apportioned between the various primary fuels according to their relative consumption. See Table 6.1.1 for further explanation. 2) Electric imports included in renewables.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption and Table A17, p. 163 for non-marketed renewable energy.

1.1.6 Buildings Share of U.S. Electricity Consumption (Percent)

	Buildings						*Delivered Total*
	Residential	Commercial	**Total**	Industry	Transportation	Total	(quads)
1980	34%	27%	**61%**	39%	0%	100%	7.1
1990	34%	31%	**65%**	35%	0%	100%	9.3
2000	35%	34%	**69%**	31%	0%	100%	11.7
2005 (1)	**37%**	**35%**	**72%**	**28%**	**0%**	**100%**	**12.5**
2010	38%	35%	**73%**	27%	0%	100%	13.5
2015	37%	36%	**74%**	26%	0%	100%	14.5
2020	38%	37%	**75%**	25%	0%	100%	15.4
2025	37%	39%	**76%**	24%	0%	100%	16.5
2030	40%	40%	**80%**	23%	0%	100%	17.6

Note(s): 1) Buildings accounted for 80% (or $238 billion) of total U.S. electricity expenditures.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption, Table A3, p. 140-141 for 2005 expenditures.

1.1.7 Buildings Share of U.S. Natural Gas Consumption (Percent)

	Site Consumption				Primary Consumption			U.S. Natural Gas Total
	Buildings	Industry	Electric Gen.	Transportation	**Buildings**	Industry	Transportation	(quads)
1980	**37%**	41%	19%	3%	**50%**	47%	3%	20.4
1990	**37%**	43%	17%	3%	**49%**	47%	3%	19.8
2000	**35%**	40%	22%	3%	**53%**	45%	3%	23.8
2005 (1)	**36%**	**35%**	**26%**	**3%**	**55%**	**42%**	**3%**	**22.6**
2010	**34%**	36%	27%	3%	**54%**	43%	3%	24.7
2015	**34%**	35%	28%	3%	**55%**	42%	3%	26.1
2020	**34%**	35%	27%	3%	**55%**	42%	3%	27.0
2025	**35%**	36%	25%	3%	**54%**	42%	3%	27.1
2030	**37%**	37%	23%	3%	**54%**	43%	3%	26.9

Note(s): 1) Buildings accounted for 62% (or $102 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption, Table A3, p. 140-141 for 2005 expenditures.

1.1.8 Buildings Share of U.S. Petroleum Consumption (Percent)

	Site Consumption				Primary Consumption			U.S. Petroleum Total
	Buildings	Industry	Electric Gen.	Transportation	**Buildings**	Industry	Transportation	(quads)
1980	**9%**	28%	8%	56%	**14%**	30%	56%	34.2
1990	**7%**	25%	4%	64%	**10%**	26%	64%	33.6
2000	**6%**	24%	3%	67%	**8%**	24%	67%	38.4
2005	**6%**	**24%**	**3%**	**68%**	**8%**	**25%**	**67%**	**40.6**
2010	**5%**	23%	2%	70%	**7%**	23%	70%	41.8
2015	**5%**	22%	2%	71%	**7%**	22%	71%	44.3
2020	**5%**	21%	2%	72%	**7%**	22%	72%	46.5
2025	**5%**	21%	2%	73%	**6%**	21%	73%	49.0
2030	**4%**	20%	2%	73%	**6%**	21%	73%	52.2

Note(s): 1) Buildings accounted for an estimated 7.5% (or $31 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption, Table A3, p. 137-138 for 2005 expenditures.

1.1.9 Buildings Share of U.S. Petroleum Consumption (Million Barrels per Day)

	Buildings					
	Residential	Commercial	**Total**	Industry	Transportation	Total
1980	1.20	1.14	**2.34**	5.17	9.55	17.06
1990	0.90	0.75	**1.66**	4.44	10.89	16.99
2000	1.02	0.65	**1.67**	5.01	13.01	19.70
2005	**0.93**	**0.55**	**1.48**	**4.75**	**12.95**	**19.18**
2010	0.88	0.51	**1.39**	4.59	13.75	19.73
2015	0.90	0.54	**1.45**	4.69	14.77	20.91
2020	0.89	0.55	**1.44**	4.75	15.78	21.97
2025	0.88	0.56	**1.44**	4.87	16.86	23.17
2030	0.87	0.57	**1.44**	5.09	18.11	24.65

Source(s): EIA, Annual Energy Review 2006, June 2007, Table 5.13a for 1980-2000 buildings, Table 5.13b for 1980 to 2000 industry, Table 5.13c for 1980-2000 transportation, and Table 5.13d for 1980-2000 electricity generators; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption; EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000.

1.1.10 World Primary Energy Consumption and Population, by Country/Region

	Energy Consumption (Quad)				Population (million)				Annual Growth Rate 1990-2004		Annual Growth Rate 2004-2010	
Region/Country	1990	2004		2010	1990	2004		2010	Energy	Pop.	Energy	Pop.
United States	84.7	100.7	22.5%	106.5	254	294	4.6%	310	1.2%	1.1%	0.9%	0.9%
OECD Europe	69.9	81.1	18.2%	84.1	497	532	8.3%	543	1.1%	0.5%	0.6%	0.3%
China	27.0	59.6	13.3%	82.6	1,155	1,307	20.5%	1,355	5.8%	0.9%	5.6%	0.6%
Russia	39.0	30.1	6.7%	32.9	148	144	2.3%	140	-1.8%	-0.2%	1.5%	-0.5%
Other Non-OECD Asia	12.5	24.9	5.6%	30.3	743	962	15.1%	1,054	5.0%	1.9%	3.3%	1.5%
Japan	18.4	22.6	5.1%	23.5	124	128	2.0%	128	1.5%	0.2%	0.7%	0.0%
Central & S. America	14.5	22.5	5.0%	27.7	360	448	7.0%	486	3.2%	1.6%	3.5%	1.4%
Middle East	11.3	21.1	4.7%	26.3	137	191	3.0%	216	4.6%	2.4%	3.7%	2.1%
Oth. Non-OECD Europe	28.3	19.6	4.4%	21.9	200	198	3.1%	198	-2.6%	-0.1%	1.9%	0.0%
India	8.0	15.4	3.4%	18.2	849	1,087	17.0%	1,183	4.8%	1.8%	2.8%	1.4%
Africa	9.5	13.7	3.1%	16.9	636	887	13.9%	1,007	2.6%	2.4%	3.6%	2.1%
Canada	11.1	13.6	3.0%	15.5	28	32	0.5%	34	1.5%	1.0%	2.2%	1.0%
South Korea	3.8	9.0	2.0%	9.6	43	48	0.8%	49	6.4%	0.8%	1.1%	0.3%
Mexico	5.0	6.6	1.5%	8.3	84	106	1.7%	113	2.0%	1.7%	3.9%	1.1%
Australia & N. Zealand	4.4	6.2	1.4%	6.8	20	24	0.4%	25	2.5%	1.3%	1.6%	0.7%
Total World	**347.3**	**446.7**	100%	**511.1**	**5,278**	**6,388**	100%	**6,841**	1.8%	1.4%	2.3%	1.1%

Source(s): EIA, International Energy Outlook 2007, May 2007, Table A1, p. 83 and Table A14, p. 97.

1.2.1 Residential Primary Energy Consumption, by Year and Fuel Type (Quadrillion Btu and Percent of Total)

	Natural Gas		Petroleum (1)		Coal		Renewable(2)		Electricity Sales	Electricity Losses	Electricity Total		TOTAL (2)		Growth Rate 2005-Year
1980	4.86	31%	1.75	11%	0.03	0%	0.85	5%	2.45	5.91	8.36	53%	15.84	100%	-
1990	4.52	27%	1.41	8%	0.03	0%	0.64	4%	3.15	7.30	10.45	61%	17.05	100%	-
2000	5.10	25%	1.56	8%	0.01	0%	0.50	2%	4.07	9.26	13.33	65%	20.50	100%	-
2005	**4.98**	**23%**	**1.54**	**7%**	**0.01**	**0%**	**0.44**	**2%**	**4.66**	**10.15** (3)	**14.81**	**68%**	**21.78**	**100%**	-
2010	5.18	22%	1.53	7%	0.01	0%	0.47	2%	5.06	10.90	15.96	69%	23.15	100%	1.2%
2015	5.35	22%	1.55	6%	0.01	0%	0.46	2%	5.43	11.44	16.87	70%	24.23	100%	1.1%
2020	5.43	21%	1.53	6%	0.01	0%	0.46	2%	5.80	12.08	17.89	71%	25.32	100%	1.0%
2025	5.45	21%	1.49	6%	0.01	0%	0.47	2%	6.13	12.50	18.63	72%	26.05	100%	0.9%
2030	5.47	20%	1.46	5%	0.01	0%	0.47	2%	6.47	12.89	19.36	72%	26.78	100%	0.8%

Note(s): 1) Petroleum includes distillate oil, liquefied petroleum gas, and kerosene. 2) Includes *site*-marketed and non-marketed renewable energy. 3) 2005 *site*-to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p.137-139 for 2005-2030 consumption and Table A17, p. 163 for non-marketed renewable energy.

1.2.2 Residential *Site* Renewable Energy Consumption (Quadrillion Btu) (1)

	Wood	Solar Thermal	Solar PV	GHP	Total	Growth Rate 2005-Year
1980	0.8460	0.0000	N.A.	0.0000	0.8460	-
1990	0.5820	0.0560	N.A.	0.0060	0.6440	-
2000	0.4300	0.0610	N.A.	0.0090	0.5000	-
2005	**0.4084**	**0.0267**	**0.0001**	**0.0031**	**0.4382**	-
2010	0.4254	0.0342	0.0010	0.0064	0.4670	1.3%
2015	0.4056	0.0415	0.0011	0.0089	0.4571	0.4%
2020	0.4026	0.0489	0.0012	0.0114	0.4641	0.4%
2025	0.3962	0.0558	0.0013	0.0137	0.4670	0.3%
2030	0.3918	0.0630	0.0015	0.0158	0.4721	0.3%

Note(s): 1) Does not include renewable energy consumed by electric utilities (including hydroelectric).

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A17, p. 163 for 2005-2030.

1.2.3 2005 Residential Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	Natural Gas	Fuel Oil	LPG	Other Fuel(1)	Renw. En.(2)	*Site* Electric	*Site* Total	*Site* Percent	Primary Electric (3)	Primary Total	Primary Percent
Space Heating (4)	3.52	0.82	0.26	0.11	0.41	0.49	5.61	48.2%	1.57	6.69	30.7%
Space Cooling	0.00					0.84	0.84	7.2%	2.67	2.67	12.3%
Water Heating	1.14	0.12	0.05		0.03	0.42	1.75	15.0%	1.33	2.66	12.2%
Lighting						0.75	0.75	6.5%	2.40	2.40	11.0%
Refrigeration (5)						0.52	0.52	4.4%	1.64	1.64	7.5%
Electronics (6)						0.50	0.50	4.3%	1.61	1.61	7.4%
Wet Clean (7)	0.07					0.31	0.38	3.2%	0.98	1.05	4.8%
Cooking	0.22		0.03			0.23	0.48	4.1%	0.74	0.98	4.5%
Computers						0.08	0.08	0.7%	0.25	0.25	1.1%
Other (8)	0.04		0.17		0.00	0.19	0.41	3.5%	0.61	0.83	3.8%
Adjust to SEDS (9)						0.32	0.32	2.8%	1.02	1.02	4.7%
Total	**4.98**	**0.93**	**0.51**	**0.11**	**0.44**	**4.66**	**11.63**	100%	**14.81**	**21.78**	100%

Note(s): 1) Kerosene (0.10 quad) and coal (0.01 quad) are assumed attributable to space heating. 2) Comprised of wood space heating (0.41 quad), solar water heating (0.03 quad), geothermal space heating (less than 0.01 quad), and solar PV (less than 0.01 quad). 3)*Site*-to-source electricity conversion (due to generation and transmission losses) = 3.18. 4) Includes furnace fans (0.27 quad). 5) Includes biomass, (0.02 quad) solar water heating, and (less than 0.01 quad) solar pv. 4)*Site*-to-source electricity conversion (due to 7) Includes clothes washers (0.11 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.79 quad), and dishwashers (0.08 quad). Does not include water heating energy. 8) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. 9) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 1999, Jan., 1999, Tables A2, p.113-114; EIA, AEO 2007, Feb. 2007, Tables A2, p. 137-139, Table A4, p. 142-143 and Table A17, p. 163; and BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses.

1.2.4 Residential Delivered and Primary Energy Consumption Intensities, by Year

	Number of Households (10^6)	Percent Post-2000 Households (1)	*Delivered Energy Consumption* Total (10^15 Btu)	*Delivered Energy Consumption* Per Household (10^6 Btu/Hhold)	Primary Energy Consumption Total (10^15 Btu)	Primary Energy Consumption Per Household (10^6 Btu/Hhold)
1980	79.6	N.A.	9.9	124.7	15.8	198.8
1990	94.2	N.A.	9.8	103.5	17.1	181.0
2000	105.7	N.A.	11.2	106.3	20.5	193.9
2005	**113.3**	**9%**	**11.6**	**102.6**	**21.8**	**192.2**
2010	120.7	16%	12.3	101.5	23.1	191.8
2015	127.8	23%	12.8	100.1	24.2	189.7
2020	134.7	29%	13.2	98.3	25.3	188.0
2025	141.2	34%	13.5	95.9	26.0	184.5
2030	147.5	39%	13.9	94.1	26.8	181.5

Note(s): 1) Percent of houses built after Dec. 31, 2000.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139, Table A4, p. 142-143, and Table A17, p. 163 for 2005-2030, and Table A19, p. 165 for households; and DOC, Statistical Abstract of the United States 2006, Jan. 2006, Table No. 945, p. 626 for 1980-2000 households.

1.2.5 2001 Residential *Delivered* Energy Consumption Intensities, by Vintage

Year	Per Square Foot (10^3 Btu)	Per Household (10^6 Btu)	Per Household Member (10^6 Btu)	Percent of Total Consumption
Prior to 1970	51.6	100.7	40.3	56%
1970 to 1979	45.5	79.0	31.6	15%
1980 to 1989	41.4	79.7	31.9	15%
1990 to 1999	38.5	91.3	31.2	13%
2000 to 2001	36.6	111.1	32.9	1%
Average	46.7	92.2	36.0	

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table CE1-6.1u and Table CE1-6.2u.

1.2.6 2001 Residential *Delivered* Energy Consumption Intensities, by Housing Type

Type	Per Square Foot (10^3 Btu)	Per Household (10^6 Btu)	Per Household Members (10^6 Btu)	Percent of Total Consumption
Single-Family:	**44.8**	**107.3**	**39.8**	**80.1%**
Detached	44.7	108.5	39.6	69.4%
Attached	45.6	100.4	37.5	10.7%
Multi-Family:	**52.1**	**54.3**	**25.8**	**14.6%**
2 to 4 units	56.1	78.1	34.3	7.5%
5 or more units	48.5	41.0	20.5	7.1%
Mobile Homes	**72.0**	**75.9**	**29.4**	**5.3%**
				100%

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table CE1-6.1u and Table CE1-6.2u.

1.2.7 2001 Residential *Delivered* Energy Consumption Intensities, by Census Region

Region	Per Square Foot (10^3 Btu)	Per Household (10^6 Btu)	Per Household Members (10^6 Btu)	Percent of Total Consumption
Northeast	50.4	106.6	42.3	22%
Midwest	53.6	116.7	46.0	29%
South	44.8	82.5	32.1	33%
West	42.5	70.1	24.7	17%
				100%

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table CE1-9c, Table CE1-10c, Table CE1-11c, Table CE1-12c, Table HC1-9a, Table HC1-10a, Table HC1-11a, Table HC1-12a, Table HC2-9a, Table HC2-10a, Table HC2-11a, and Table HC2-12a.

1.2.8 1997 Residential *Delivered* Energy Consumption Intensities, by Ownership of Unit

Ownership	Per Square Foot (10^3 Btu)	Per Household (10^6 Btu)	Per Household Members (10^6 Btu)	Percent of Total Consumption
Owned	**58.3**	**114.7**	**43.3**	**77%**
Rented	**70.3**	**72.5**	**29.4**	**23%**
Public Housing	62.7	51.0	25.3	2%
Not Public Housing	70.9	74.8	29.8	22%
				100%

Source(s): EIA, 1997 Residential Energy Consumption Survey, Nov. 1999.

1.2.9 Aggregate Residential Building Component Loads as of 1998 (1)

	Loads (quads) and Percent of Total Loads			
Component	Heating		Cooling	
Roof	-0.65	12%	0.16	14%
Walls	-1.00	19%	0.11	10%
Foundation	-0.76	15%	-0.07	-
Infiltration	-1.47	28%	0.19	16%
Windows (conduction)	-1.34	26%	0.01	1%
Windows (solar gain)	0.43	-	0.37	32%
Internal Gains	0.79	-	0.31	27%
NET Load	**-3.99**	100%	**1.08**	100%

Note(s): 1) "Loads" represents the thermal energy losses/gains that when combined will be offset by a building's heating/cooling system to maintain a set interior temperature (which then equals *site* energy).

Source(s): LBNL, Residential Heating and Cooling Loads Component Analysis, Nov. 1998, Figure P-1, P-1 and Appendix C: Component Loads Data Tables.

1.2.10 1997 Residential *Delivered* Energy Consumption Intensities, by Principal Building Type and Vintage

	Consumption (10^3 Btu/SF)		Consumption (10^6 Btu/Hhold)		Consumption (10^6 Btu/Member)	
Building Type	Pre-1990	1990-1997	Pre-1990	1990-1997	Pre-1990	1990-1997
Single-Family	**60.9**	**45.1**	**115.4**	**108.4**	**42.6**	**36.8**
Detached	60.2	44.8	118.5	112.8	42.9	36.8
Attached	66.0	48.0	96.1	76.0	40.7	37.3
Multi-Family	**69.0**	**42.6**	**61.1**	**40.8**	**28.8**	**22.4**
2 to 4 units	94.4	50.4	92.8	46.0	41.3	20.1
5 or more units	58.0	41.5	49.3	40.0	23.7	22.8
Mobile Homes	**92.2**	**50.6**	**81.7**	**70.9**	**50.5**	**45.2**

Source(s): EIA, 1997 Residential Energy Consumption Survey, Nov. 1999.

1.3.1 Commercial Primary Energy Consumption, by Year and Fuel Type (Quadrillion Btu and Percent of Total)

	Natural Gas		Petroleum (1)		Coal		Renewable(2)		Electricity Sales	Electricity Losses		Electricity Total		TOTAL (2)		Growth Rate 2005-Year
1980	2.67	25%	1.29	12%	0.12	1%	0.02	**0%**	1.91	4.60		6.51	61%	10.60	100%	-
1990	2.70	20%	0.95	7%	0.12	1%	0.10	**1%**	2.86	6.62		9.48	71%	13.35	100%	-
2000	3.25	19%	0.76	4%	0.09	1%	0.13	**1%**	3.96	9.00		12.96	75%	17.18	100%	-
2004	**3.15**	**18%**	**0.77**	**4%**	**0.10**	**1%**	**0.15**	**1%**	**4.32**	**9.42**	(3)	**13.74**	**77%**	**17.91**	**100%**	-
2010	3.31	17%	0.75	4%	0.10	1%	0.15	1%	4.77	10.27		15.04	78%	19.36	100%	1.3%
2015	3.64	17%	0.79	4%	0.10	0%	0.15	1%	5.28	11.13		16.41	78%	21.09	100%	1.5%
2020	3.86	17%	0.80	3%	0.10	0%	0.15	1%	5.78	12.03		17.81	78%	22.72	100%	1.5%
2025	4.10	17%	0.81	3%	0.10	0%	0.16	1%	6.36	12.97		19.33	79%	24.48	100%	1.5%
2030	4.36	16%	0.81	3%	0.10	0%	0.16	1%	7.03	14.01		21.05	79%	26.49	100%	1.5%

Note(s): 1) Petroleum includes distillate and residual fuels, liquefied petroleum gas, kerosene, and motor gasoline. 2) Includes *site*-marketed and non-marketed renewable energy. 3) 2005 *site*-to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 and Table A17, p. 163 for non-marketed renewable energy.

1.3.2 Commercial *Site* Renewable Energy Consumption (Quadrillion Btu) (1)

	Wood (2)	Solar Thermal (3)	Solar PV(3)	GHP	Total	Growth Rate 2005-Year
1980	0.0210	N.A.	N.A.	N.A.	0.0210	-
1990	0.0940	N.A.	N.A.	0.0030	0.0970	-
2000	0.1190	N.A.	N.A.	0.0080	0.1270	-
2005	**0.1202**	**0.0246**	**0.0010**	**N.A.**	**0.1458**	-
2010	0.1202	0.0261	0.0032	N.A.	0.1495	0.5%
2015	0.1202	0.0276	0.0035	N.A.	0.1512	0.4%
2020	0.1202	0.0279	0.0040	N.A.	0.1521	0.3%
2025	0.1202	0.0283	0.0066	N.A.	0.1550	0.3%
2030	0.1202	0.0286	0.0148	N.A.	0.1635	0.5%

Note(s): 1) Does not include renewable energy consumed by electric utilities (including hydroelectric). 2) Includes wood and wood waste, municipal solid waste, and other biomass used by the commercial sector to cogenerate electricity. 3) Includes only solar energy.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A17, p. 163 for 2005-2030.

1.3.3 2005 Commercial Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	Natural Gas	Fuel Oil (1)	LPG	Other Fuel(2)	Renw. En.(3)	*Site* Electric	*Site* Total	*Site* Percent	Primary Electric (4)	Primary Total	Primary Percent
Lighting						1.44	1.44	16.9%	4.57	4.57	25.5%
Space Heating	1.35	0.33		0.13		0.23	2.04	24.0%	0.75	2.55	14.2%
Space Cooling	0.02					0.73	0.75	8.9%	2.32	2.34	13.1%
Water Heating	0.57	0.07			0.02	0.18	0.84	9.9%	0.56	1.23	6.8%
Ventilation						0.34	0.34	4.0%	1.08	1.08	6.0%
Electronics						0.35	0.35	4.2%	1.12	1.12	6.3%
Refrigeration						0.23	0.23	2.7%	0.74	0.74	4.1%
Computers						0.18	0.18	2.2%	0.58	0.58	3.2%
Cooking	0.23					0.04	0.27	3.2%	0.12	0.35	2.0%
Other (5)	0.26	0.02	0.09	0.05	0.12	0.57	1.12	13.2%	1.82	2.37	13.2%
Adjust to SEDS (6)	0.71	0.18				0.03	0.92	10.9%	0.08	0.98	5.5%
Total	**3.15**	**0.61**	**0.09**	**0.17**	**0.15**	**4.32**	**8.49**	100%	**13.74**	**17.91**	100%

Note(s): 1) Includes (0.48 quad) distillate fuel oil and (0.14 quad) residual fuel oil. 2) Kerosene (0.02 quad) and coal (0.10 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.12 quad) biomass, (0.02 quad) solar water heating, and (less than 0.01 quad) solar pv. 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.18. 5) Includes service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 6) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Tables A2, p. 137-139, Table A5, p. 144-145, and Table A17, p. 163; EIA, National Energy Modeling System for AEO 2007, Feb. 2007; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2 and 5-25 - 5-26; EIA, AEO 1998, Dec. 1997, Table A5, p. 108-109 for 1995 ventilation; and BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63;

1.3.4 Commercial *Delivered* and Primary Energy Consumption Intensities, by Year

		Floorspace (10^9 SF)	Percent Post-2000 Floorspace (1)	*Delivered Energy Consumption* Total (10^15 Btu)	*Delivered Energy Consumption* Consumption per SF (10^3 Btu/SF)	Primary Energy Consumption Total (10^15 Btu)	Primary Energy Consumption Consumption per SF (10^3 Btu/SF)
1980		50.9	N.A.	6.00	117.8	10.60	208.2
1990		64.3	N.A.	6.73	104.7	13.36	207.7
2000	(2)	68.5	N.A.	8.18	119.4	17.18	250.8
2005	**(2)**	**74.3**	**15%**	**8.49**	**114.3**	**17.91**	**241.1**
2010	(2)	80.4	25%	9.08	113.0	19.36	240.8
2015	(2)	86.5	35%	9.96	115.1	21.09	243.7
2020	(2)	92.9	43%	10.69	115.1	22.72	244.6
2025	(2)	100.1	52%	11.52	115.0	24.48	244.5
2030	(2)	108.0	59%	12.47	115.5	26.49	245.2

Note(s): 1) Percent built after Dec. 31, 2000. 2) Excludes parking garages and commercial buildings on multi-building manufacturing facilities.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; DOE for 1980 floorspace; EIA, Annual Energy Outlook (AEO) 1994, Jan. 1994, Table A5, p. 62 for 1990 floorspace; EIA, AEO 2003, Jan. 2003, Table A5, p. 127 for 2000 floorspace; and EIA, AEO 2007, Feb. 2007, Table A2, p. 137-139, Table A5, p. 144-145, and Table A17, p.163 for 2005-2030.

1.3.5 Commercial *Delivered* Energy Consumption Intensities, by Vintage (1)

Year Constructed	Consumption per Square Foot (10^3 Btu/SF)	
Prior to 1960	84.4	23.3%
1960 to 1969	91.5	12.1%
1970 to 1979	97.0	18.3%
1980 to 1989	100.0	19.1%
1990 to 1999	90.3	19.3%
2000 to 2003	81.6	7.8%
Average	91.0	

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Oct. 2006, Table C1a.

1.3.6 2003 Commercial *Delivered* Energy Consumption Intensities, by Principal Building Type and Vintage (1)

Building Type	Consumption (10^3 Btu/SF) Pre-1959	1960-1989	1990-2003	Building Type	Consumption (10^3 Btu/SF) Pre-1959	1960-1989	1990-2003
Health Care	178.1	216.0	135.7	Education	77.7	88.3	80.6
Inpatient	230.3	255.3	253.8	Service	62.4	86.0	74.8
Outpatient	91.6	110.4	84.4	Food Service	145.2	290.1	361.2
Food Sales	205.8	197.6	198.3	Religious Worship	46.6	39.9	43.3
Lodging	88.2	111.5	88.1	Public Order & Safety	N.A.	101.3	110.6
Office	93.6	94.4	88.0	Warehouse & Storage	N.A.	38.9	33.3
Mercantile	80.4	91.8	94.4	Public Assembly	61.9	107.6	119.7
Retail (Non-Malls)	74.1	63.7	86.4	Vacant	21.4	23.1	N.A.
Retail (Malls)	N.A.	103.9	99.5	Other	161.3	204.9	125.3

Note(s): 1) See Table 1.3.4 for primary versus *delivered* energy consumption.
Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Oct. 2006, Table C12a.

1.3.7 2003 Commercial Primary Energy Consumption Intensities, by Principal Building Type (1)

Building Type	Consumption (10^3 Btu/SF)	Percent of Total Consumption	Building Type	Consumption (10^3 Btu/SF)	Percent of Total Consumption
Health Care	345.9	8%	Education	159.0	11%
Inpatient	438.8	6%	Service	151.6	4%
Outpatient	205.9	2%	Food Service	522.4	6%
Food Sales	535.5	5%	Religious Worship	77.0	2%
Lodging	193.1	7%	Public Order and Safety	221.1	2%
Office	211.7	19%	Warehouse and Storage	94.3	7%
Mercantile	223.6	18%	Public Assembly	180.0	5%
Retail (Non-Malls)	172.6	5%	Vacant	33.1	1%
Enclosed & Strip Malls	255.6	13%	Other	318.8	4%

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Oct. 2006, Table C1a.

1.3.8 2003 Commercial *Delivered* Energy Consumption Intensities, by Ownership of Unit (1)

Ownership	Consumption (10^3 Btu/SF)	
Nongovernment Owned	**85.1**	**72%**
Owner-Occupied	87.3	35%
Nonowner-Occupied	88.4	36%
Government Owned	**105.3**	**28%**
		100%

Note(s): 1) Mall buildings are no longer included in most CBECs tables; therefore, some data is not directly comparable to past CBECs.
Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, June 2006, Table C3.

1.3.9 Aggregate Commercial Building Component Loads as of 1998 (1)

	Loads (quads) and Percent of Total Loads			
	Heating		Cooling	
Component				
Roof	-0.103	12%	0.014	1%
Walls (2)	-0.174	21%	-0.008	-
Foundation	-0.093	11%	-0.058	-
Infiltration	-0.152	18%	-0.041	-
Ventilation	-0.129	15%	-0.045	-
Windows (conduction)	-0.188	22%	-0.085	-
Windows (solar gain)	0.114	-	0.386	32%
Internal Gains				
Lights	0.196	-	0.505	42%
Equipment (electrical)	0.048	-	0.207	17%
Equip. (non-electrical)	0.001	-	0.006	1%
People	0.038	-	0.082	7%
NET Load	**-0.442**	100%	**0.963**	100%

Note(s): 1) "Loads" represents the thermal energy losses/gains that, when combined, will be offset by a building's heating/cooling system to maintain a set interior temperature (which then equals *site* energy). 2) Includes common interior walls between buildings.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, June 1998, Table 24, p. 45 and Figure 3, p. 61.

1.3.10 1995 Commercial *Delivered* End-Use Energy Consumption Intensities, by Principal Building Type (1)

	Consumption (10^3 Btu/SF)					
Building Type	Space Heating	Space Cooling	Water Heating	Lighting	Total (2)	Percent of Total Consumption
Office	24.3	9.1	8.7	28.1	90.5	21%
Mercantile and Service	30.6	5.8	5.1	23.4	69.6	14%
Education	32.8	4.8	17.4	15.8	75.0	12%
Health Care	55.2	9.9	63.0	39.3	176.4	10%
Lodging	22.7	8.1	51.4	23.2	99.5	8%
Public Assembly	53.6	6.3	17.5	21.9	81.7	7%
Food Service	30.9	19.5	27.5	37.0	241.2	8%
Warehouse and Storage	15.7	0.9	2.0	9.8	44.0	9%
Food Sales	27.5	13.4	9.1	33.9	202.2	4%
Vacant (3)	36.0	1.4	5.2	4.7	26.4	3%
Public Order and Safety	27.8	6.1	23.4	16.4	86.9	2%
Other (4)	59.6	9.3	15.3	26.7	144.0	3%
All Buildings	29.0	6.0	13.8	20.4	90.5	100%

Note(s): 1) Further detail can be found in Table 7.4.1. Parking garages and commercial buildings on multibuilding manufacturing facilities are excluded from CBECS 1995. 2) Includes all end-uses. 3) Includes vacant and religious worship. 4) Includes mixed uses, hangars, crematoriums, laboratories, and other.

Source(s): EIA, Commercial Building Energy Consumption and Expenditures 1995, Apr. 1998, Table EU-2, p. 311.

1.4.1 FY 2005 Federal Primary Energy Consumption (Quadrillion Btu)

Buildings and Facilities	**0.65**	
Vehicles/Equipment/Energy-Intensive Operations	0.97	(mostly jet fuel and diesel)
Total Federal Government Consumption	1.62	

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 2006, Table A-1, p. 148 for total consumption and Table A-3, p. 150 for buildings consumption.

1.4.2 FY 2005 Federal Building Energy Use Shares, by Fuel Type and Agency

Fuel Type	*Site* Percent	Primary Percent	Agency	Primary Percent		FY 2005 (10^15 Btu)
Electricity	46.1%	74.7%	DOD	62.9%	Total *Delivered*	
Natural Gas	33.2%	15.6%	USPS	10.0%	Energy Consumption =	0.30
Fuel Oil	9.4%	4.4%	DOE	5.3%	Total Primary	
Coal	4.3%	2.0%	VA	8.5%	Energy Consumption =	0.65
Other	6.9%	3.3%	GSA	4.8%		
Total	100%	100%	Other	8.5%		
			Total	100%		

Note(s): See Table 2.3.1 for floorspace.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table A-5, p. 152 for fuel types and Table A-3, p. 150 for agency consumption.

1.4.3 Federal Building *Delivered* Energy Consumption Intensities, by Year (1)

Year	Consumption per Gross Square Foot (10^3 Btu/SF)	Year	Consumption per Gross Square Foot (10^3 Btu/SF)
FY 1985	123.0	FY 1996	115.0
FY 1986	131.3	FY 1997	111.9
FY 1987	136.9	FY 1998	107.7
FY 1988	136.3	FY 1999	106.7
FY 1989	132.6	FY 2000	104.8
FY 1990	128.6	FY 2001	105.9
FY 1991	122.9	FY 2002	104.6
FY 1992	125.5	FY 2003	105.2
FY 1993	122.3	FY 2004	104.9
FY 1994	120.2	FY 2005 (3)	98.2
FY 1995 (2)	117.3	FY 2010 (4)	80.0

Note(s): 1) See Table 2.3.1 for floorspace. 2) Exceeds the National Energy Conservation Policy Act goal of 125,700 Btu/SF. 3) Misses the goal of Executive Order 13123 for FY 2005 of 97,600 Btu/SF. 4) Executive Order 13123 goal.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 29, 2004, Table 5-B, p. 57 for 1990-2002 energy consumption and Table 8-A, p. 65 for 2002 floorspace; DOE/FEMP, Annual Report to Congress on FEMP, Aug. 9, 2005, Table 6-A, p. A-10 for 2003; DOE/FEMP, Annual Report to Congress on FEMP, Feb. 24, 2006, Table 6-A, p. A-10 for 2004; DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table 2, p. 13 for 1985 and 2005; and DOE/FEMP for remaining data.

1.4.4 Federal Agency Progress Toward the Renewable Energy Goal (Trillion Btu) (1)

	Purchased Renewable Energy	Total Renewable Energy Usage			Total Facility Electricity Use
DOD	5.33	8.35	8%		101.0
GSA	2.25	2.25	23%		9.9
DOE	0.53	0.55	3%		16.7
EPA	0.52	0.53	113%	(2)	0.5
NASA	0.46	0.46	8%		5.5
DOC	0.30	0.30	27%		1.9
Others	0.46	0.56	1%		52.3
All Agencies	**9.85**	**13.00**	7%		**187.8**

Note(s): 1) In July 2000, in accordance with Section 503 of Executive Order 13123, the Secretary of Energy approved a goal that the equivalent of 2.5 percent of electricity consumption from Federal facilities should come from new renewable energy sources by 2005. 2) EPA's renewable energy use is 112.6% of its electricity use due to its purchases and generation of non-electric renewable energy.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table 5, p. 21, and p. 20 for note 1.

1.5.1 Buildings Share of U.S. Electricity Consumption/Sales (Percent)

	Buildings					*Delivered* Total
	Residential	Commercial	**Total**	Industry	Transportation	Total	(10^15 Btu)
1980	34%	27%	**61%**	39%	0%	100%	7.1
1990	34%	31%	**65%**	35%	0%	100%	9.3
2000	35%	34%	**69%**	31%	0%	100%	11.7
2005 (1)	**37%**	**35%**	**72%**	**28%**	**0%**	**100%**	**12.5**
2010	38%	35%	**73%**	27%	0%	100%	13.5
2015	37%	36%	**74%**	26%	0%	100%	14.5
2020	38%	37%	**75%**	25%	0%	100%	15.4
2025	37%	39%	**76%**	24%	0%	100%	16.5
2030	37%	40%	**77%**	23%	0%	100%	17.6

Note(s): 1) Buildings accounted for 80% (or $238 billion) of total U.S. electricity expenditures.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption, and Table A3, p. 140-141 expenditures.

1.5.2 U.S. Electricity Generation Input Fuel Shares (Percent)

				Renewables				Net Electric	
	Natural Gas	Petroleum	Coal	Hydro.	Oth(2)	Total	Nuclear	Imports	Total
1980	16%	11%	50%	12%	0%	12%	11%	(1)	100%
1990	11%	4%	53%	10%	2%	12%	20%	(1)	100%
2000	14%	3%	53%	7%	2%	9%	21%	(1)	100%
2005	**15%**	**3%**	**52%**	**7%**	**2%**	**9%**	**20%**	**0%**	**100%**
2010	15%	2%	52%	7%	4%	11%	19%	0%	100%
2015	16%	2%	52%	7%	4%	11%	19%	0%	100%
2020	16%	2%	53%	6%	4%	10%	19%	0%	100%
2025	14%	2%	56%	6%	4%	10%	18%	0%	100%
2030	12%	2%	59%	6%	4%	10%	18%	0%	100%

Note(s): 1) Electric imports included in renewables. 2) Includes geothermal, municipal solid waste, biomass, solar thermal, solar PV, and wind.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption and Table A17, p. 163 for renewables.

1.5.3 U.S. Electricity Generation Input Fuel Consumption (Quadrillion Btu)

				Renewables				Net Electric		Growth Rate
	Natural Gas	Petroleum	Coal	Hydro.	Oth(2)	Total	Nuclear	Imports	Total	2005-Year
1980	3.80	2.63	12.16	2.87	0.11	2.98	2.74	(1)	24.32	-
1990	3.33	1.29	16.26	3.01	0.64	3.66	6.10	(1)	30.64	-
2000	5.32	1.14	20.22	2.77	0.75	3.52	7.86	(1)	38.06	-
2005	**5.95**	**1.16**	**20.75**	**2.68**	**0.96**	**3.64**	**8.13**	**0.08**	**39.71**	-
2010	6.56	0.90	22.13	2.99	1.68	4.67	8.23	0.04	42.53	1.4%
2015	7.31	0.97	23.45	3.04	1.79	4.83	8.47	0.03	45.07	1.3%
2020	7.40	0.97	25.05	3.05	1.88	4.93	9.23	0.04	47.62	1.2%
2025	6.78	0.99	27.9	3.06	2.04	5.09	9.23	0.04	50.04	1.2%
2030	6.09	1.01	31.14	3.06	2.09	5.15	9.33	0.04	52.77	1.1%

Note(s): 1) Electric imports included in renewables. 2) Includes geothermal, municipal solid waste, biomass, solar thermal, solar PV, and wind.

Source(s): EIA, State Energy Data 2004: Consumption, June 2007, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 consumption, and Table A17, p. 163 for renewables.

1.5.4 U.S. Electricity Net Generation, by Plant Type (Billion kWh)

				Renewables						Growth Rate
	Natural Gas	Petroleum	Coal	Hydr(1)	Oth(2)	Total	Nuclear	CHP(3)	Tot.(4)	2005-year
1980	346	246	1,162	276	6	282	251	N.A.	2,286	-
1990	265	118	1,560	286	35	324	577	61	2,901	-
2000	399	98	1,911	266	45	316	754	165	3,638	-
2005	**546**	**111**	**1,956**	**269**	**54**	**323**	**780**	**178**	**3,883**	**-**
2010	658	82	2,090	288	81	370	789	172	4,209	1.6%
2015	756	89	2,233	300	93	416	812	179	4,501	1.5%
2020	776	89	2,418	301	115	416	885	176	4,781	1.4%
2025	702	91	2,766	301	133	434	886	166	5,063	1.3%
2030	609	92	3,191	301	133	434	896	157	5,402	1.3%

Note(s): 1) Electricity used for hydroelectric pumped storage is subtracted from this conventional hydroelectric generation. 2) Includes geothermal, municipal solid waste, wood, biomass, solar thermal, solar photovoltaic, and wind. 3) CHP = Combined heat and Power. Includes CHP plants whose primary business is to sell electricity and heat to the public. 4) Includes batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, distributed generation, and other miscellaneous technologies that are not listed individually.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A8, p. 151-152; EIA, Annual Energy Review 2005, July 2006, Table 8.2c, p. 230 for 1990-2000; and EIA, Annual Energy Review 2002, Oct. 2003, Table 8.2b, p. 149 for 1980.

1.5.5 U.S. Electric Utility and Nonutility Net Summer Electricity Generation Capacity (GW)

Electric Generator	1990	2000	2005	2010	2015	2020	2025	2030
Coal Steam	300	305	306	316	319	343	389	446
Other Fossil Steam	144	135	121	119	89	89	88	87
Combined Cycle	7	29	144	161	163	171	178	179
Comb. Turbine/Diesel	46	79	130	134	118	124	133	152
Nuclear Power	100	98	100	101	102	112	112	113
Pumped Storage	18	20	21	21	21	21	21	21
Fuel Cells	0	0	0	0	0	0	0	0
Conv. Hydropower	75	78	80	80	80	80	80	80
Geothermal	3	3	2	2	3	3	3	3
Municipal Solid Waste	2	3	3	3	4	4	4	4
Biomass	7	2	2	2	2	2	3	4
Solar Thermal	0	0	0	1	1	1	1	1
Solar Photovoltaic	0	0	0	0	0	0	0	0
Wind	2	2	10	17	18	18	18	18
Distributed Generation	N.A.	0	0	0	1	2	5	11
Total	**703**	**754**	**919**	**957**	**920**	**970**	**1,035**	**1,119**

Note(s): 1) Nuclear capacity includes 3 GW of uprates from 2005 to 2030. New nuclear plants are expected to come online 2013-2019.

Source(s): EIA, Annual Energy Outlook (AEO) 1994, Jan. 1994, Table A9, p. 66 and Table A16, p. 73 for 1990; EIA, AEO 2003, Jan. 2003, Table A9, Table 133-134, and Table A17, p.142 for 2000; and EIA, AEO 2007, Feb. 2007, Table A9, p. 153-154 and Table A16, p. 162 for 2005-2030.

1.5.6 U.S. Electric Power Sector Cumulative Power Plant Additions Needed to Meet Future Electricity Demand (1)

Electric Generator	Typical New Plant Capacity (MW)	Number of New Power Plants to Meet Demand 2010	2015	2020	2025	2030
Coal Steam	600	19	30	70	148	242
Combined Cycle	400	42	47	68	85	88
Combustion Turbine/Diesel	160	28	47	87	141	261
Nuclear Power (2)	1,000	-	1	9	9	12
Pumped Storage	142 (3)	-	-	-	-	-
Fuel Cells	10	-	-	-	-	-
Conventional Hydropower	5	4	4	30	42	42
Geothermal	50	4	5	10	13	17
Municipal Solid Waste	30	7	19	19	19	21
Wood and Other Biomass	80	2	2	4	10	22
Solar Thermal	100	1	2	2	2	2
Solar Photovoltaic	5	9	21	37	55	72
Wind	50	147	162	165	165	167
Total		**262**	**340**	**501**	**691**	**947**
Distributed Generation	160 (4)	1	3	13	34	71

Note(s): 1) Cumulative additions after Dec. 31, 2005. 2) Nuclear capacity includes 3 GW of uprates from 2004 to 2030. New nuclear plants are expected to come online 2013-2019. 3) Based on current stock average capacity. 4) Combustion Turbine/Diesel data used.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A9, p. 153-154 and Table A16, p. 162; EIA, Assumption to the AEO 2007, Feb. 2007, Table 39, p. 77; and EIA, Electric Power Annual 2005, Sept. 2006, Table 2.2, p. 19 for pumped storage plant capacity and Table 2.6, p. 21 for hydroelectric plant capacity

1.5.7 2005 Existing Capacity, by Energy Source (GW)

	Number of Generators	Generator Nameplate Capacity	Net Summer Capacity	Net Winter Capacity
Coal	1,522	336	313	316
Petroleum	3,753	65	59	63
Natural Gas	5,467	437	383	412
Other Gases	102	2	2	2
Nuclear	104	106	100	102
Hydroelectric Conventional	3,993	77	78	77
Other Renewables	1,671	24	21	21
Pumped Storage	150	20	21	21
Other	45	1	1	1
Total	**16,807**	**1,067**	**978**	**1,015**

Source(s): EIA, Electric Power Annual 2005, Oct. 2006, Table 2.2, pg. 19.

1.5.8 Electric Capacity Factors, by Year and Fuel Type

	Coal	Petroleum	Natural Gas	Nuclear	Conventional Hydroelectric	Solar PV	Wind
1990	59%	29%	25%	66%	45%	13%	18%
1995	63%	19%	29%	77%	45%	17%	21%
2000	71%	21%	31%	88%	40%	15%	27%
2001	69%	22%	29%	89%	31%	16%	20%
2002	70%	18%	25%	90%	38%	16%	27%
2003	72%	22%	21%	88%	40%	15%	21%
2004	72%	23%	22%	90%	39%	17%	25%
2005	73%	24%	23%	89%	40%	15%	23%
2006 (1)	72%	12%	24%	90%	42%	14%	26%

Note(s): 1) Preliminary

Source(s) EIA, Annual Energy Review 2006, June 2007, 8.2a, pg. 226, Table 8.11a, p. 260.

2.1.1 Total Number of Households and Buildings, Floorspace, and Household Size, by Year

	Households (Millions)	Percent Post-2000 Households (1)	Buildings (Millions)	Floorspace (Billion SF)	U.S. Population (Millions)	Average Household Size (2)
1980	80	N.A.	65.5	142.5	227	2.9
1990	94	N.A.	74.2	169.2	250	2.6
2000	106	N.A.	82.6 (3)	168.8 (3)	282	2.7
2005	**113**	**9%**	**N.A.**	**N.A.**	**296**	**2.6**
2010	121	16%	N.A.	N.A.	309	2.6
2015	128	23%	N.A.	N.A.	322	2.5
2020	135	29%	N.A.	N.A.	336	2.5
2025	141	34%	N.A.	N.A.	349	2.5
2030	147	39%	N.A.	N.A.	364	2.5

Note(s): 1) Percent built after Dec. 31, 2000. 2) Number of residents. 3) Number of buildings and floorspace in 1997; for comparison, 1997 households = 101.5 million; percentage of floorspace: 85% single-family, 11% multi-family, and 4% manufactured housing. 2001 households = 107.2 million; percentage of floorspace: 83% single-family, 13% multi-family, and 4% manufactured housing.

Source(s): DOC, Statistical Abstract of the U.S. 2007, Oct. 2006, No. 948, p. 626 1980-2000 households, No. 2-3, p. 7-8 for population; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A4, p. 142-143 for 2005-2030 households and Table A19, p. 165 for housing starts; EIA, Buildings and Energy in the 1980's, June 1995, Table 2.1, p. 23 for residential buildings and floorspace in 1980 and 1990; EIA, RECS 1997 for 1997 buildings and floorspace; and EIA RECS 2001 for 2001 households and floorspace.

2.1.2 Share of Households, by Housing Type and Type of Ownership, as of 2001 (Percent)

Housing Type	Owned	Rented	Total
Single-Family:	**59.1%**	**9.8%**	**68.9%**
Detached	52.1%	6.9%	59.0%
Attached	7.0%	2.9%	9.9%
Multi-Family:	**3.6%**	**21.1%**	**24.8%**
2 to 4 units	2.0%	6.9%	8.9%
5 or more units	1.7%	14.2%	15.9%
Mobile Homes	**5.3%**	**1.0%**	**6.4%**
Total	**68.0%**	**32.0%**	**100%**

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Table HC1-2a.

2.1.3 Share of Households, by Census Region and Vintage, as of 2001 (Percent)

Region	Prior to 1970	1970 to 1979	1980 to 1989	1990 to 2001	Total
Northeast	13.3%	2.0%	2.2%	1.4%	18.9%
Midwest	13.5%	3.4%	3.4%	2.6%	22.9%
South	13.8%	7.2%	8.3%	7.1%	36.3%
West	10.3%	5.0%	3.2%	3.4%	21.8%
					100%

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Table HC1-2a.

2.1.4 Residential Floorspace (heated square feet), as of 2001 (Percent of Total Households)

Floorspace	
Fewer than 500	4%
500 to 999	20%
1,000 to 1,499	21%
1,500 to 1,999	16%
2,000 to 2,499	13%
2,500 to 2,999	9%
3,000 to 3,499	6%
3,500 to 4,000	4%
4,000 or more	8%
Total	100%

Note(s): The 2001 average new single-family housing floorspace was 2,324 square feet.
Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Table CE11-6.1u.

2.1.5 Housing Vintage, as of 2001

Vintage	
1949 or Before	25%
1950 to 1959	13%
1960 to 1969	13%
1970 to 1979	18%
1980 to 1989	17%
1990 to 2001	14%
Total	100%

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Table HC1-2a.

2.1.6 Construction Statistics of New Homes Completed/Placed

	Single-Family		Multi-Family		Mobile Homes	Total
	1000 Units	Average SF	1000 Units	Average SF	1000 Units	1000 Units
1975	875	1,645	430	1,000	229	1,534
1980	957	1,740	545	979	234	1,736
1981	819	1,720	447	980	229	1,495
1985	1,072	1,785	631	922	283	1,986
1986	1,120	1,825	636	911	256	2,012
1990	966	2,080	342	1,005	195	1,503
1991	838	2,075	253	1,020	174	1,265
1992	964	2,095	194	1,040	212	1,370
1993	1,039	2,095	153	1,065	243	1,435
1994	1,160	2,100	187	1,035	291	1,638
1995	1,066	2,095	247	1,080	319	1,632
1996	1,129	2,120	284	1,070	338	1,751
1997	1,116	2,150	284	1,095	336	1,736
1998	1,160	2,190	314	1,065	374	1,848
1999	1,270	2,223	334	1,104	338	1,942
2000	1,242	2,266	332	1,114	281	1,855
2001	1,256	2,324	315	1,171	196	1,767
2002	1,325	2,320	323	1,166	174	1,822
2003	1,386	2,330	292	1,173	140	1,818
2004	1,532	2,349	310	1,173	124	1,966
2005	1,636	2,434	296	1,247	123	2,055
2006	1,654	2,469	325	1,277	111	2,090

Source(s): DOC, 2006 Characteristics of New Housing, June 2007, p. 4 for single-family completions, p. 260 for single-family average SF; NAHB, Housing Economics, Mar. 1995; NAHB, Facts, Figures and Trends, 1997, Characteristics of New Multi-family Homes, 1971-1995, p. 7; DOC, Current Construction Reports, Characteristics of New Housing, C25/98-A, Table 18, p. 44; DOC, Placements of New Manufactured Homes by Region and Size of Home, 1974-1988; and DOC, Placements of New Manufactured Homes by Region and Size of Home, 1980-2006.

2.1.7 Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000

13,837 board-feet of lumber
13,118 square feet of sheathing
19 tons of concrete
3,206 square feet of exterior siding material
3,103 square feet of roofing material
3,061 square feet of insulation
6,050 square feet of interior wall material
2,335 square feet of interior ceiling material
226 linear feet of ducting
19 windows
4 exterior doors (3 hinged, 1 sliding)
2,269 square feet of flooring material
12 interior doors
6 closet doors
2 garage doors
1 fireplace
3 toilets; 2 bathtubs; 1 shower stall
3 bathroom sinks
15 kitchen cabinets; 5 other cabinets
1 kitchen sink
1 range; 1 refrigerator; 1 dishwasher; 1 garbage disposal; 1 range hood
1 washer; 1 dryer
1 heating and cooling system

Source(s): NAHB, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7; D&R International for appliances and HVAC.

2.1.8 2006 New Homes Completed/Placed, by Census Region
(Thousand Units and Percent of Total Units by Housing Type) (1)

Region	Single-Family Units		Multi-Family Units		Mobile Homes Units		Total
Northeast	128	8%	51	13%	8	7%	187
Midwest	286	19%	40	15%	15	14%	340
South	826	46%	161	49%	65	55%	1,052
West	415	27%	74	23%	24	23%	513
Total	**1,655**	100%	**325**	100%	**111**	100%	**2,091**

Note(s) 1) Preliminary.
Source(s): DOC, Manufacturing, Mining and Construction Statistics: New Residential Construction: New Privately Owned Housing Units Completed, for single- and multi-family; and DOC, Manufacturing, Mining and Construction Statistics: Manufactured Homes Placements by Region and Size of Home, Mar. 2006 for mobile home placements.

2.1.9 2006 Construction Method of Single-Family Homes, by Region
(Thousand Units and Percent of Total Units by Construction Method)

Region	Stick Built Units		Modular Units		Panelized/Precut Units		Total
Northeast	112	7%	11	28%	5	14%	128
Midwest	260	16%	14	35%	11	31%	285
South	797	50%	13	33%	16	46%	826
West	410	26%	2	5%	3	9%	415
Total	**1,579**	100%	**40**	100%	**35**	100%	**1,654**

Source(s): DOC, Manufacturing, Mining and Construction Statistics, New Residential Construction: Type of Construction Method of New One-Family Houses Completed, Mar. 2006.

2.1.10 Market Indices for 2006 ENERGY STAR Qualified New Single-Family Homes, by Selected State (1000s)

	ENERGY STAR Qualified New Homes	New Single-Family Housing Permits	Market Penetration
Nevada	18.9	26.7	71%
Alaska	1.0	1.6	64%
Iowa	5.9	10.3	57%
Texas	60.8	162.8	37%
Hawaii	2.1	5.6	37%
Arizona	20.1	55.6	36%
New Jersey	5.4	17.1	31%
Delaware	1.2	5.0	24%
Vermont	0.5	2.1	24%
Connecticut	1.6	7.1	23%
California	18.1	107.7	17%
New Hampshire	0.8	4.8	17%
Utah	3.6	22.6	16%
Ohio	3.5	27.5	13%
New York	2.6	20.0	13%
Florida	3.3	146.2	2%
United States	**169.8**	**1,378.2**	**12%**

Source(s): EPA, ENERGY STAR Qualified New Homes Market Indices for States, http://www.energystar.gov/index.cfm?fuseaction=qhmi.showHomesMarketIndex for top states; E-mail correspondence with EPA ENERGY STAR program for complete data set.

2.2.1 Total Commercial Floorspace and Number of Buildings, by Year

	Commercial Sector Floorspace (10^9 square feet)	Percent Post-2000 Floorspace (2)	Buildings (10^6)
1980	50.9 (1)	N.A.	3.1 (3)
1990	64.3	N.A.	4.5 (3)
2000 (4)	68.5	N.A.	4.7 (5)
2005 (4)	**74.3**	**15%**	N.A.
2010 (4)	80.4	25%	N.A.
2015 (4)	86.5	35%	N.A.
2020 (4)	92.9	43%	N.A.
2025 (4)	100.1	52%	N.A.
2030 (4)	108.0	59%	N.A.

Note(s): 1) Based on PNNL calculations. 2) Percent built after Dec. 31, 2000. 3) Actually for previous year. 4) EIA now excludes parking garages and commercial buildings on multi-building manufacturing facilities from the commercial building sector. 5) Data is from 1999. In 1999, commercial building floorspace = 64.6 billion square feet.

Source(s): EIA, Annual Energy Outlook (AEO) 1994, Jan. 1994, Table A5, p. 62 for 1990 floorspace; EIA, AEO 2003, Jan. 2003, Table A5, p. 127-128 for 2000 floorspace; EIA, AEO 2007, Feb. 2007, Table A5, p. 144-145 for 2005-2030 floorspace; EIA, Commercial Building Characteristics 1989, June 1991, Table A4, p. 17 for 1990 number of buildings; EIA, Commercial Building Characteristics 1999, Aug. 2002, Table 3 for 1999 number of buildings and floorspace; and EIA, Buildings and Energy in the 1980s, June 1995, Table 2.1, p. 23 for number of buildings in 1980.

2.2.2 Principal Commercial Building Types, as of 2003 (Percent of Total Floorspace) (1)

	Total Floorspace	Total Buildings	Primary Energy Consumption
Office	17%	17%	19%
Mercantile	16%	14%	18%
Retail	6%	9%	5%
Enclosed & Strip Malls	10%	4%	13%
Education	14%	8%	11%
Warehouse and Storage	14%	12%	7%
Lodging	7%	3%	7%
Service	6%	13%	4%
Public Assembly	5%	6%	5%
Religious Worship	5%	8%	2%
Health Care	4%	3%	8%
Inpatient	3%	0%	6%
Outpatient	2%	2%	2%
Food Sales	2%	5%	5%
Food Service	2%	6%	6%
Public Order and Safety	2%	1%	2%
Other	2%	2%	4%
Vacant	4%	4%	1%
Total	100%	100%	100%

Note(s): 1) For primary energy intensities by building type, see Table 1.3.7. Total CBECS 1999 commercial building floorspace is 71.7 billion SF.

Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Consumption and Expenditures Tables, Oct. 2006, Table C1A.

2.2.3 Number of Floors and Type of Ownership, as of 2003 (Percent of Total Floorspace)

Floors	
One	40%
Two	25%
Three	12%
Four to Nine	16%
Ten or More	8%
Total	100%

Ownership	
Nongovernment Owned	**76%**
Owner-Occupied	36%
Nonowner-Occupied	37%
Unoccupied	3%
Government Owned	**24%**
Federal	3%
State	5%
Local	15%
Total	100%

Source(s): EIA, Commercial Building Characteristics 2003, June 2006, Table C1.

2.2.4 Share of Commercial Floorspace, by Census Region and Vintage, as of 2003 (Percent)

Region	Prior to 1960	1960 to 1989	1990 to 2003	Total
Northeast	9%	8%	3%	20%
Midwest	8%	11%	6%	25%
South	5%	18%	14%	37%
West	3%	9%	5%	18%
				100%

Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables, Oct. 2006, Table A2, p. 3-4.

2.2.5 Commercial Building Size, as of 2003 (Number of Buildings and Percent of Total Floorspace)

Square Foot Range	Number of Buildings (1000s)	
1,001 to 5,000	2,586	10%
5,001 to 10,000	948	10%
10,001 to 25,000	810	18%
25,001 to 50,000	261	13%
50,001 to 100,000	147	14%
100,001 to 200,000 (2)	74	14%
200,001 to 500,000 (2)	26	10%
Over 500,000 (2)	8	11%
Total	**4,859**	100%

Note(s): 1) 35% of commercial floorspace is found in 2.2% of commercial buildings that are larger than 100,000 square feet.
Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables, Oct. 2006, Table A1, p. 1-2.

2.2.6 Commercial Building Vintage, as of 2003

	Percent of Total Floorspace
1919 or Before	5%
1920 to 1945	10%
1946 to 1959	10%
1960 to 1969	12%
1970 to 1979	17%
1980 to 1989	17%
1990 to 1999	20%
2000 to 2003	9%
Total	100%

Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables, Oct. 2006, Table A1, p. 1-2.

2.2.7 Commercial Building Median Lifetimes (Years)

Building Type	Median (1)	66% Survival (2)	33% Survival (2)
Health Care	65	48	88
Food Sales	65	49	86
Food Service	65	49	86
Lodging	69	49	98
Mercantile & Service	65	44	96
Assembly	80	54	118
Large Office	73	52	103
Small Office	73	52	103
Education	80	61	104
Warehouse	80	52	123
Other	75	57	99

Note(s): 1) PNNL estimates the median lifetime of commercial buildings is 70-75 years. 2) Number of years after which the building survives. For example, a third of the office buildings constructed today will survive 103 years later.

Source(s): EIA, Assumptions for the Annual Energy Outlook 2007, Feb. 2007, Table 12, p. 28; EIA, Model Documentation Report: Commercial Sector Demand Module of the National Energy Modeling System, Apr. 2007, p. 30-35; and PNNL, Memorandum: New Construction in the Annual Energy Outlook 2003, Apr. 24, 2003 for Note 2.

2.2.8 2003 Average Commercial Building Floorspace, by Principal Building Type and Vintage

	Average Floorspace/Building (1000 SF)			
Building Type	1959 or Prior	1960 to 1989	1990 to 2003	All
Education	27.5	26.9	21.7	25.6
Food Sales	N.A.	N.A.	N.A.	5.6
Food Service	6.4	4.4	5.0	5.6
Health Care	18.5	37.1	N.A.	24.5
Inpatient	N.A.	243.6	N.A.	238.1
Outpatient	N.A.	11.3	11.6	10.4
Lodging	9.9	36.1	36.0	35.9
Retail (Other Than Mall)	6.2	9.3	17.5	9.7
Office	12.4	16.4	14.2	14.8
Public Assembly	13.0	13.8	17.3	14.2
Public Order and Safety	N.A.	N.A.	N.A.	15.4
Religious Worship	8.7	9.6	15.6	10.1
Service	6.1	6.5	6.8	6.5
Warehouse and Storage	19.7	17.2	15.4	16.9
Other	N.A.	N.A.	N.A.	22.0
Vacant	N.A.	N.A.	N.A.	14.1

Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables, June 2006, Table B8, p. 63-69 and Table B9, p. 70-76.

2.2.9 U.S. LEED Certified Projects, by Certification Type and Selected State (1)

	Platinum	Gold	Silver	Bronze	Certified (2)		Platinum	Gold	Silver	Bronze	Certified (2)
Arizona	1	7	4	1	21	New York	3	10	7	0	32
California	12	37	31	0	120	Ohio	0	4	8	0	22
Colorado	2	11	15	0	41	Oregon	2	32	13	1	60
Georgia	2	10	19	0	41	Pennsylvania	3	28	31	0	78
Illinois	4	8	14	0	40	Texas	0	7	13	0	36
Maryland	1	6	5	0	20	Virginia	0	4	9	0	23
Massachusetts	3	6	9	0	41	Washington	1	20	23	0	70
Michigan	0	13	11	0	34	Wisconsin	0	5	6	0	20
New Jersey	0	7	7	0	21						
United States	**43**	**266**	**293**	**3**	**933**						

Note(s): 1) Project types include new construction, major renovations, existing building operations, interior design, homes, neighborhood development, development multi-building complexes, schools, and retail spaces. 2) Certified projects do not constitute the sum total of the other four categories, but rather designate an entirely separate category in and of itself.

Source(s): United States Green Building Council Web site, accessed Aug. 2007.

2.2.10 U.S. LEED Registered Projects, by Ownership Category

Private-Sector Corporations	33%
Local Governments	25%
Nonprofit Corporations	14%
State Governments	13%
Federal Government	10%
Other	5%
Total	100%

Source(s): Building Design & Construction, White Paper on Sustainability, Nov. 2003.

2.3.1 Federal Building Gross Floorspace, by Year and Agency

Fiscal Year	Floorspace (10^9 SF)
FY 1985	3.37
FY 1986	3.38
FY 1987	3.40
FY 1988	3.23
FY 1989	3.30
FY 1990	3.40
FY 1991	3.21
FY 1992	3.20
FY 1993	3.20
FY 1994	3.11
FY 1995	3.04
FY 1996	3.03
FY 1997	3.02
FY 1998	3.07
FY 1999	3.07
FY 2000	3.06
FY 2001	3.07
FY 2002	3.03
FY 2003	3.04
FY 2004	2.97
FY 2005	2.96

Agency	2005 Percent of Total Floorspace
DOD	66%
USPS	12%
GSA	6%
VA	5%
DOE	2%
Other	8%
Total	100%

Note(s): The Federal Government owns/operates over 500,000 buildings, including 422,000 housing structures (for the military) and 51,000 nonresidential buildings.

Source(s): DOE/FEMP for FY 1986-1998; DOE/FEMP, Annual Report to Congress on FEMP, May 10, 2001, Table 7-A, p. 56 for FY 1999; DOE/FEMP, Annual Report to Congress on FEMP, Dec. 11, 2002, Table 8-A, p. 83 for FY 1985 and FY 2000; DOE/FEMP, Annual Report to Congress on FEMP, Feb. 4, 2004, Table 8-A, p. 66 for 2001; DOE/FEMP, Annual Report to Congress on FEMP, Sept. 29, 2004, Table 8-A, p. 65 for 2002; DOE/FEMP, Annual Report to Congress on FEMP, Aug. 9, 2005, Table 6-A, p. 65 for 2003; DOE/FEMP, Annual Report to Congress on FEMP, February 24, 2006, Table 6-A, p. A-10 for 2004; and DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table 2, p. 13 for 2005 .

3.1.1 Carbon Dioxide Emissions for U.S. Buildings, by Year (10^6 metric tons of carbon) (1)

	Buildings				U.S.			
	Site Fossil	Electricity	Total	Growth Rate 2005-Year	Total	Growth Rate 2005-Year	Buildings % of Total U.S.	Buildings % of Total Global
1980	172.0	255.2	427.1	-	1,281.7	-	33%	8.5%
1990	153.7	317.2	470.9	-	1,359.7	-	35%	8.1%
2000	167.4	426.2	593.5	-	1,581.3	-	38%	9.1%
2005	**164.3** (2)	**466.0** (2)	**630.3**	-	**1,622.6**	-	**39%**	**9.1%** (3)
2010	168.7	498.4	667.1	1.1%	1,695.9	0.9%	39%	8.5%
2015	177.0	539.4	716.4	1.3%	1,798.3	1.0%	40%	7.7%
2020	180.9	579.5	760.4	1.3%	1,895.3	1.0%	40%	7.6%
2025	184.0	635.4	819.4	1.3%	2,026.3	1.1%	40%	7.5%
2030	187.7	697.7	885.4	1.4%	2,169.8	1.2%	41%	7.6%

Note(s): 1) Excludes emissions of buildings-related energy consumption in the industrial sector. Emissions assume complete combustion from energy consumption and exclude energy production activities such as gas flaring, coal mining, and cement production. 2) Carbon emissions calculated from EIA, Assumptions to the AEO 2007 and differs from EIA, AEO 2007, Table A18. Buildings sector total varies by 0.2% from EIA, AEO 2007. 3) U.S. buildings emissions approximately equal the combined carbon emissions of Japan, France, and the United Kingdom.

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 1985-1990, Sept. 1993, Appendix B, Tables B1-B5, p. 73-74 for 1980; EIA, Emissions of Greenhouse Gases in the U.S. 2003, Dec. 2004, Tables 7-11, p. 29-31 for 1990 and 2000; EIA, Assumptions to the Annual Energy Outlook (AEO) 2007, Mar. 2007, Table 2, p. 9 for carbon coefficients; EIA, AEO 2007, Feb. 2007, Table A2, p. 137-139 for 2005-2030 energy consumption and Table A18, p. 164 for 2005-2030 emissions; EIA, International Energy Outlook 2007, May 2007, Table A10, p. 93 for 2004-2030 global emissions; and EIA, International Energy Annual 2006, July 2006, Table H1, www.eia.doe.gov for 1980-2000 global emission.

3.1.2 2005 Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons of Carbon Equivalent (MMTCE)) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	70.1	20.0	2.9	4.5	2.3	29.7	2.9	37.8	140.6	22.3%
Lighting								113.7	113.7	18.0%
Space Cooling	0.4							81.5	81.8	13.0%
Water Heating	24.6	3.7		0.8		4.5		30.8	59.9	9.5%
Refrigeration (5)								38.8	38.8	7.4%
Electronics (6)								44.5	44.5	7.1%
Cooking	6.4			0.5		0.5		14.1	21.0	3.3%
Ventilation (7)								17.6	17.6	2.8%
Wet Clean (8)	1.0							15.9	16.9	2.7%
Computers								13.5	13.5	2.1%
Other (9)	4.4	0.5		4.5	0.9	5.9		39.7	50.0	3.2%
Adjust to SEDS (10)	10.3	3.6				3.6		18.0	31.9	3.9%
Total	**117.1**	**27.8**	**2.9**	**10.2**	**3.2**	**44.2**	**2.9**	**466.0**	**630.3**	100%

Note(s): 1) Emissions assume complete combustion from energy consumption, excluding gas flaring, coal mining, and cement production. Emissions exclude wood since it is assumed that the carbon released from combustion is reabsorbed in a future carbon cycle. Carbon emissions calculated from EIA, Assumptions to the AEO 2007 and differs from EIA, AEO 2007, Table A18. Buildings sector total varies by 0.2% from EIA, AEO 2007. 2) Includes kerosene space heating (1.9 MMTCE) and motor gasoline other uses (0.9 MMTCE). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (4.4 MMTCE). 5) Includes refrigerators (20.3 MMTCE) and freezers (6.5 MMTCE). 6) Includes color television (15.7 MMTCE) and other office equipment. 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers (1.8 MMTCE), natural gas clothes dryers (1.0 MMTCE), electric clothes dryers (12.9 MMTCE), and dishwashers (1.3 MMTCE). Does not include water heating energy. 9) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, and manufacturing performed in commercial buildings. 10) Emissions related to a discrepancy between data sources. Energy attributable to the buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A4, p. 142-143 and Table A5, p. 144-145 for energy consumption, and Table A18, p. 164 for emissions; EIA, National Energy Modeling System for AEO 2007, Feb. 2007; EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for emission coefficients; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p.63; and EIA, AEO 1999, Dec. 1998, Table A4, p. 118-119 and Table A5, p. 120-121 for 1996 data.

3.1.3 2005 Residential Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (MMTCE) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity (2)	Total	Percent
Space Heating (3)	50.7	16.1	4.5	1.9	22.5	0.3	25.7	99.1	28.9%
Water Heating	16.4	2.3	0.8		3.1		21.7	41.2	12.0%
Space Cooling	0.0						43.6	43.6	12.7%
Lighting							39.2	39.2	11.4%
Refrigeration (4)							26.7	26.7	7.8%
Electronics (5)							26.2	26.2	7.6%
Wet Clean (6)	1.0						15.9	16.9	4.9%
Cooking	3.1		0.5		0.5		12.1	15.6	4.6%
Computers							4.0	4.0	1.2%
Other (7)	0.6		2.9		2.9		10.0	13.6	4.0%
Adjust to SEDS (8)							16.6	16.6	4.9%
Total	**71.8**	**18.4**	**8.7**	**1.9**	**29.0**	**0.3**	**241.7**	**342.8**	100%

Note(s): 1) Emissions assume complete combustion from energy consumption, excluding gas flaring, coal mining, and cement production. Emissions exclude wood since it is assumed that the carbon released from combustion is reabsorbed in a future carbon cycle. Carbon emissions calculated from EIA, Assumptions to the AEO 2007 and differs from EIA, AEO 2007, Table A18. Sector total varies from EIA, AEO 2007. 2) Excludes electric imports by utilities. 3) Includes furnace fans (4.4 MMTCE). 4) Includes refrigerators (20.3 MMTCE) and freezers (6.5 MMTCE). 5) Includes color television (15.7 MMTCE) and other office equipment (10.5 MMTCE). 6) Includes clothes washers (1.8 MMTCE), natural gas clothes dryers (1.0 MMTCE), electric clothes dryers (12.9 MMTCE), and dishwashers (1.3 MMTCE). Does not include water heating energy. 7) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. 8) Emissions related to a discrepancy between data sources. Energy attributable to the sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A4, p. 142-143 for energy consumption, and Table A18, p. 164 for emissions; EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for emission coefficients; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses; and EIA, AEO 1999, Dec. 1998, Table A4, p. 118-119 for 1996 electric end-use data.

3.1.4 2005 Commercial Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (MMTCE) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Lighting								74.6	74.6	25.9%
Space Heating	19.4	3.9	2.9		0.5	7.3	2.6	12.2	41.4	14.4%
Space Cooling	0.4							37.8	38.2	13.3%
Water Heating	8.2	1.4				1.4		9.2	18.7	6.5%
Electronics								18.3	18.3	6.4%
Ventilation								17.6	17.6	6.1%
Refrigeration								12.1	12.1	4.2%
Computers								9.5	9.5	3.3%
Cooking	3.3							2.0	5.3	1.9%
Other (4)	3.8	0.5		1.5	0.9	2.9		29.8	36.4	12.7%
Adjust to SEDS (5)	10.3	3.6				3.6		1.4	15.3	5.3%
Total	**45.3**	**9.4**	**2.9**	**1.5**	**1.4**	**15.2**	**2.6**	**224.3**	**287.5**	100%

Note(s): 1) Emissions assume complete combustion from energy consumption, excluding gas flaring, coal mining, and cement production. Emissions exclude wood since it is assumed that the carbon released from combustion is reabsorbed in a future carbon cycle. Carbon emissions calculated from EIA, Assumptions to the AEO 2007 and differs from EIA, AEO 2007, Table A18. Sector total varies by less than 0.2% from EIA, AEO 2007. 2) Includes kerosene space heating (0.5 MMTCE) and motor gasoline other uses (0.9 MMTCE). 3) Excludes electric imports by utilities. 4) Includes service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, and manufacturing performed in commercial buildings. 5) Emissions related to a discrepancy between data sources. Energy attributable to the sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A5, p. 144-145 for energy consumption, and Table A18, p. 164 for emissions; EIA, National Energy Modeling System for AEO 2007, Feb. 2007; EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for emission coefficients; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p.63; and EIA, AEO 1998, Dec. 1997, Table A5, p. 108-109 for 1995 data.

3.1.5 World Carbon Dioxide Emissions (1)

	Emissions (10^6 metric tons of carbon equivalent)				Annual Growth Rate	
Nation/Region	1990	2004		2010	1990-2004	2004-2010
United States	1,362	1,617	22.0%	1,696	1.2%	0.8%
China	612	1,305	17.8%	1,773	5.6%	5.2%
OECD Europe	1,117	1,196	16.3%	1,226	0.5%	0.4%
Russia	637	459	6.2%	494	-2.3%	1.2%
Other Non-OECD Asia	220	435	5.9%	527	5.0%	3.3%
Middle East	192	352	4.8%	437	4.4%	3.7%
Japan	276	344	4.7%	348	1.6%	0.2%
Other Non-OECD Eurasia	507	309	4.2%	343	-3.5%	1.7%
India	158	303	4.1%	350	4.8%	2.4%
Central & S. America	184	280	3.8%	337	3.1%	3.1%
Africa	177	244	3.3%	311	2.3%	4.2%
Canada	129	159	2.2%	177	0.0%	0.0%
South Korea	64	136	1.8%	143	5.5%	0.9%
Australia & New Zealand	79	116	1.6%	129	2.7%	1.8%
Mexico	82	105	1.4%	131	1.8%	3.8%
Total World	**5,792**	**7,348**	100%	**9,249**	**1.7%**	**3.9%**

Source(s): EIA, International Energy Outlook 2007, May 2007, Table A10, p. 93.

3.1.6 2005 Methane Emissions for U.S. Buildings Energy Production, by Fuel Type (MMTCE) (1)

Fuel Type	Residential	Commercial	Buildings Total
Petroleum	0.2	0.1	0.4
Natural Gas	9.8	6.2	15.9
Coal	0.0	0.1	0.1
Wood	2.3	0.0	2.3
Electricity (2)	10.5	9.7	20.2
Total	**22.8**	**16.1**	**38.9**

Note(s): 1) Sources of emissions include oil and gas production, processing, and distribution; coal mining; and utility and site combustion. Carbon equivalent units are calculated by converting methane emissions to carbon dioxide emissions (methane's global warming potential is 23 times that of carbon dioxide) and carbon dioxide to carbon equivalent. 2) Emissions of electricity generators attributable to the buildings sector.

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 2005, Nov. 2006, Table 15, p. 38 for energy production emissions, and Table 19, p. 42 for stationary combustion emissions; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for energy consumption.

3.1.7 2005 Carbon Dioxide Emission Coefficients for Buildings (MMTCE per Quadrillion Btu) (1)

	All Buildings	Residential Buildings	Commercial Buildings
Coal			
Average (2)	25.80	25.80	25.80
Natural Gas			
Average (2)	14.41	14.41	14.41
Petroleum Products			
Distillate Fuel Oil/Diesel	19.76	-	-
Kerosene	19.54	-	-
Motor Gasoline	19.15	-	-
Liquefied Petroleum Gas	17.13	-	-
Residual Fuel Oil	21.29	-	-
Average (2)	19.15	18.88	19.68
Electricity Consumption (3)			
Average - Primary (4)	16.36	16.36	16.36
Average - *Site* (5)	52.01	52.01	52.01
New Generation			
Gas Combined Cycle - *Site* (6)	31.35	31.35	31.35
Gas Combustion Turbine - *Site* (6)	47.23	47.23	47.23
Stock Gas Generator - *Site* (7)	38.40	38.40	38.40
All Fuels (3)			
Average - Primary	15.90	15.76	16.08
Average - *Site*	31.45	29.51	33.91

Note(s): 1) Emissions assume complete combustion from energy consumption, excluding gas flaring, coal mining, and cement production. The combustion of fossil fuels produces carbon in the form of carbon dioxide and carbon monoxide; however, carbon monoxide emissions oxidize in a relatively short time to form carbon dioxide. 2) Coefficients do not match total emissions reported in the AEO 2007 and were adjusted using Assumptions to the AEO 2007. 3) Excludes electricity imports from utility consumption. Includes nuclear and renewable (including hydroelectric) generated electricity. 4) Use this coefficient to estimate carbon emissions resulting from the consumption of energy by electric generators. 5) Use this coefficient to estimate carbon emissions resulting from the consumption of electricity by end-users. 6) Use this coefficient to estimate emissions of the next-built (2005) natural gas-fired, electric generator resulting from the consumption of electricity by end-users. 7) Use this coefficient to estimate emissions of existing natural gas-fired, electric generators resulting from the consumption of electricity by end-users.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A8, p. 151-152, Table A17, p. 163 for consumption and Table A18, p. 164 for emissions; EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for coefficients and Table 38, p. 76 for generator efficiencies; EIA, Annual Energy Review 2006, June 2007, Diagram 5, p. 221 for Transmission and Distribution (T&D) losses.

3.2.1 Halocarbon Environmental Coefficients and Principal Uses

Compound	100-Year Global Warming Potential (CO2 = 1)	Ozone Depletion Potential (ODP) (Relative to CFC-11)	Principal Uses
Chlorofluorocarbons			
CFC-11	4,600	1.00	Blowing Agent, Chillers
CFC-12 (1)	10,600	1.00	Auto A/C, Chillers, & Blowing Agent
CFC-113	6,000	0.80	Solvent
CFC-114	9,800	1.00	Solvent
CFC-115 (2)	7,200	0.60	Solvent, Refrigerant
Hydrochlorofluorocarbons			
HCFC-22 (2)	1,700	0.06	Residential A/C
HCFC-123	120	0.02	Refrigerant
HCFC-124	620	0.02	Sterilant
HCFC-141b	700	0.11	CFC Replacement
HCFC-142b	2,400	0.07	CFC Replacement
Bromofluorocarbons			
Halon-1211	1,300	3.00	Fire Extinguishers
Halon-1301	6,900	10.00	Fire Extinguishers
Hydrofluorocarbons			
HFC-23	12,000	0.00	HCFC Byproduct
HFC-125	3,400	0.00	CFC/HCFC Replacement
HFC-134a	1,300	0.00	Auto A/C, Refrigeration
HFC-152a (1)	140	0.00	Aerosol Propellant
HFC-227ea	2,900	0.00	CFC Replacement

Note(s): 1) R-500: 74% CFC-12 and 26% HFC-152a. 2) R-502: 49% HCFC-22 and 51% CFC-115.

Source(s): Intergovernmental Panel for Climate Change, Climate Change 2001: The Scientific Basis, Jan. 2001, Table 3, p. 47 for global warming potentials and uses; EPA for halon ODPs; AFEAS Internet Homepage, Atmospheric Chlorine: CFCs and Alternative Fluorocarbons, Feb. 1997 for remaining ODPs; and ASHRAE, 1993 ASHRAE Handbook: Fundamental, p. 16.3 for Notes 1 and 2; EPA, Emissions of Greenhouse Gases in the U.S. 2005, Table ES-1, p ES-3 for GWP of HFCs.

3.2.2 Phase-Out Schedule of Halocarbons in the U.S. (1)

Gas	Manufacturing Base Level (2)	Manufacturing Freeze (3)	Montreal Protocol Reduction %	Montreal Protocol Reduction By	U.S. Clean Air Act Reduction %	U.S. Clean Air Act Reduction By
Chlorofluorocarbons (CFCs)	1996	1989	75%	1994	75%	1994
			100%	1996 (4)	100%	1996
Bromofluorocarbons (Halons)	1996	1992	100%	1994 (4)	100%	1994
Hydrochlorofluorocarbons (HCFCs)	1989 HCFC consumption + 2.8 %	1996	35%	2004	35%	2003
			65%	2010	65%	2010
			90%	2015	90%	2015
					99.5%	2020
			100%	2030 (4)	100%	2030
Hydrofluorocarbons (HFCs)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note(s): (1) The phase-out of halocarbons is consistent with Title VI of the Clean Air Act and is in accordance with the Montreal Protocol and Amendments. (2) The amount of gas produced and consumed in this year is established and defined as the base level. In order to meet basic domestic needs, levels of production are allowed to exceed the base level by up to 10%. (3) After this year, levels of production are no longer permitted to exceed the base year level. (4) With possible essential use exemptions.

Source(s): Federal Register, Vol. 72, No. 123, June 2007, p. 35230, http://www.epa.gov/ozone/title6/phaseout; United Nations Ozone Environmental Programme, Ozone Secretariat, 2005, http://www.unep.ch/ozone/index.shtml; and Title VI, The Clean Air Act of 1990, S.1630, 101st Congress., 2nd Session.

3.2.3 Conversion and Replacements of Centrifugal CFC Chillers

	Conversions	Replacements	Total	Cumulative Percent of 1992 Chillers (1)
Pre-1995	2,304	7,208	9,512	12%
1995	1,198	3,915	5,113	18%
1996	1,311	3,045	4,356	24%
1997	815	3,913	4,728	30%
1998	905	3,326	4,231	35%
1999	491	3,085	3,576	39%
2000	913	3,235	4,148	45%
2001	452	3,324	3,776	49%
2002	360	3,433	3,793	54%
2003	334	2,549	2,883	55%
2004	165	2,883	3,048	59%
2005 (2)	155	2,674	2,829	62%
2006 (2)	130	2,860	2,990	66%
2007 (2)	108	3,002	3,110	70%
Total	**9,641**	**48,452**	**58,093**	

Note(s): 1) In 1992, approximately 80,000 centrifugal CFC chillers were in service, 82% of which used CFC-11, 12% CFC-12, and 6% CFC-113, CFC-114, or R-500. 2) Projected.

Source(s): ARI, Replacement and Conversion of CFC for a Decade Chillers Slower Than Expected Assuring Steady Demand for Non-CFC Units, Apr. 25, 2005; ARI, New Legislation Would Spur Replacement of CFC Chillers, Mar. 31, 2004; ARI, Economy Affects CFC Chiller Phase-out, Apr. 2, 2003; ARI, Half-way Mark in Sight for Replacement and Conversion of CFC Chiller Used for Air Conditioning of Buildings, Apr. 11, 2001; ARI, Replacement and Conversion of CFC Chillers Dipped in 1999 Assuring Steady Demand for Non-CFC Units for a Decade, Mar. 29, 2000; ARI, Survey Estimates Long Use of CFC Chillers Nearly Two-Thirds of Units Still in Place, Apr. 15, 1999; ARI, CFCs Widely Used to Cool Buildings Despite 28-Month Ban on Production, Apr. 8, 1998; ARI, 1997 Chiller Survey, Apr. 9, 1997; Air Conditioning, Heating and Refrigeration News, Apr. 1996, p. 1; and ARI's web site, www.ari.org, Chiller Manufacturer Survey Confirms Slow Pace of Conversion and Replacements of CFC Chillers, Apr. 12, 1995.

3.2.4 Estimated U.S. Emissions of Halocarbons, 1987-2001 (MMTCE)

Gas	1987	1990	1992	1995	1998	2000	2001
Chlorofluorocarbons							
CFC-11	107	67	57	45	31	29	29
CFC-12	318	326	233	150	61	50	62
CFC-113	136	43	28	14	0	0	0
CFC-114	N.A.	13	8	4	0	N.A.	N.A.
CFC-115	N.A.	8	7	6	5	N.A.	N.A.
Bromofluorocarbons							
Halon-1211	N.A.	0	0	0	0	N.A.	N.A.
Halon-1301	N.A.	3	3	3	4	N.A.	N.A.
Hydrochlorofluorocarbons							
HCFC-22	32	37	37	34	35	37	37
HCFC-123	N.A.	0	0	0	0	N.A.	N.A.
HCFC-124	0	0	0	1	1	N.A.	N.A.
HCFC-141b	N.A.	0	0	4	5	1	1
HCFC-142b	N.A.	0	0	5	6	7	7
Hydrofluorocarbons							
HFC-23	13	10	10	8	11	9	6
HFC-125	N.A.	0	0	0	1	1	2
HFC-134a	N.A.	0	0	5	10	12	11
Total	**605**	**508**	**384**	**279**	**170**	**145**	**154**

Source(s): Intergovernmental Panel for Climate Change, Climate Change 2001: The Scientific Basis, Jan. 2001, Table 3, p. 47 for GWPs; EIA, Emissions of Greenhouse Gases in the U.S. 2001, Dec. 2002, Table 29, p. 71 and Table D2, p. D-5 for 1990-2001 emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–1998, Table ES-6, p. ES-9 for HFCs and Annex L, Table L-1, p. L-2 for 1990-1998 ozone depleting refrigerants; and EIA, Emissions of Greenhouse Gases in the U.S. 1985-1994, Oct. 1995, Table 34, p. 54 for 1987.

3.3.1 2002 EPA Emissions Summary Table for U.S. Buildings Energy Consumption (Thousand Short Tons) (1)

	Buildings				Buildings Percent
	Wood/Site Fossil	Electricity	Total	U.S. Total	of U.S. Total
SO2	575	7,343 (2)	7,918	15,353	52%
NOx	725	3,353	4,078	21,102	19%
CO	2,498	356	2,854	112,049	3%
VOCs	790	37	827	16,544	5%
PM-2.5	384	415	799	6,803	12%
PM-10	405	496	901	22,154	4%

Note(s): 1) VOCs = volatile organic compounds; PM-10 = particulate matter less than 10 micrometers in aerodynamic diameter. PM-2.5 = particulate matter less than 2.5 micrometers in aerodynamic diameter. CO and VOCs site fossil emissions mostly from wood burning. 2) Emissions of SO2 are 28% lower for 2002 than 1994 estimates since Phase II of the 1990 Clean Air Act Amendments began in 2000. Buildings Energy Consumption related to SO2 emissions dropped 27% from 1994 to 2002.

Source(s): EIA, Annual Energy Outlook 2005, Feb. 2005, Table A2, p. 140-142; and EPA, 2002 Average Annual Emissions, All Criteria Pollutants, Aug. 2005, Tables A-2 to A-8.

3.3.2 2002 EPA Criteria Pollutant Emissions Coefficients
(Million Short Tons/*Delivered* Quadrillion Btu, unless otherwise noted)

Residential

	Electricity (1)	Gas	Oil(3)	Coal	Electricity (per primary quad) (1)
SO2	0.870	(2)	0.086	(2)	0.270
NOx	0.397	0.047	0.036	(2)	0.123
CO	0.042	(2)	(2)	(2)	0.013

Commercial

	Electricity (1)	Gas	Oil(3)	Coal	Electricity (per primary quad) (1)
SO2	0.870	(2)	0.351	(2)	0.270
NOx	0.397	0.072	0.102	(2)	0.123
CO	0.042	(2)	(2)	(2)	0.013

All Buildings

	Electricity (1)	Gas	Oil(3)	Coal	Electricity (per primary quad) (1)
SO2	0.870	(2)	0.171	(2)	0.270
NOx	0.397	0.056	0.058	(2)	0.123
CO	0.042	(2)	(2)	(2)	0.013

Note(s): 1) Emissions of SO2 are 28% lower for 2002 than 1994 estimates since Phase II of the 1990 Clean Air Act Amendments began in 2000. Buildings energy consumption related SO2 emissions dropped 27% from 1994 to 2002. 2) Data not available, significant enough, or reliable. 3) Oil includes distillate and residual fuel oils, LPG, motor gasoline, and kerosene.

Source(s): EPA, 2002 Average Annual Emissions, All Criteria Pollutants, Aug. 2005, Tables A-2 to A-8 for emissions; and EIA, AEO 2005, Feb. 2005, Table A2, p. 140-142 for energy consumption.

3.4.1 Characteristics of U.S. Construction Waste

- Two to seven tons of waste (a rough average of 4 pounds of waste per square foot) are generated during the construction of a new single-family detached house.
- 15 to 70 pounds of hazardous waste are generated during the construction of a detached, single-family house. Hazardous wastes include paint, caulk, roofing cement, aerosols, solvents, adhesives, oils, and greases.
- Each year, U.S. builders produce between 30 and 35 million tons of construction, renovation, and demolition (C&D) waste.
- Annual C&D debris accounts for roughly 24% of the municipal solid waste stream.
- Wastes include wood (27% of total) and other (73% of total, including cardboard and paper; drywall/plaster; insulation; siding; roofing; metal; concrete, asphalt, masonry, bricks, and dirt rubble; waterproofing materials; and landscaping material).
- As much as 95% of buildings-related construction waste is recyclable, and most materials are clean and unmixed.

Source(s): First International Sustainable Construction Conference Proceedings, Construction Waste Management and Recycling Strategies in the U.S., Nov. 1994, p. 689; Fine Homebuilding, Construction Waste, Feb./Mar. 1995, p. 70-75; NAHB, Housing Economics, Mar. 1995, p. 12-13; and Cost Engineering, Cost-Effective Waste Minimization for Construction Managers, Vol. 37/No. 1, Jan. 1995, p. 31-39.

3.4.2 "Typical" Construction Waste Estimated for a 2,000-Square-Foot Home (1)

Material	Weight (pounds)		Volume (cu. yd.) (2)
Solid Sawn Wood	1,600	20%	6
Engineered Wood	1,400	18%	5
Drywall	2,000	25%	6
Cardboard (OCC)	600	8%	20
Metals	150	2%	1
Vinyl (PVC) (3)	150	2%	1
Masonry (4)	1,000	13%	1
Hazardous Materials	50	1%	-
Other	1,050	13%	11
Total (5)	**8,000**	100%	**50**

Note(s): 1) See Table 2.1.7 for materials used in the construction of a new single-family home. 2) Volumes are highly variable due to compressibility and captured air space in waste materials. 3) Assuming 3 sides of exterior clad in vinyl siding. 4) Assuming a brick veneer on home's front facade. 5) Due to rounding, sum does not add up to total.

Source(s): NAHB's Internet web site, www.nahb.org, Residential Construction Waste: From Disposal to Management, Oct. 1996.

3.4.3 1996 Construction and Demolition Debris Generated from Construction Activities and Debris Generation Rates

	Debris (million tons)			Debris Generation Rates (lbs/ sq. ft.)	
	Residential	Commercial	Buildings	Residential	Commercial
New Construction	6.6	4.3	10.8	4.38	3.89
Demolition	19.7	45.1	64.8	115	155
Renovation	31.9	28.0	59.9	N.A.	N.A.
Total	**58.2**	**77.4**	**135.5**		

Source(s): EPA/OSW, Characterization of Buildings-Related Construction and Demolition Debris in the United States, June 1998, Tables 3-6, p. 2-3 - 2-8, and Table 8, p. 2-11.

4.1.1 Building Energy Prices, by Year and Major Fuel Type ($2005 per Million Btu)

	Residential Buildings				Commercial Buildings				Building
	Electricity	Natural Gas	Petroleum (1)	Avg.	Electricity	Natural Gas	Petroleum (2)	Avg.	Avg. (3)
1980	32.77	7.51	15.14	15.82	33.50	6.93	11.77	16.63	16.14
1990	31.72	7.78	12.09	16.76	29.29	6.49	8.22	16.76	16.76
2000	24.49	8.61	13.02	14.31	21.86	6.64	5.68	16.14	15.08
2005	**27.59**	**12.43**	**16.14**	**19.03**	**25.25**	**11.20**	**12.87**	**21.37**	**20.01**
2010	26.91	10.98	17.70	18.23	24.50	9.34	12.71	20.31	19.10
2015	25.99	10.24	16.11	17.44	23.33	8.48	11.07	18.94	18.09
2020	26.37	10.54	16.79	18.01	23.95	8.67	11.67	19.43	18.64
2025	26.61	10.97	17.40	18.56	24.23	8.96	12.10	19.77	19.11
2030	26.76	11.43	18.11	19.08	24.27	9.30	12.61	19.98	19.50

Note(s): 1) Residential petroleum products include distillate fuel, LPG, and kerosene. 2) Commercial petroleum products include distillate fuel, LPG, kerosene, motor gasoline, and residual fuel. 3) In 2005, buildings average electricity price was $26.46/10^6 Btu or ($0.090/kWh), average natural gas price was $11.95/10^6 Btu ($12.31/1000 CF), and petroleum was $23.62/10^6 Btu ($2.55/gal.). Averages do not include wood or coal prices.

Source(s): EIA, State Energy Data 2004: Prices and Expenditures, June 2007, Tables 2-3, p. 24-25 for 1980-2000 and prices for note, Tables 8-9, p. 18-19 for 1980-2000 consumption; EIA, Annual Energy Outlook 2007 Feb. 2007, Table A2, p. 137-139, Table A3, p. 140-141, Table A12, p. 158, and Table A13, p. 159 for 2005-2030 consumption and prices; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

4.1.2 Building Energy Prices, by Year and Fuel Type ($2005)

	Residential Buildings				Commercial Buildings			
	Electricity (¢/kWh)	Natural Gas (¢/therm)	Distillate Oil ($/gal)	LPG ($/gal)	Electricity (¢/kWh)	Natural Gas (¢/therm)	Distillate Oil ($/gal)	Residual Oil ($/gal)
1980	11.18	75.10	2.03	1.42	11.43	69.26	1.87	1.29
1990	10.82	77.79	1.54	1.30	9.99	64.94	1.14	0.71
2000	9.29	86.13	1.56	1.40	8.28	73.96	1.17	0.76
2005	**9.41**	**124.28**	**2.04**	**1.66**	**8.62**	**112.03**	**1.76**	**1.26**
2010	9.18	109.76	2.06	2.03	8.36	93.36	1.76	1.13
2015	8.87	102.42	1.75	1.96	7.96	84.77	1.49	0.97
2020	9.00	105.40	1.82	1.99	8.17	86.74	1.57	1.06
2025	9.08	109.74	1.88	2.02	8.27	89.60	1.64	1.07
2030	9.13	114.26	1.96	2.05	8.28	93.03	1.73	1.09

Source(s): EIA, State Energy Data 2004: Prices and Expenditures, June 2007, Tables 2-3, p. 24-25 for 1980-2000; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A3, p. 140-141 for 2005-2030 and Table H1, p. 233 for fuels' heat content; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

4.1.3 Buildings Aggregate Energy Expenditures, by Year and Major Fuel Type ($2005 Billion) (1)

	Residential Buildings				Commercial Buildings				Total Building
	Electricity	Natural Gas	Petroleum (2)	Total	Electricity	Natural Gas	Petroleum (3)	Total	Expenditures
1980	80.2	36.5	26.5	143.2	63.9	18.5	15.2	97.5	240.7
1990	100.0	35.2	17.0	152.2	83.8	17.5	7.8	109.1	261.3
2000	110.7	43.9	20.4	175.0	96.0	24.1	6.9	126.9	301.9
2005	**128.5**	**61.9**	**24.8**	**215.2**	**109.1**	**35.2**	**9.9**	**154.3**	**369.5**
2010	136.2	56.9	27.0	220.1	116.9	30.9	9.5	157.4	377.5
2015	141.1	54.8	25.0	220.8	123.2	30.8	8.8	162.8	383.7
2020	153.0	57.2	25.6	235.9	138.4	33.5	9.3	181.2	417.1
2025	163.1	59.8	25.9	248.9	154.1	36.7	9.8	200.6	449.5
2030	173.1	62.5	26.5	262.1	170.7	40.6	10.3	221.6	483.7

Note(s): 1) Expenditures exclude wood and coal. 2005 U.S. energy expenditures were $1.04 trillion. 2) Residential petroleum products include distillate fuel oil, LPG, and kerosene. 3) Commercial petroleum products include distillate fuel oil, LPG, kerosene, motor gasoline, and residual fuel.

Source(s): EIA, State Energy Data 2004: Prices and Expenditures, June 2006, p. 24-25 for 1980-2000; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A3, p. 140-141 for 2005-2030; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

4.1.4 FY 2005 Federal Buildings Energy Prices and Expenditures, by Fuel Type ($2005)

Fuel Type	Average Fuel Prices ($/million Btu)	Total Expenditures ($million) (2)
Electricity	20.86 (1)	2,887.8
Natural Gas	8.27	823.7
Fuel Oil	9.34	263.9
Coal	3.01	38.9
Purchased Steam	10.52	130.1
LPG/Propane	12.06	36.7
Other	14.19	77.1
Average	**14.19**	**Total** **4,258.3**

Note(s): 1) $0.071/kWh. 2) Energy used in buildings in FY 2005 accounted for 29.5% of the total Federal energy bill.
Source(s): DOE, Annual Report to Congress on FEMP, Sept. 2006, Table 5, p 152 for prices and expenditures, and p. E-2 for Federal buildings energy expenditures.

4.1.5 2005 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2005 Billion) (1)

	Natural Gas	Petroleum					Coal	Electricity	Total	Percent
		Distil.	Resid.	LPG	Oth(2)	Total				
Space Heating (3)	58.8	14.5	1.1	5.0	1.6	22.3	0.2	19.6	100.9	27.3%
Lighting								57.1	57.1	15.5%
Space Cooling	0.3							41.6	41.9	11.3%
Water Heating (4)	20.5	2.6		0.9		3.5		16.0	40.0	10.8%
Refrigeration (5)								23.0	23.0	6.2%
Electronics (6)								22.8	22.8	6.2%
Cooking	5.3			0.5		0.5		7.4	13.2	3.6%
Wet Clean (7)	0.9							8.5	9.3	2.5%
Ventilation (8)								8.6	8.6	2.3%
Computers								6.7	6.7	1.8%
Other (9)	2.9	0.3		4.9	0.9	6.1		19.8	28.8	7.8%
Adjust to SEDS (10)	8.5	2.3				2.3		5.9	16.8	4.6%
Total	**97.2**	**19.8**	**1.1**	**11.4**	**2.5**	**34.7**	**0.2**	**237.0**	**369.1**	100%

Note(s): 1) Expenditures include coal and exclude wood (unlike Table 4.1.3). 2) Includes kerosene space heating ($1.3 billion) and motor gasoline other uses ($0.9 billion). 3) Includes furnace fans ($2.3 billion). 4) Includes residential recreation water heating ($1.2 billion). 5) Includes refrigerators ($10.8 billion) and freezers ($9.6 billion). 6) Includes color televisions ($8.3 billion) and other electronics ($5.6 billion). 7) Includes clothes washers ($0.9 billion), natural gas clothes dryers ($0.9 billion), electric clothes dryers ($6.9 billion) and dishwashers ($0.7 billion). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling ($0.5 billion). 9) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial services station equipment, ATMs, telecommunications equipment, medical equipment, pumps, lighting, emergency electric generators, manufacturing performed in commercial buildings. 10) Expenditures related to an energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sectors, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139, Table A3, p. 140-141 for prices, Table A4, p. 142-143 for residential energy consumption, and Table A5, p. 144-145 for commercial energy consumption; EIA, National Energy Modeling System for AEO 2007, Feb. 2007; EIA, State Energy Data 2004: Prices and Expenditures, June 2007, p. 24-25 for coal prices; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2, 5-25 and 5-26 for commercial ventilation; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63 for commercial lighting; OBT/A.D. Little, Energy Savings Potential for Commercial Refrigeration Equipment, June 1996, Figure 1-1-, p. 1-1; and EIA, AEO 1999, Dec. 1998, Table A5, p. 120 for 1996 commercial refrigeration.

4.1.6 Implicit Price Deflators (2000 = 1.00)

Year	Implicit Price Deflator	Year	Implicit Price Deflator	Year	Implicit Price Deflator
1980	0.54	1990	0.82	2000	1.00
1981	0.59	1991	0.84	2001	1.02
1982	0.63	1992	0.86	2002	1.04
1983	0.65	1993	0.88	2003	1.06
1984	0.68	1994	0.90	2004	1.09
1985	0.70	1995	0.92	2005	1.13
1986	0.71	1996	0.94		
1987	0.73	1997	0.95		
1988	0.76	1998	0.96		
1989	0.79	1999	0.98		

Source(s): EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377.

4.2.1 2005 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2005 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	43.7	12.0	5.0	1.3	18.3	0.04	13.6	75.7	35.2%
Water Heating (3)	14.1	1.7	0.9		2.6		11.5	28.3	13.1%
Space Cooling (4)	0.0						23.2	23.2	10.8%
Lighting							20.8	20.8	9.7%
Refrigeration (5)							14.2	14.2	6.6%
Electronics (6)							13.9	13.9	6.5%
Cooking	2.7		0.5		0.5		6.4	9.6	4.5%
Wet Clean (7)	0.9						8.5	9.3	4.3%
Computers							2.1	2.1	1.0%
Other (8)	0.5		3.3		3.3		5.3	9.2	4.3%
Adjust to SEDS (9)							8.8	8.8	4.1%
Total	**61.9**	**13.7**	**9.8**	**1.3**	**24.8**	**0.04**	**128.5**	**215.2**	100%

Note(s): 1) Expenditures include coal and exclude wood (unlike Table 4.1.3). 2) Includes furnace fans ($2.3 billion). 3) Includes residential recreation water heating ($1.2 billion). 4) Fan energy use included. 5) Includes refrigerators ($10.8 billion) and freezers ($3.5 billion). 6) Includes color televisions ($8.3 billion) and other electronics ($5.6 billion). 7) Includes clothes washers ($0.9 billion), natural gas clothes dryers ($0.7 billion), electric clothes dryers ($6.4 billion), and dishwashers ($0.9 billion). 8) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. 9) Expenditures related to an energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential building sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A4, p. 142-143 for energy, Table A3, p. 140-141 for prices; EIA, State Energy Data 2004: Prices and Expenditures, June 2007, p. 24 for coal price; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators; and BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses.

4.2.2 Average Annual Energy Expenditures per Household, by Year ($2005)

Year	
1980	1,798
1990	1,615
2000	1,617
2005	**1,899**
2010	1,824
2015	1,729
2020	1,751
2025	1,762
2030	1,777

Source(s): EIA, State Energy Data 2004: Prices and Expenditures, June 2007, p. 24 for 1980-2000; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139, Table A4, p. 142-143 for consumption, Table A3, p. 140-141 for prices 2005-2030; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators; and DOC, Statistical Abstract of the United States 2007, Feb. 2007, Table No. 949, p. 606 for 1980-2000 occupied units.

4.2.3 2001 Energy Expenditures per Household, by Housing Type and Square Footage ($2005)

	Per Household	Per Square Foot
Single-Family	**1,868**	**0.78**
-Detached	1,899	0.78
-Attached	1,686	0.77
Multi-Family	**1,065**	**1.02**
-2 to 4 units	1,389	1.00
-5 or more units	884	1.05
Mobile Home	**1,471**	**1.40**

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Table CE1-6.2u; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.2.4 2001 Energy Expenditures per Household, by Census Region ($2005)

Region	
Northeast	1,917
Midwest	1,697
South	1,684
West	1,286

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Tables CE1-9c, CE1-10c, CE1-11c and CE1-12c; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.2.5 2001 Household Energy Expenditures, by Vintage ($2005)

Year	Per Household	Per Square Foot	Per Household Member	Percent of Residential Sector Expenditures
Prior to 1970	1,672	0.86	655	52%
1970 to 1979	1,529	0.88	611	16%
1980 to 1989	1,584	0.82	633	16%
1990 to 1999	1,734	0.73	594	14%
2000 to 2001	2,032	0.67	602	1%
				Total 100%
Average	**1,644**	**0.83**	**635**	

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Tables CE1-6.1u and CE1-6.2u; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.2.6 2001 Households and Energy Expenditures, by Income Level ($2005)

Household Income	Households (10^6)		Energy Expenditures by Household	Energy Expenditures by Household Member	Mean Individual Energy Burden (1)
Less than $9,999	11.0	10%	1,039	554	16%
$10,000 to $14,999	7.7	7%	1,124	528	9%
$15,000 to $19,999	8.9	8%	1,290	565	7%
$20,000 to $29,999	14.0	13%	1,315	561	5%
$30,000 to $39,999	13.9	13%	1,398	547	4%
$40,000 to $49,999	13.2	12%	1,518	562	3%
$50,000 to $74,999	21.7	20%	1,683	577	3%
$75,000 to $99,999	8.1	8%	1,825	624	2%
$100,000 or more	8.6	8%	2,231	732	2%
Total	**107.1**	100%			**3%**

Note(s): 1) See Tables 4.2.7 and 7.1.10 for more on energy burdens. 2) A household is defined as a family, an individual, or a group of up to nine unrelated individuals occupying the same housing unit.

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Oct. 2003, Tables CE1-5.1u.; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.2.7 Energy Burden Definitions and Residential Energy Burdens, by Weatherization Eligibility and Year (1)

Energy burden is an important statistic for policy makers who are considering the need for energy assistance. Energy burden can be defined broadly as the burden placed on household incomes by the cost of energy, or more simply the ratio of energy expenditures to income for a household. However, there are different ways to compute energy burden, and different interpretations and uses of the energy burden statistics. DOE Weatherization primarily uses mean individual burden and mean group burden since these statistics provide data on how an "average" individual household fares against an "average" group of households (that is, how burdens are distributed for the population). DOE Weatherization (and HHS) also uses the median individual burden which shows the burden of a "typical" individual.

	1987	1990		FY 2000 (2)			FY 2005 (3)		
	Mean Group	Mean Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group
Total U.S. Households	4.0%	6.8%	3.2%	6.1%	3.5%	2.4%	6.8%	3.7%	2.9%
Federally Eligible	**13.0%**	**14.4%**	**10.1%**	**12.1%**	**7.9%**	**7.7%**	**14.6%**	**8.6%**	**9.1%**
Federally Ineligible	4.0%	3.5%	N.A.	3.0%	2.6%	2.0%	3.2%	2.8%	2.3%
Below 125% Poverty Line	13.0%	N.A.	N.A.	N.A.	N.A.	N.A.	20.2%	13.7%	12.8%

Note(s): 1) See Section 7.1 for more on low-income housing. 2) Data are derived from RECS 1997, adjusted to reflect FY 2000, HDD, CDD, 3) Data are derived from RECS 2001, adjusted to reflect FY 2005, HDD, CDD, and fuel prices.

Source(s): HHS, LIHEAP Home Energy Notebook for Fiscal Year 2005, May 2007, Tables A-2a, A-2b, and A-2c, p. 59-61 for FY 2005; HHS, LIHEAP Home Energy Notebook for FY 2000, April 2002, Tables A-2a, A-2b, and A-2c, p. 48-50 for FY 2000; HHS, LIHEAP Report to Congress FY 1995, Aug. 1997, p. 55 for energy burden definitions; HHS, Characterizing the Impact of Energy Expenditures on Low-Income Households: An Analysis of Alternative National Energy Burden Statistics, November 1994, p. vii-ix for burdens; ORNL, Scope of the of the Weatherization Assistance Program: Profile of the Population in Need, Mar. 1994, p. xii for mean individual and mean group burdens and p. xi for 1990 Federally ineligible mean individual burden; and EIA, Household Energy Consumption and Expenditures 1987, Oct. 1989, Table 13, p. 48-50 for 1987 mean group burdens.

4.2.8 1998 Cost Breakdown of a 2,150-Square-Foot, New Single-Family Home ($2005) (1)

	Cost	
Finished Lot	**62,539**	**24%**
Construction Cost		
Inspection/Fees	4,087	2%
Shell/Frame		
Framing	29,928	11%
Windows/Doors	9,940	4%
Exterior Finish	10,939	4%
Foundation	15,610	6%
Wall/Finish Trim	27,301	10%
Flooring	6,978	3%
Equipment		
Plumbing	8,552	3%
Electrical Wiring	5,456	2%
Lighting Fixtures	1,510	1%
HVAC	5,972	2%
Appliances	2,095	1%
Property Features	17,000	6%
Financing	**4,985**	**2%**
Overhead & General Expenses	**15,139**	**6%**
Marketing	**3,716**	**1%**
Sales Commission	**8,940**	**3%**
Profit	**24,350**	**9%**
Total	**265,036**	100%

Note(s): 1) Based on a NAHB survey asking builders to provide a detailed breakdown of the cost of constructing a 2,150SF house with 3 or 4 bedrooms on a 7,500- to 10,000SF lot. Average sales price of a new home in 42 surveyed markets was $226,680 (in $1998).

Source(s): NAHB, The Truth About Regulatory Barriers to Housing Affordability, 1999, p. 4; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.3.1 2005 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2005 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								36.3	36.3	23.5%
Space Heating	15.1	2.5	1.1		0.3	4.0	0.2	5.9	25.2	16.3%
Space Cooling	0.3							18.4	18.7	12.1%
Water Heating	6.4	0.9				0.9		4.5	11.7	7.6%
Electronics								8.9	8.9	5.8%
Ventilation								8.6	8.6	5.5%
Refrigeration								5.9	5.9	3.8%
Computers								4.6	4.6	3.0%
Cooking	2.6					-		1.0	3.6	2.3%
Other (4)	2.9	0.3		1.6	0.9	2.8		14.5	20.2	13.0%
Adjust to SEDS (5)	8.0	2.3				2.3		0.7	11.0	7.1%
Total	**35.2**	**6.0**	**1.1**	**1.6**	**1.2**	**9.9**	**0.2**	**109.1**	**154.5**	100%

Note(s): 1) Expenditures include coal and exclude wood (unlike Table 4.1.3). 2) Includes kerosene space heating ($0.2 billion) and motor gasoline other uses ($0.7 billion). 3) Coal average price is from 2004. 4) Includes service station equipment, ATMs, medical equipment, telecommunications equipment, pumps, lighting, emergency electric generators, and manufacturing performed in commercial buildings. 5) Expenditures related to an energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A3, p. 140-141 for prices, and Table A5, p. 144-145 for energy consumption; EIA, National Energy Modeling System for AEO 2006, April 2006; EIA, State Energy Data 2004: Prices and Expenditures, June 2007, p. 25 for coal price; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2, 5-25 and 5-26 for ventilation; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63; OBT/A.D. Little, Energy Savings Potential for Commercial Refrigeration Equipment, June 1996, Figure 1-1-, p. 1-1; and EIA, AEO 1999, Dec. 1998, Table A5, p. 120 for 1996 refrigeration.

4.3.2 Average Annual Energy Expenditures per Square Foot of Commercial Floorspace, by Year ($2005)

Year	
1980	1.92
1990	1.70
2000	1.85
2005	**2.31**
2010	2.17
2015	2.08
2020	2.13
2025	2.18
2030	2.21

Source(s): EIA, State Energy Data 2004: Prices and Expenditures, June 2007, p. 25 for 1980-2000; EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139 and Table A5, p. 144-145 for consumption, Table A3, p. 140-141 for prices for 2005-2030; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators; EIA, AEO 1994, Jan. 1994, Table A5, p. 62 for 1990 floorspace; and PNNL for 1980 floorspace.

4.3.3 2003 Energy Expenditures per Square Foot of Commercial Floorspace and per Building, by Building Type ($2005) (1)

	Per Square Foot	Per Building (10^3)		Per Square Foot	Per Building (10^3)
Food Service	4.40	24.5	Mercantile	2.01	34.3
Food Sales	4.22	23.4	Education	1.29	33.0
Health Care	2.49	61.2	Service	1.25	8.2
Public Order and Safety	1.86	28.8	Warehouse and Storage	0.72	12.2
Office	1.81	26.8	Religious Worship	0.69	7.0
Public Assembly	1.56	22.1	Vacant	0.31	4.3
Lodging	1.55	55.4	Other	2.69	59.0

Note(s): 1) Mall buildings are no longer included in most CBECs tables; therefore, some data is not directly comparable to past CBECs.

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Oct. 2006, Table 4; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

4.3.4 2003 Energy Expenditures per Square Foot of Commercial Floorspace, by Vintage ($2005)

Prior to 1960	1.30
1960 to 1969	1.53
1970 to 1979	1.69
1980 to 1989	1.88
1990 to 1999	1.69
2000 to 2003	1.55
Average	**1.60**

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Table C4; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

4.4.1 Annual Energy Expenditures per Gross Square Foot of Federal Floorspace Stock, by Year ($2005)

FY 1985	2.18
FY 2000	1.24
FY 2002	1.35
FY 2003	1.35
FY 2004	1.39
FY 2005	1.44

Note(s): Total Federal buildings and facilities energy expenditures in FY 2005 were $4.26 billion (in $2005).

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table 7-B, p. 62 for energy costs, and Table 2, p. 13 for floorspace; DOE/FEMP, Annual Report to Congress on FEMP, Feb. 24, 2006, Table 5, p. A-9 for energy costs and Table 6-A, p. A-10 for floorspace; DOE/FEMP, Annual Report to Congress on FEMP, Aug. 9, 2005, Table 5, p. A-9 for energy costs and Table 6-A, p. A-10 for floorspace; DOE/FEMP, Annual Report to Congress on FEMP, Sept. 29, 2004, Table C, p. C-2 for energy costs and Table 8-A, p. 65 for floorspace; and DOE/FEMP, Annual Report to Congress on FEMP, Dec. 2002, Table 8-A, p. 61 for floorspace.

4.4.2 Direct Appropriations on Federal Buildings Energy Conservation Retrofits and Capital Equipment ($2005 Million)

FY 1985	475.92	FY 1991	152.25	FY 1997	256.31	FY 2003	182.64
FY 1986	307.18	FY 1992	189.33	FY 1998	232.97	FY 2004	179.93
FY 1987	88.73	FY 1993	154.18	FY 1999	242.28	FY 2005	290.56
FY 1988	97.70	FY 1994	150.17	FY 2000	137.29		
FY 1989	74.93	FY 1995	399.93	FY 2001	147.70		
FY 1990	92.92	FY 1996	239.61	FY 2002	134.49		

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 26, 2006, Table 10-B, p. 32; DOE/FEMP, Annual Report to Congress on FEMP, Dec. 11, 2002, Table 4-A, p. 32; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

4.5.1 Estimated Value of All U.S. Construction Relative to the GDP ($2005)

- 2005 estimated value of all U.S. construction is $1.72 trillion (including renovation; heavy construction; public works; residential, commercial, and industrial new construction; and non-contract work).
- Compared to the $12.5 trillion U.S. gross domestic product (GDP), all construction holds a 13.8% share.
- In 2005, residential and commercial building renovation (valued at $392 billion) and new building construction (valued at $776 billion) is estimated to account for over 71% (approximately $1.21 trillion) of the $1.72 trillion.

Source(s): National Science and Technology Council, Construction & Building: Interagency Program for Technical Advancement in Construction and Building, 1999, p. 5; DOC, 1997 Census of Construction Industries: Industry Summary, Jan. 2000, Table 7, p. 15; DOC, Annual Value of Construction Put in Place 2006, June 2007; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators and GDP.

4.5.2 Value of New Building Construction Relative to GDP, by Year ($2005 Billion)

	Value of New Construction Put in Place				Bldgs. Percent of
	Residential	Commercial (1)	All Bldgs. (1)	GDP	Total U.S. GDP
1980	149.4	143.9	293.2	5,819	5.0%
1985	192.1	203.7	395.7	6,825	5.8%
1990	187.8	204.8	392.7	8,018	4.9%
1995	214.7	185.8	400.6	9,055	4.4%
2000	303.5	291.1	594.6	11,067	5.4%
2004	437.8	278.7	716.6	12,223	5.9%
2005	490.0	285.9	775.8	12,456	6.2%

Note(s): 1) New buildings construction differs from Table 4.5.1 by excluding industrial building construction.

Source(s): DOC, Current Construction Reports: Value of New Construction Put in Place, C30, Aug. 2003, Table 1 for 1980-1990; DOC, Annual Value of Private Construction Put in Place, July 2007 for 1995-2006; DOC, Annual Value of Public Construction Put in Place, July 2007 for 1995-2006; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for GDP and price deflators; Historic Expenditures for Residential Properties by Property Type: Quarterly 2003-2006 (New structural purposes).

4.5.3 Value of Building Improvements and Repairs Relative to GDP, by Year ($2005 Billion) (1)

	Value of Improvements and Repairs				Bldgs. Percent of
	Residential	Commercial	All Bldgs.	GDP	Total U.S. GDP
1980	96.7	N.A.	N.A.	5,819	N.A.
1985	132.8	126.2 (2)	259.0	6,825	3.8%
1990	159.5	128.3 (3)	287.8	8,018	3.6%
1995	153.0	111.2	264.2	9,055	2.9%
2000	172.5	180.6	353.1	11,067	3.2%
2004	204.5	172.9	377.4	11,067	3.1%
2005	215.0	177.4	392.4	12,456	3.2%

Note(s): 1) Improvements includes additions, alterations, reconstruction, and major replacements. Repairs include maintenance.
2) 1986. 3) 1989.

Source(s): DOC, Expenditures for Residential Improvements and Repairs by Property Type, Quarterly, May 2005 for 1980-1990; DOC, Current Construction Reports: Expenditures for Nonresidential Improvements and Repairs: 1992, CSS/92, Sept. 1994, Table A, p. 2 for 1986-1990 expenditures; DOC, 1997 Census of Construction Industries: Industry Summary, Jan. 2000, Table 7, p. 15; DOC, Annual Value of Private Construction Put in Place, July 2007 for 1995-2005; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for GDP and price deflators;

4.5.4 2003 U.S. Private Investment into Construction R&D

Sector	Percent of Sales	Building Technology	Percent of Sales
Average Construction R&D (1)	**1.2**	Building Technology	
Heavy Construction	2.0	Appliances	2.0
Special Trade Construction	0.2	Lighting	1.2
		HVAC	1.5
U.S. Average of All Private R&D (2)	**3.2**	Fans, Blowers, & Air Cleaning Equipment	1.6
Manufacturing Average	3.1	Lumber and Wood Products	0.3
Service Industry Average	3.3	Commercial Building Operations	2.2

Note(s): 1) Includes all construction (e.g., bridges, roads, dams, buildings, etc.).

Source(s): National Science Foundation, Research and Development in Industry: 2003, Table 27, p. 76-77; and Schonfeld & Associates, R&D Ratios & Budgets, June 2003, p. 219-222.

4.5.5 1997/1998 International Investment into Construction and Energy R&D

	Construction Percent of Private R&D to Total Private R&D	Gas, & Water Percent of Private R&D to Total Private R&D	Mining Percent of Private R&D to Total Private R&D
United States	0.2	0.2	0.1
Canada	0.3	2.7	2.9
Germany	0.3	0.3	0.5
France	1.0	3.0	1.8
Italy	0.3	1.7	0.0
Japan	2.1	0.9	0.0
United Kingdom	0.4	1.4	1.4
Russian Federation	0.9	0.5	3.3
Sweden	0.6	0.8	1.1
Finland	0.8	1.6	0.7

Source(s): National Science Foundation, Science & Engineering Indicators -- 2002, Volume 1, Jan. 2002, Table 4-16, p. 4-53.

4.5.6 FY2003-2005 Green Building R&D, as Share of Federal Budget and by Organization

Budget Function	Percent of U.S. Federal Budget	Organization	Average Annual Funding ($1000s)
National Defense	57.2%	DOE	123,170
Health	23.1%	EPA	25,317
Other energy, general science, natural resources, and environment	8.0%	NSF	22,940
Space research and technology	6.3%	PIER (1)	11,100
Transportation	1.5%	DOC-NIST	7,500
Agriculture	1.5%	NYSERDA	5,800
Veterans' benefits and services research	0.7%	HUD	5,000
Green building	**0.2%**	GSA	3,000
Other functions (2)	1.6%	ASHRAE	2,400
Total	100%		

Note(s): 1) PIER = Public Interest Energy Research 1) Other functions include education, training, employment, and social services; income security; and commerce.

Source(s): U.S. Green Building Council, Green Building Research Funding: An Assessment of Current Activity in the United States, 2006, Chart 1, p. 3, Chart 2, p. 3.

4.6.1 Buildings Design and Construction Trades, by Year

		Employees, in thousands			Number of Residential Builder Establishments with Payrolls, in thousands (2)			
		Architects	Construction (1)		New Construction	Remodeling	Both	Total (3)
1980		N.A.	3,065	1982	14.4	21.7	57.5	93.6
1990		N.A.	3,861	1987	38.4	32.8	48.1	119.3
2000	(4)	215	5,183	1992	36.3	43.3	51.0	130.6
2003		180	6,735	1997	46.6	33.6	52.1	134.1
2004		207	6,964	2002	95.4	28.0	47.7	167.4
2005		235	7,277					

Note(s): 1) Does not include industrial building or heavy construction (e.g., dam and bridge building). In 1999, 76% of the employment shown is considered for "production." The entire U.S. construction industry employs an estimated 10 million people, including manufacturing. 2) In 2000, NAHB report having 200,000 members, one-third of which were builders. 3) Excludes homebuilding establishments without payrolls, estimated by NAHB at an additional 210,000 in 1992. 4) NAHB reports that 2,448 full-time jobs in construction and related industries are generated from the construction of every 1,000 single-family homes and 1,030 jobs are created from the construction of every 1,000 multi-family units.

Source(s): DOC, Statistical Abstract of the U.S. 2001, May 2002, Table 593, p. 380 for 2000 architect employment, Table 609, p. 393; Statistical Abstract of the U.S. 2004-2005, December 2004, Table 597, p. 385 for 2003 architect employment, Table 602 for 2005 architect employment, Table 613, p. 400; DOC, 1992 Census of Construction Activities: U.S. Summary, CC92-I-27, Jan. 1996, p. 27-5 for construction employees; DOC, 1997 Economic Census: Construction - Industry Summary, EC97C23IS, Jan. 2000, Table 2, p. 8 for industrial builders; DOC, 1997 Economic Census: Construction - Single-Family Housing Construction, EC97C-2332A, Nov. 1999, Table 10, p. 14 for 1997 builder establishments; DOC, 2002 Economic Census: Construction - New Single-Family Housing Construction, EC02-231-236115, Dec. 2004, New Housing Operatives, ECO2-231-236118, Dec. 2004, Residential Remodelers, EC02-231-236119, Dec. 2004, Industrial Building Construction, 231-236210, Dec. 2004; NAHB, Housing Economics, May 1995, Table 2, p. 14 for 1982-1992 builder establishments; National Science and Technology Council, Construction & Building: Federal Research and Development in Support of the U.S. Construction industry for construction employees in Note 1; NAHB, Housing at the Millennium: Facts, Figures, and Trends, May 2000, p. 21 for Note 2; and NAHB, 1997 Housing Facts, Figures and Trends, 1997, p. 35 for Note 3, and p. 13 for Note 4.

4.6.2 Heating, Cooling, and Ventilation Equipment Trades, by Year (1000 Employees)

Industry	1980	1985	1990	1995	2000	2003
Air Conditioning and Refrigeration Equipment (incl. warm-air furnaces): SIC 3585						
- Total Employment	118.4	122.8	126.9	136.3	150.2	109.1
- Production Workers	81.6	87.2	92.4	102.4	111.6	76.7
Plumbing, Heating, and Air-Conditioning Contractors: SIC 171						
- Total Employment	532.8	605.1	649.2	736.5	928.5	844.9
- Construction Workers	400.4	447.3	476.7	542.4	687.2	630.4
Wholesalers of Hardware, Plumbing and Heating Equipment: SIC 507						
- Total Employment	242.7	254.1	283.8	288.2	318.3	230.5

Source(s): ARI, Statistical Profile of the Air-Conditioning, Refrigeration, and Heating Industry (from U.S. Bureau of Labor Statistics), April 2001, Table 3, p. 10, Table 4, p. 11, Table 5, p. 13, Table 6, p. 14, and Table 8, p. 16 for 1980 to 1990 data; ARI, Statistical Profile of the Air-Conditioning, Refrigeration and Heating Industry, October 2004, Table 3, p. 9, Table 4, p. 10, Table 5, p. 12, Table 6, p. 13 and Table 8, p. 15 for 1995 to 2003 data.

5.1.1 2006 Five Largest Residential Homebuilders

Homebuilder	Number of Home Closings (1)	Gross Revenue ($million)	Market Share of Total New Home Closings (%) (2)
D.R. Horton	53,410	15,016	5.0%
Pulte Homes	49,568	16,267	4.7%
Lennar Homes	41,487	14,274	3.9%
Centex Corporation	37,539	14,400	3.5%
KB Home	32,124	11,004	3.0%
Total of Top Five	**214,128**	**70,961**	**20.2%**
Habitat for Humanity (3)	4,862	357	0.5%

Note(s): 1) 2006 total U.S. new home closings were 1.06 million (only single-family). 2) Total share of closings of top 20 builders was 35%. Total share of the top 100 builders was 47%. 3) Habitat for Humanity built more than 400 homes during the week of May 31, 2007. Habitat for Humanity has built over 1,000 homes in the New Orleans area since Hurricane Katrina. Habitat for Humanity's 2,100 worldwide affiliates have completed more than 200,000 homes since 1976, providing more than 1,000,000 with housing.

Source(s): Builder Magazine, May 2007, Builder 100; e-mail correspondence with Habitat for Humanity for relevant data, Aug. 2007; and Habitat for Humanity, http://www.habitat.org/, for note 3.

5.1.2 Value of New Building Construction, by Year ($2005 Billion)

	Residential	Commercial	All Bldgs.
1980	149.4	143.9	293.2
1985	192.1	203.7	395.7
1990	187.8	204.8	392.7
1995	214.7	185.8	400.6
2000	303.5	291.1	594.6
2003	376.2	270.5	646.7
2004	437.8	278.7	716.6
2005	490.0	285.9	775.8

Note(s): 1) In 2005, new building construction accounted for 6.2% of the $12.5 trillion U.S. GDP. Refer to Chapter 2 for more new buildings statistics.

Source(s): DOC, Current Construction Reports: Value of New Construction Put in Place, C30, Aug. 2003, Table 1 for 1980-1990; DOC, Annual Value of Construction Put in Place, July 2006 for 1995-2005; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

5.1.3 Market Indices for 2006 ENERGY STAR Qualified New Single-Family Homes, by Selected State (1000s)

	ENERGY STAR Qualified New Homes	New Single-Family Housing Permits	Market Penetration
Nevada	18.9	26.7	71%
Alaska	1.0	1.6	64%
Iowa	5.9	10.3	57%
Texas	60.8	162.8	37%
Hawaii	2.1	5.6	37%
Arizona	20.1	55.6	36%
New Jersey	5.4	17.1	31%
Delaware	1.2	5.0	24%
Vermont	0.5	2.1	24%
Connecticut	1.6	7.1	23%
California	18.1	107.7	17%
New Hampshire	0.8	4.8	17%
Utah	3.6	22.6	16%
Ohio	3.5	27.5	13%
New York	2.6	20.0	13%
Florida	3.3	146.2	2%
United States	**169.8**	**1,378.2**	**12%**

Source(s): EPA, ENERGY STAR Qualified New Homes Market Indices for States, http://www.energystar.gov/index.cfm?fuseaction=qhmi.showHomesMarketIndex for top states; E-mail correspondence with EPA ENERGY STAR program for complete data set.

5.2.1 2007 Top Five Manufacturers of Factory-Built Housing Units (1)

Company	Units Produced	Gross Sales Volume ($million)	Market Share of Top 25 Company Sales (2)
CMH Manufacturing	31,100	1,327.8	20%
Champion Enterprises, Inc.	21,126	1,286.6	19%
Palm Harbor Homes, Inc.	8,911	679.1	10%
Fleetwood Enterprises, Inc.	15,137	600.0	9%
Skyline Corporation	8,207	376.4	6%

Note(s): 1) Data based on mail-in surveys from manufacturers which may not be entirely complete. 2) Market shares based on total gross sales volume of the factory-built home producers included in the list of the top 25 factory-built producers responding to the survey. In 2007, surveyed factory-built home sales were estimated at $6.6 billion and 133,361 units.

Source(s): HousingZone.com, 2007 Factory Built Housing Results, http://www.housingzone.com/factory.html.

5.2.2 2007 Top Five Manufacturers of Modular/3D Housing Units (1)

Company	Units Produced	Gross Sales Volume ($million)	Market Share of Top 25 Company Sales (2)
Champion Enterprises, Inc.	4,653	438.7	27%
CMH Manufacturing	3,200	228.8	14%
All American Homes, LLC	1,689	165.4	10%
Palm Harbor Homes, Inc.	1,614	162.9	10%
Excel Homes LLC	1,200	110.6	7%

Note(s): 1) Data based on mail-in surveys from manufacturers, which may not be entirely complete. 2) Market shares based on total gross sales volume of the Modular/3D home producers included in the list of the top 25 factory-built producers responding to the survey. In 2007, surveyed modular/3D home sales were estimated at $1.6 billion and 20,601 units.

Source(s): HousingZone.com, 2007 Factory Built Housing Results, http://www.housingzone.com/factory.html.

5.2.3 2007 Top Five Manufacturers of HUD-Code (Mobile) Homes (1)

Company	Units Produced	Gross Sales Volume ($million)	Market Share of Top 25 Company Sales (2)
CMH Manufacturing	27,900	1,099	23%
Champion Enterprises, Inc.	16,473	848	18%
Fleetwood Enterprises, Inc.	15,137	600	12%
Palm Harbor Homes	7,297	516	11%
Skyline Corporation	8,207	376	8%

Note(s): 1) Data based on mail-in surveys from manufacturers, which may not be entirely complete. 2) Market shares based on total gross sales volume of the HUD-Code home producers included in the list of the top 25 factory-built producers responding to the survey. In 2007, surveyed HUD-Code home sales were estimated at $4.83 billion and 109,320 units.

Source(s): HousingZone.com, 2007 Factory Built Housing Results, http://www.housingzone.com/factory.html.

5.2.4 2004 Top Five Manufacturers of Factory-Fabricated Components (Trusses, Wall Panels, Doors) (1)

Company	Gross Sales Volume ($million)	Market Share of Top 26 Company Sales (2)	Number of Employees (3)
Carpenter Contractors	175.0	26%	1,130
Automated Building Company	102.5	15%	702
Landmark Truss	45.0	7%	425
Southern Building Products	25.9	4%	180
Dolan Lumber & Truss	25.1	4%	260

Note(s): 1) Data based on mail-in surveys from manufacturers, which may not be entirely complete. 2) Market shares based on total gross sales volume of producers of only components included in the list of the top 26 IH producers responding to the survey. In 2004, surveyed component sales was estimated at $665.1 million. 3) The top 26 companies employ over 4,970 people at their plants.

Source(s): Automated Builder Magazine, Sept. 2005, p. 40-41.

5.2.5 2004 Number of Industrialized Housing Manufacturers versus Production Companies (Stick-Builders)

Type	Number of Companies
Panelized	3,500
Modular (1)	200
HUD-Code	90
Production Builders	7,000
Component Manufacturers	2,200
Special (Commercial) Units	170

Note(s): 1) 170 of these companies also produce panelized homes.
Source(s): Automated Builder Magazine, Mar. 2005, p. 34-35; Automated Builder Magazine, Jan. 2004, p. 16 for Note 1.

5.2.6 2006 HUD-Code (Mobile) Home Placements, by Census Region and Top Five States (Percent of National Total)

Region		Top Five States	
Northeast	7%	Florida	11%
Midwest	13%	California	8%
South	59%	Texas	8%
West	22%	Arizona	6%
Total	100%	Lousiana	5%

Source(s): DOC, Manufactured Housing Statistics, 2006 New Manufactured Homes Placed by Size of Home, by State, Apr. 2007.

5.3.1 Value of Building Improvements and Repairs, by Sector ($2005 Billion) (1)

	Value of Improvements and Repairs		
	Residential	Commercial	All Bldgs.
1980	96.7	N.A.	N.A.
1985	132.8	126.2 (2)	259.0
1990	159.5	128.3 (3)	287.8
1995	153.0	136.1	289.1
2000	172.5	180.6	353.1
2003	188.7	167.9	356.6
2004	204.5	172.9	377.4
2005	215.0 (4)	177.4 (5)	392.4

Note(s): 1) Improvements includes additions, alterations, reconstruction, and major replacements. Repairs include maintenance. 2) 1986. 3) 1989. 4) Includes 75% improvements and 25% maintenance and repairs. 5) Includes 76% improvements and 24% maintenance and repairs.

Source(s): DOC, Expenditures for Residential Improvements and Repairs by Property Type, Quarterly, May 2005 for 1980-1990; DOC, Current Construction Reports: Expenditures for Nonresidential Improvements and Repairs: 1992, CSS/92, Sept. 1994, Table A, p. 2 for 1986-1990 expenditures; DOC, 1997 Census of Construction Industries: Industry Summary, Jan. 2000, Table 7, p. 15; DOC, Annual Value of Private Construction Put in Place, July 2007 for 1995-2005; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for GDP and price deflators;

5.3.2 2005 Professional and Do-It-Yourself Improvements, by Project ($2005)

	Professional Installation			Do-It-Yourself Installation		
Repair/Improvement	Homeowners (10^6)	Total Expenditures ($10^9)	Mean Expenditures ($)	Homeowners (1000)	Total Expenditures ($10^9)	Mean Expenditures ($)
Disaster Repairs	0.61	8.7	14,398	0.20	1.3	6,698
Kitchen Remodeled	1.13	13.0	11,550	1.05	5.7	5,411
Additions Built	1.27	29.5	23,212	1.38	9.3	6,767
Bathroom Remodeled or Added	1.13	8.5	7,527	1.34	3.8	2,852
Exterior Improvements	3.85	23.0	5,983	3.11	7.9	2,527
Siding Replaced or Added	0.82	5.2	6,322	0.39	1.0	2,583
Roof Replacement	2.67	14.1	5,281	0.81	1.9	2,366
HVAC Replacement	2.44	7.1	2,895	0.51	1.5	2,909
Windows/Doors Installed	2.53	7.6	2,995	1.72	2.6	1,501
Flooring/Paneling/Ceiling Replacement	4.65	12.4	2,661	3.48	4.2	1,221
Electric System Replacement	1.35	1.5	1,144	0.89	0.4	451
Plumbing Replacement	0.84	1.4	1,726	2.08	1.0	467
Insulation Added	0.59	1.4	2,361	0.72	1.1	1,513
Appliance/Major Equipment Replacement	3.59	2.4	657	2.49	1.0	385

Note(s): Expenditures are $36.7 billion higher in Table 4.5.3 and 5.3.1. This discrepancy is due to sampling methods used by HUD for the American Housing Survey and DOC in the Survey of Expenditures for Residential Improvements and Repairs.

Source(s): Joint Center for Housing Studies of Harvard University, Improving America's Housing 2007, Feb. 2007, Table A-2, p. 28.

5.3.3 Single-Family Residential Renovations, by Project and Vintage

	Year Home was Built					
	Pre-1946	1946-60	1961-73	1974-80	1981-98	1999 or later
Kitchen remodeled	60%	57%	54%	60%	44%	8%
Bathroom remodeled	59%	52%	59%	55%	40%	4%
Add room(s)	29%	18%	14%	24%	21%	15%
Exterior improvement	21%	15%	15%	16%	9%	4%
Basement room finished	14%	10%	6%	12%	16%	65%
Redesign/Restructure	14%	8%	11%	10%	5%	4%
Bathroom added	8%	7%	6%	7%	6%	27%
Sun room added	4%	6%	3%	4%	5%	8%

Note(s): Data based on a nationwide study of 819 consumers who have remodeled their homes in the past 12 months or will in the next 12 months..

Source(s): Professional Remodeler, Consumer Research: What Consumers Want, Sept. 2002, p.44-50.

5.4.1 U.S. Insulation Demand, by Type (Million Pounds) (1)

Insulation Type	1992		2001		2006 (1)	
Fiberglass	2,938	55%	3,760	54%	4,085	53%
Foamed Plastic	1,223	23%	1,775	25%	1,955	26%
Cellulose	485	9%	665	9%	730	10%
Mineral Wool	402	8%	445	6%	480	6%
Other	309	6%	370	5%	395	5%
Total	**5,357**	100%	**7,015**	100%	**7,645**	100%

Note(s): 1) Projected.
Source(s): National Insulation Association, www.insulation.org, Aug. 2006.

5.4.2 Industry Use Shares of Mineral Fiber (Glass/Wool) Insulation (1)

	1997	1999	2001	2003	2004	2005
Insulating Buildings (2)	70%	71%	72%	65%	64%	63%
Industrial, Equipment, and Appliance Insulation	27%	26%	25%	28%	30%	31%
Unknown	3%	3%	3%	7%	6%	5%
Total	100%	100%	100%	100%	100%	100%

Note(s): 1) Based on value of shipments. 2) Including industrial.
Source(s): DOC, Annual Survey of Manufacturers: Value of Product Shipments 2005, Nov. 2006, Table 1, p. 54 for 2003-2005; and DOC, 2001 Annual Survey of Manufacturers: Value of Product Shipments, Dec. 2002, p. 65 for 1997-2001.

5.4.3 Thermal Performance of Insulation

	R-Value per Inch (1)			R-Value per Inch (1)
Fiberglass (2)			Perlite/Vermiculite	
Batts	3.1 - 4.3	(3)	Loose-Fill	2.1 - 3.7
Loose-Fill	2.5 - 3.7		Foam Boards	
Spray-Applied	3.7 - 3.9		Expanded Polystyrene	3.9 - 4.4
Rock Wool (2)			Polyisocyanurate/	
Loose-Fill	2.5 - 3.7		Polyurethane	5.6 - 7.0
Cellulose			Phenolic	4.4 - 8.2
Loose-Fill	3.1 - 3.7		Reflective Insulation	2 - 17
Spray-Applied	2.9 - 3.5		Vacuum Powder Insulation	25 - 30
			Vacuum Insulation Panel	20 - 100

Note(s): 1) Hr-SF-F/Btu-in. Does not include the effects of aging and settling. 2) Mineral fiber. 3) System R-value depends on heat-flow direction and number of air spaces.
Source(s): ASHRAE, 1997 ASHRAE Handbook: Fundamentals, p. 24-4, 22-5; DOE, Insulation Fact Sheet, Jan. 1988, p. 6; Journal of Thermal Insulation, 1987, p. 81-95; ORNL, ORNL/SUB/88-SA835/1, 1990; ORNL, Science and Technology for a Sustainable Energy Future, Mar. 1995, p. 17; and ORNL for vacuum insulation panel.

5.5.1 Residential Prime Window Sales, by Type (Million Units) (1)

	New Construction				Remodeling/Replacement				Total Construction			
Type	1990	1995	2000	2005	1990	1995	2000	2005	1990	1995	2000	2005
Aluminum (2)	5.9	4.7	3.7	6.5	3.6	3.9	4.0	2.4	9.5	8.6	7.7	8.9
Wood (3)	9.4	11.6	12.8	9.2	7.6	9.4	10.2	10.0	17.0	21.0	23.0	19.2
Vinyl	1.2	4.8	9.0	17.4	7.1	9.6	14.8	23.2	8.3	14.4	23.8	40.6
Other	0.1	0.3	0.4	1.0	0.1	0.2	0.2	0.9	0.2	0.5	0.6	1.9
Total (4)	**16.6**	**21.4**	**25.8**	**34.1**	**18.4**	**23.1**	**29.2**	**36.4**	**35.0**	**44.5**	**55.0**	**70.5**

Note(s): 1) Average window life span is 35-45 years. 2) In 1993, 65% of aluminum-framed windows were thermally broken. 3) Includes vinyl-clad and metal-clad units. 4) Due to rounding, sums may not add up to totals.

Source(s): AAMA/Ducker Research, Industry Statistical Review and Forecast 1992, 1993 for Note 2; AAMA/NWWDA/Ducker Research, Industry Statistical Review and Forecast 1996, 1997, Table 6, p. 6 for 1990; AAMA/WDMA, 2000 AAMA/WDMA Industry Statistical Review and Forecast, Feb. 2001, p. 6 for 1995; 2003 AAMA/WDMA Industry Statistical Review and Forecast, June 2004, p. 6 for 2000 and 2003; and LBNL, Savings from Energy Efficient Windows, Apr. 1993, p. 6 for window life span; AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, p. 41 for 2005.

5.5.2 Residential Storm Window and Door Shipments, by Type (Million Units)

	Windows				Doors				Total			
Type	1990	1995	2000	2005	1990	1995	2000	2005	1990	1995	2000	2005
Aluminum	9.9	9.2	8.0	6.6	1.9	3.8	4.3	4.4	11.8	13.0	12.3	11.0
Wood	0.5	1.8	2.3	2.0	0.4	1.3	1.4	1.7	0.9	3.1	3.7	3.7
Other (1)	0.1	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.2	0.4	0.4	0.3
Total (2)	**10.5**	**11.3**	**10.6**	**8.8**	**2.4**	**5.2**	**5.8**	**6.4**	**12.9**	**16.5**	**16.4**	**15.2**

Note(s): 1) "Other" includes metal over wood/foam core or vinyl, etc. 2) Due to rounding, sums may not add up to totals.

Source(s): AAMA/NWWDA/Ducker Research, Industry Statistical Review and Forecast 1996, 1997, Table 7, p. 7 for 1990; AAMA/NWWDA, 2000 AAMA/WDMA Industry Statistical Review and Forecast, Feb. 2001, p. 7 for 1995; and 2003 AAMA/WDMA Industry Statistical Review and Forecast, June 2004, p. 6 for 2000 and 2003; and AAMA/WDMA/Ducker, Study of U.S. Market for Windows, Doors, and Skylights, Apr. 2006, p. 101, Exhibit G.2 for 2005.

5.5.3 Nonresidential Window Usage, by Type and Census Region (Million SF of Vision Area) (1)

	Northeast		Midwest		South		West		Total	
Type	1995	2005	1995	2005	1995	2005	1995	2005	1995	2005
New Construction										
Commercial Windows (2)	4	32	16	31	21	52	13	30	54	141
Curtain Wall	3	13	6	12	16	23	8	15	33	64
Store Front	7	19	11	20	14	42	11	24	43	104
Total (3)	**14**	**63**	**33**	**62**	**51**	**117**	**32**	**68**	**130**	**310**
Remodeling/Replacement										
Commercial Windows (2)	18	24	25	24	46	30	27	15	116	45
Curtain Wall	4	3	6	2	8	5	10	3	28	18
Store Front	12	8	18	9	24	19	22	10	76	34
Total (3)	**34**	**35**	**49**	**34**	**78**	**53**	**59**	**29**	**220**	**97**
Total										
Commercial Windows (2)	22	57	41	54	67	82	40	45	170	238
Curtain Wall	7	15	12	14	24	27	18	18	61	75
Store Front	19	27	29	29	38	61	33	34	119	150
Total (3)	**48**	**99**	**82**	**97**	**129**	**171**	**91**	**97**	**350**	**463**

Note(s): 1) "Usage" is a good indication of sales. 2) Formerly referred to as Architectural. Includes both shop fabricated (true architectural) and *site fabricated products. 3) Due to rounding, sums may not add up to totals.*

Source(s): AAMA/Ducker Research, Industry Statistical Review and Forecast 1996, Mar. 1997, p. 17 for 1995; and AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, p. 81 for 2005.

5.5.4 Insulating Glass Historical Penetration, by Sector (Percent of Total U.S. Usage) (1)

Sector	1985	1990	1995	2000	2005
Residential	73%	86%	89%	92%	94%
Nonresidential	63%	80%	84%	86%	88%

Note(s): 1) "Usage" is a good indication of sales. Includes double- and triple-pane sealed units.

Source(s): Ducker Research, Industry Statistical Review and Forecast 1992, 1993 for 1985; AAMA/Ducker Research, Industry Statistical Review and Forecast 1993, for 1990; AAMA/WDMA, 2000 AAMA/WDMA Industry Statistical Review and Forecast, Feb. 2001, p. 12 for 1995-1997; and 2003 AAMA/WDMA Industry Statistical Review and Forecast, June 2004, p.12 for 1998-2000; and AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, for 2005.

5.5.5 Residential Prime Window Sales, by Type (Million Units)

Type	1980	1990	1995	1999	2001	2003	2005
Single Lite	8.6	4.9	5.5	4.8	3.9	4.7	4.2
Two Lite, Sealed, IG (1)	0.0	12.0	37.8	55.2	50.9	55.9	63.8
Other	16.6	18.7	1.3	2.0	1.5	2.2	2.5
Total	**25.2**	**35.6**	**44.5**	**62.0**	**56.3**	**62.8**	**70.5**

Note(s): 1) IG = Insulated Glazing.

Source(s): AAMA/NWWDA, Study of the U.S. Market for Windows and Doors, 1996, Table 22, p.49; AAMA/WDMA Ducker, Study of U.S. and Canadian Market for Windows and Doors, Apr. 2000, Exhibit E.7, p. 55; AAMA/WDMA, Study of the Market for U.S. Doors, Windows and Skylights, Apr. 2004, Exhibit D.4, p. 46; and, AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, Exhibit D.8 Conventional Window Glass Usage, p. 50.

5.5.6 2005 Residential Prime Window Stock, by Type

Type	Existing U.S. Stock (1) (% of households)
Single Lite	49%
Two Lite, Non-Sealed	15%
Two Lite, Sealed, IG (2)	35%
Other	1%
Total	100%

Note(s): 1) Assumes 14 single-pane windows are replaced in housing units receiving replacement or remodeled windows. Windows in demolished housing units are assumed to be single pane. 2) IG = Insulated Glazing.

Source(s): EIA, Housing Characteristics 1993, June 1995, Table 3.29a for existing stock data; AAMA/NWWDA, Study of the U.S. Market for Windows and Doors, 1996, Table 22, p.49; AAMA/WDMA Ducker, Study of U.S. and Canadian Market for Windows and Doors, Apr. 2000, Exhibit E.7, p. 55; AAMA/WDMA, Study of the Market for U.S. Doors, Window and Skylights, Apr. 2004, Exhibit D.4, p. 46; U.S. Census Bureau, Manufacturing, Mining and Construction Statistics, New Residential Construction: New Privately Owned Housing Units Completed for 1999-2004 single and multi-family units; and DOC, Current Construction Reports: Housing Completions - Annual Data, Mar. 2001 for 1993-1998 single- and multi-family units. AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, for 2005.

5.5.7 Nonresidential Window Stock and Usage, by Type (1)

Type	Existing U.S. Stock (% of buildings)	Glass Area Usage (million square feet) 1992	1995	2001	2003	2005
Single-Pane	53%	42	56	57	48	56
Insulating Glass (2)	47%	188	294	415	373	407
Total	100%	**230**	**350**	**472**	**421**	**463**
Clear	65%	9%	36%	49%	43%	44%
Tinted	28%	54%	40%	24%	17%	15%
Reflective	7%	20%	7%	8%	6%	4%
Low-e	(3)	17%	17%	19%	34%	37%
Total	100%	100%	100%	100%	100%	100%

Note(s): 1) "Usage" is a good indication of sales. 2) Includes double- and triple-pane sealed units (and stock glazing with storm windows). 3) Included as part of the "Tinted" category.

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, June 2006, Table B1 for stock data; AAMA, 1994 Combined Study of the Residential and Nonresidential Markets for Windows and Skylights, Table 5, p. 5, for 1992 usage values; AAMA/NWWDA, 1996 Study of the U.S. Market for Windows and Doors, Table 27, p. 60 for 1995 usage values; 2003 AAMA/WDMA Study of the U.S. Market for Windows, Doors and Skylights, Exhibits D.31 and D.32 for 2001; and AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, Exhibit D.31 and Exhibit D.32, p. 73 for 2003 and 2005.

5.5.8 Typical Thermal Performance of Residential Windows, by Type (1)

Type	U-Factor (2)	Solar Heat Gain Coefficient (2)
Single-Pane	0.93 - 1.23	0.69 - 0.84
Single-Pane, Tinted	0.90 - 1.21	0.50 - 0.61
Double-Pane	0.49 - 0.73	0.62 - 0.76
Double-Pane, Tinted	0.48 - 0.73	0.40 - 0.54
Double-Pane, Low-e, Gas-fill	0.34 - 0.42	0.48 - 0.58
Double-Pane, Spectrally Selective Low-e, Gas-fill	0.32	0.35
Triple Pane	0.38 - 0.60	0.54 - 0.68
Triple-Pane, 2 Low-e, Gas-fill	0.24	0.40

Note(s): 1) Residential windows available in 1999 had an average U-Factor of 0.47 and a Solar Heat Gain Coefficient of 0.45. 2) U-Factor and SHGC are whole-window values calculated using Windows 4.0 and standard assumptions about frame and glazing dimensions. Ranges reflect differences in frame materials and design; aluminum-frame windows are on the higher end of the ranges, while wood- and vinyl-framed windows have the lowest values.

Source(s): ACEEE, 1996 ACEEE Proceedings, The National Energy Requirements of Residential Windows in the U.S.: Today and Tomorrow, Summer 1996, p. 10.48-10.50; and NFRC, Directory of Certified Products, Dec. 1999, U-Factor Chart from www.nfrc.org for Note 1.

5.6.1 U.S. Heating and Air Conditioning System Manufacturer Shipments, by Type (Including Exports)

Equipment Type	1990 (1000s)	2000 (1000s)	2005 (1000s)	2005 Value of Shipments ($million) (6)
Air Conditioners (1)	**2,920.0**	**5,346.0**	**6,472.3**	**5,836.6**
Heat Pumps	**808.7**	**1,539.2**	**2,336.0**	**2,226.4**
Air-to-Air Heat Pumps	808.7	1,339.4	2,113.9	1,869.5
Water-Source Heat Pumps (2)	N.A.	199.8	222.0	356.9
Chillers	**N.A.**	**38.1**	**37.3**	**1,092.6**
Reciprocating	N.A.	24.8	24.1	462.1
Centrifugal/Screw	5.0	8.5	5.8	566.3
Absorption	N.A.	4.8	7.4	64.2
Furnaces	**2,368.9**	**3,680.7**	**3,623.7**	**2,143.7**
Gas-Fired (3)	1,950.5	3,104.2	3,512.5	2,081.0
Electric	280.0	455.0	N.A.	N.A.
Oil-Fired (4)	138.5	121.5	111.2	62.8
Boilers (5)	**316.1**	**368.4**	**369.7**	**N.A.**

Note(s): 1) Includes exports and gas air conditioners (gas units <10,000 units/yr) and rooftop equipment. Excludes heat pumps, packaged terminal air conditioner units, and room air conditioners. Approximately 95% of unitary air conditioners shipped are 5.5 tons or less (65,000 Btu/Hr). ~70% residential and ~30% commercial applications. 2) Includes ground-source heat pumps (GSHPs), which numbered around 80,600 units shipped in 2005. 3) Gas-fired furnace value of shipments are based on Census unit shipment data, which is about 873,500 units higher than the industry data shown. 4) Oil-fired furnace value of shipments are based on Census unit shipment data, which is approximately 33,600 units lower than the industry data shown. 5) 61% of shipments were gas-fired and 39% were oil-fired. 96% of shipments are cast iron and 4% are steel. 6) Total 2005 value of shipments for heating, ventilation, and air conditioning (HVAC) and refrigeration was $24.7 billion, including industrial and excluding boilers and electric furnaces.

Source(s): ARI, Statistical Profile, Oct. 7, 2004, Table 17, p. 24, Table 18, p. 25, and Table 22, p.30 for air conditioner, air-to-air heat pump, and 1990 centrifugal/screw chiller shipments; ARI, ARI Koldfax, Feb. 2005, p. 1 for 2004 air conditioner shipments; GAMA, GAMA Statistical Highlights: Ten Year Summary, 1987-1996; GAMA, GAMA Statistical Highlights: Ten Year Summary, 1994-2000 for furnace and boiler shipments; GAMA, GAMA News Release, Jan. 2005 for 2004 boiler shipments; GAMA, Statistical Highlights, Mar. 2005, p. 4 for 2004 furnace shipments; Appliance Manufacturer, Feb. 1998 for electric furnace; DOC, Current Industrial Reports: Refrigeration, Air Conditioning and Warm Air Heating Equipment, MA333M(06)-1, July 2007, Table 2 for water-source heat pumps, chillers, and value of shipments; Appliance Magazine Appliance Statistical Review, 54th Annual Report, May 2007, p. S1 - S4 for 2005 Boiler data; ARI Statistical News Releases 2005, http://ari.org/newsroom/stats/2005/; and GAMA News Release, Jan. 2007 for note 5.

5.6.2 Minimum Efficiency Standards and Maximum Energy Use for Typical Single-Family Residential Heating and Cooling Equipment

			Maximum Energy Use for Space Heating (2)							
			1992				2006			
	Minimum Efficiency (1)		New		Existing		New		Existing	
Heating Equipment	1992	2006	North	South	North	South	North	South	North	South
Natural Gas, Furnace	78 AFUE	78 AFUE	1170	445	1489	771	1170	445	1489	771
Oil, Boiler	80 AFUE	80 AFUE	731	N.A.	930	422	731	N.A.	930	422
Electric, Heat Pump	6.8 HSPF	7.7 HSPF	12923	4685	11232	5546	11412	4137	9919	4898

			Maximum Electricity Use for Space Cooling							
			1992				2006			
	Minimum Efficiency (3)		New		Existing		New		Existing	
Cooling Equipment	1992	2006	North	South	North	South	North	South	North	South
Central Air Conditioner	10 SEER	13 SEER	1113	2543	1000	3743	927	2119	833	3119
Electric, Heat Pump	10 SEER	13 SEER	1100	2414	813	2657	846	1857	625	2044

Note(s): 1) AFUE = Annual Fuel Utilization Efficiency. HSPF = Heating Season Performance Factor. 2) Gas use is in therms. Oil use is in gallons. Electricity use is in kWh. 3) SEER = Seasonal Energy Efficiency Ratio.

Source(s): DOC/GPO, Title 10, Chapter 2, Part 430, Section 430.32, Jan 1, 2001, p. 259 for efficiencies; LBNL, Energy Data Sourcebook for the U.S. Residential Sector, Sept. 1997, Table 3.20, p. 52-53 and Table 3.21, p. 58; and Federal Register, Energy Conservation Program for Consumer Products: Central Air Conditioners and Heat Pumps Energy Conservation Standards, Vol. 66, No. 14, Jan. 22, 2001, p. 7170 for central air conditioner and heat pump.

5.6.3 Residential Furnace Efficiencies (Percent of Units Shipped) (1)

Gas-Fired			
AFUE Range	1985	AFUE Range	2006
Below 65%	15%	75% to 88%	64%
65% to 71%	44%	88% and Over	36%
71% to 80%	10%	Total	100%
80% to 86%	19%		
Over 86%	12%		
Total	100%		

Oil-Fired	
AFUE Range	1985
Below 75%	10%
75% to 80%	56%
Over 80%	35%
Total	100%

Average shipped in 1985 (2):	74% AFUE	Average shipped in 1985 (2):	79% AFUE
Average shipped in 1995:	84% AFUE	Average shipped in 1995:	81% AFUE
Best Available in 1981:	85% AFUE	Best Available in 1981:	85% AFUE
Best Available in 2007:	97% AFUE	Best Available in 2007:	87% AFUE

Note(s): 1) Federal appliance standards effective Jan. 1, 1992, require a minimum of 78% AFUE for furnaces. 3) Includes boilers.

Source(s): GAMA's Internet Home Page for 2006 AFUE ranges; GAMA News, Feb. 24, 1987, for 1985 AFUE ranges; LBNL for average shipped AFUE; GAMA, Consumer's Directory of Certified Efficiency Ratings, May 2004, p. 12 and 72-73 for 2004 best-available AFUEs; GAMA Consumers' Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, May 2007; GAMA Tax Credit Eligible Equipment: Gas- and Oil-Fired Furnaces 95% AFUE or Greater, May 2007; and GAMA AFUE Press Release 2006: U.S. Shipments of gas warm-air central furnaces

5.6.4 Residential Boiler Efficiencies (1)

Gas-Fired Boilers		Oil-Fired Boilers	
Average shipped in 1985 (2):	74% AFUE	Average shipped in 1985 (2):	79% AFUE
Best Available in 1981:	81% AFUE	Best Available in 1981:	86% AFUE
Best Available in 2007:	96% AFUE	Best Available in 2007:	89% AFUE

Note(s): 1) Federal appliance standards effective Jan. 1, 1992, require a minimum of 80% AFUE (except gas-fired steam boiler, which must have a 75% AFUE or higher). 2) Includes furnaces.

Source(s): GAMA, Consumer's Directory of Certified Efficiency Ratings for Residential Heating and Water Heating Equipment, Aug. 2005, p. 88 and 106 for best-available AFUE; and GAMA for 1985 average AFUEs; GAMA Tax Credit Eligible Equipment: Gas- and Oil-Fired Boilers 95% AFUE or Greater, May 2007; and GAMA Consumers' Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, May 2007.

5.6.5 Residential Air Conditioner and Heat Pump Cooling Efficiencies (1)

Equipment Type	Efficiency Parameter	2004 U.S. Average New Efficiency	2005 Best-Available New Efficiency
Air Conditioners	SEER	11.2 (2)	18.9
Heat Pump - Cooling			
Air-Source	SEER	11.5 (2)	18.6
Ground-Source	EER	16.0	27.0 (3)
Heat Pump - Heating			
Air-Source	HSPF	6.8	10.6
Ground-Source	COP	3.5	4.9 (3)

Note(s): 1) Federal appliance standards effective Jan. 1, 1992, require a minimum SEER of 10. 2) 2003. 3) 2004.

Source(s): EIA/Navigant Consulting, Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2004, p. 22-27; ARI, Statistical Profile of the Air-Conditioning, Refrigeration, and Heating Industry, Oct. 2004, p. 27 for shipment-weighted SEERs; and ACEEE : The Most Energy-Efficient Appliances 2005, Apr. 2005.

5.6.6 Commercial Equipment Efficiencies

Equipment Type	Efficiency Parameter	2003 Stock Efficiency	2004 U.S. Average New Efficiency	2004 Best-Available New Efficiency
Chiller				
Reciprocating	COP	2.6	2.9	3.5
Centrifugal	COP	4.7	5.9	7.3
Gas-Fired Absorption	COP	1.0	1.0	N.A.
Gas-Fired Engine Driven	COP	1.0	2.0	N.A.
Rooftop A/C	COP	2.7	3.0	4.0
Rooftop Heat Pump	EER	9.3	10.3	11.7
Boilers				
Gas-Fired	Thermal Efficiency	76	80	90
Oil-Fired	Thermal Efficiency	79	83	89
Electric	Thermal Efficiency	98	98	98
Gas-Fired Furnace	AFUE	76	80	82 (1)
Water Heater				
Gas-Fired	Thermal Efficiency	76	80	99 (1)
Electric Resistance	Thermal Efficiency	96	98	98
Gas-Fired Instantaneous	Thermal Efficiency	76	80	89 (1)

Note(s): 1) 2007.

Source(s): EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Buildings Technologies Reference Case, Sept. 2004, p. 38-68; and GAMA Consumers' Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, May 2007.

5.6.7 2005 Air-Conditioner/Heat Pump Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
UTC/Carrier	28%
Goodman (Amana)	16%
American Standard (Trane)	15%
Lennox	12%
Rheem	11%
York	10%
Nordyne	7%
Others	2%
Total (2)	100%

Total Units Shipped: 8,607,525 (1)

Note(s): 1) Does not include water-source or ground-source heat pumps.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2.

5.6.8 2005 Gas Furnace Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
UTC/Carrier	30%
Goodman (Amana)	15%
Lennox	14%
American Standard (Trane)	13%
Rheem	11%
York	9%
Nordyne	6%
Others	2%
Total	100%

Total Units Shipped: 3,512,464

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2.

5.6.9 Major Residential HVAC Equipment Lifetimes, Ages, and Replacement Picture

Equipment Type	Typical Service Lifetime Range	Average Lifetime	1990 Average Stock Age	Units to be Replaced During 2007 (1000s)
Central Air Conditioners	**8 - 15**	**12**	**9**	**4,063**
Heat Pumps	**8 - 15**	**12**	**8**	**1,025**
Furnaces				**2,287**
Electric	10 - 20	15	11	N.A.
Gas-Fired	12 - 17	15	12	2,107
Oil-Fired	15 - 20	18	N.A.	180
Steam or Hot-Water Boilers (gas and oil)	**20 - 40**	**N.A.**	**14**	**N.A.**

Note(s): Replacement values include smaller commercial building units. Gas/oil furnaces include wall furnaces.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-5 for service and average lifetimes, and units to be replaced; ASHRAE, 1999 ASHRAE Handbook: HVAC Applications, Table 3, p. 35.3 for boilers service lifetimes; and EIA, Housing Characteristics 1990, May 1992, Table 7, p. 24 for 1990 average stock ages.

5.6.10 Major Commercial HVAC Equipment Lifetimes and Ages

Equipment Type	Median Lifetime	
Air Conditioners		
Through-the-Wall	15	
Water-Cooled Package	24	(1)
Roof-Top	15	
Chillers		
Reciprocating	20	
Centrifugal	25	(1)
Absorption	23	
Heat Pumps		
Air-to-Air	15	
Water-to-Air	24	(1)
Furnaces (gas or oil)	18	
Boilers (gas or oil)		
Hot-Water	24 - 35	
Steam	25 - 30	
Unit Heaters		
Gas-Fired or Electric	13	
Hot-Water or Steam	20	
Cooling Towers (metal or wood)		
Metal	22	(1)
Wood	20	

Note(s): 1) Data from 2005. All other data is from 1978.

Source(s): ASHRAE, 2007 ASHRAE Handbook: HVAC Applications, Table 4, p. 36.3 for median service lifetimes.

5.6.11 Main Residential Heating Fuel, by Vintage as of 2001 (Percent of Total Households)

Heating Fuel	1949 or Before	1950 to 1959	1960 to 1969	1970 to 1979	1980 to 1989	1990 to 2001
Natural Gas	68%	67%	63%	42%	41%	56%
Electricity	11%	16%	22%	45%	50%	36%
Fuel Oil	14%	13%	8%	4%	2%	2%
LPG	6%	3%	4%	4%	5%	5%
Other (1)	2%	1%	2%	4%	2%	1%
Total (2)	100%	100%	100%	100%	100%	100%

Note(s): 1) Other includes wood and kerosene.
Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table HC3-2a.

5.6.12 Main Residential Heating Equipment as of 1987, 1993, 1997, and 2001 (Percent of Total Households)

Equipment Type	1987	1993	1997	2001
Natural Gas	**55%**	**53%**	**53%**	**55%**
Central Warm-Air Furnace	35%	36%	38%	42%
Steam or Hot-Water System	10%	9%	7%	7%
Floor/Wall/Pipeless Furnace	6%	4%	4%	3%
Room Heater/Other	4%	3%	4%	3%
Electricity	**20%**	**26%**	**29%**	**29%**
Central Warm-Air Furnace	8%	10%	11%	12%
Heat Pump	5%	8%	10%	10%
Built-In Electric Units	6%	7%	7%	6%
Other	1%	1%	2%	2%
Fuel Oil	**12%**	**11%**	**9%**	**7%**
Steam or Hot-Water System	7%	6%	5%	4%
Central Warm-Air Furnace	4%	5%	4%	3%
Other	1%	0%	0%	0%
Other	**13%**	**11%**	**9%**	**8%**
Total	100%	100%	100%	100%

Note(s): Other equipment includes wood, LPG, kerosene, other fuels, and none.
Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table HC3-2a; EIA, A Look at Residential Energy Consumption in 1997, Nov. 1999, Table HC3-2a, p. 55; EIA, Housing Characteristics 1993, June 1995, Table 3.7b, p. 63; and EIA, Housing Characteristics 1987, May 1989, Table 14, p. 33.

5.6.13 Main Commercial Heating and Cooling Equipment as of 1995, 1999, and 2003 (Percent of Total Floorspace) (1)

Heating Equipment	1995	1999	2003 (2)
Packaged Heating Units	29%	38%	28%
Boilers	29%	29%	32%
Individual Space Heaters	29%	26%	19%
Furnaces	25%	21%	30%
Heat Pumps	10%	13%	14%
District Heat	10%	8%	8%
Other	11%	6%	5%

Cooling Equipment	1995	1999	2003 (2)
Packaged Air Conditioning Units	45%	54%	46%
Individual Air Conditioners	21%	21%	19%
Central Chillers	19%	19%	18%
Residential Central Air Conditioners	16%	12%	17%
Heat Pumps	12%	14%	14%
District Chilled Water	4%	4%	4%
Swamp Coolers	4%	3%	2%
Other	2%	2%	2%

Note(s): 1) Heating and cooling equipment percentages of floorspace add to over 100% since equipment shares floorspace. 2) Malls are no longer included in most CBECs tables; therefore, some data is not directly comparable to past CBECs.
Source(s): EIA, Commercial Building Characteristics 1995, Oct. 1998, Tables B34 and B36 for 1995, and EIA, Commercial Building Characteristics 1999, Aug. 2002, Tables B33 and B34 for 1999; and, EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, June 2006, Tables B39 and B41 for 2003.

5.6.14 Main Commercial Primary Energy Use of Heating and Cooling Equipment as of 1995

Heating Equipment		Cooling Equipment	
Packaged Heating Units	25%	Packaged Air Conditioning Units	54%
Boilers	21%	Room Air Conditioning	5%
Individual Space Heaters	2%	PTAC (2)	3%
Furnaces	20%	Centrifugal Chillers	14%
Heat Pumps	5%	Reciprocating Chillers	12%
District Heat	7%	Rotary Screw Chillers	3%
Unit Heater	18%	Absorption Chillers	2%
PTHP & WLHP (1)	2%	Heat Pumps	7%
	100%		100%

Note(s): 1) PTHP = Packaged Thermal Heat Pump, WLHP = Water Loop Heat Pump. 2) PTAC = Packaged Thermal Air Conditioner

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume 1: Chillers, Refrigerant Compressors, and Heating Systems, Apr. 2001, Figure 5-5, p. 5-14 for cooling and Figure 5-10, p. 5-18 for heating.

5.7.1 U.S. Commercial Buildings Conditioned Floorspace, Building Type and System Type (Million SF)

	Individual AC	Packaged	Central VAV	Central FCU	Central CAV	Not Cooled	Total
Education	805	2,204	551	466	212	3,522	7,760
Food Sales	-	534	-	-	-	20	554
Food Service	83	1,100	-	-	-	64	1,247
Health Care	134	557	401	334	802	159	2,387
Lodging	1,669	283	85	707	85	779	3,608
Mercantile and Service	333	5,820	1,081	831	249	2,507	10,821
Office	1,257	4,450	2,322	484	1,161	561	10,235
Public Buildings	371	3,337	847	-	741	2,168	7,464
Warehouse/Storage	119	1,482	-	-	102	2,285	3,988
Total	**4,771**	**19,767**	**5,287**	**2,822**	**3,352**	**12,065**	**48,064**

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, Table A2-12, p. B2-1.

5.7.2 Thermal Distribution Design Load and Electricity Intensities, by Building Activity

	Design Load Intensity (W/SF)	End Use Intensity (kWh/SF)
Education	0.5	1.3
Food Sales	1.1	6.4
Food Service	1.5	6.4
Health Care	1.5	5.6
Lodging	0.5	1.9
Mercantile and Service	0.9	2.7
Office	1.3	3.3
Public Assembly	1.2	3.0
Warehouse	0.4	1.8
All Buildings	**1.0**	**2.8**

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, Table 5-11, p. 5-27.

5.7.3 Thermal Distribution Equipment Design Load and Electricity Intensities, by System Type

	Design Load Intensity (W/SF)			End Use Intensity (kWh/SF)		
	Central VAV	Central CAV	Packaged CAV	Central VAV	Central CAV	Packaged CAV
Condenser Fan			0.3			0.2
Cooling Tower Fan	0.2	0.2		0.1	0.2	
Condenser Water Pump	0.2	0.2		0.3	0.3	
Chilled Water Pump	0.2	0.2		0.1	0.2	
Supply & Return Fans	0.7	0.5	0.6	1.2	1.9	1.9
Chiller/Compressor	1.9	1.8	3.3	1.7	2.3	4.0

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, Table 5-11 p. 5-22.

5.7.4 Typical Commercial Building Thermal Energy Distribution Design Load Intensities (Watts per SF)

Distribution System Fans		**Other**	
Central System Supply Fans	0.3 - 1.0	Cooling Tower Fan	0.1 - 0.3
Central System Return Fans	0.1 - 0.4	Air-Cooled Chiller Condenser Fan	0.6
Terminal Box Fans	0.5	Exhaust Fans (2)	0.05 - 0.3
Fan-Coil Unit Fans (1)	0.1 - 0.3	Condenser Fans	0.6
Packaged or Split System Indoor Blower	0.6		
Pumps			
Chilled Water Pump	0.1 - 0.3		
Condenser Water Pump	0.1 - 0.2		
Heating Water Pump	0.1 - 0.2		

Note(s): 1) Unducted units are lower than those with some ductwork. 2) Strong dependence on building type.

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, Table 3-1, p. 3-6.

5.7.5 Market Share of Major HVAC Equipment Manufacturers ($2005 Million)

	Total Market Size
Air Handling Units	931
Cooling Towers	480
Pumps	300
Central System Terminal Boxes	173
Classroom Unit Ventilator	144
Fan Coil Units	111

Source(s): BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, Table 4-1, p. 4-4; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

5.7.6 1999 Energy Efficient Motors, Replacements and Sales, by Horsepower Class

	Existing		Replacements	
	Units in Use	Horsepower		Energy Efficient
Horsepower Range	(1000s)	(10^6)	% Retired	Share of New Motors
1 - 5	20,784	59.6	2.5%	17%
5.1 - 20	6,927	81.8	2.0%	29%
21 - 50	2,376	78.2	1.5%	45%
51 - 100	738	59.6	1.0%	52%
101 - 200	412	56.5	0.8%	65%

Source(s): Electrical Apparatus Service Association, Past Trends and Probably Future Changes in the Electric Motor Industry 1990-1999, 2001, p. 18 for existing stock and retirements and p. 28 for energy efficient motor sales

5.7.7 1999 AC Adjustable Speed Drive Population

Horsepower Range	
1 - 5	70%
5.1 - 20	23%
21 - 50	4%
51 - 100	1%
101 - 200	1%
200 +	1%
Total	100%

Source(s): Electrical Apparatus Service Association, Past Trends and Probably Future Changes in the Electric Motor Industry 1990-1999, 2001, p. 30.

5.8.1 Solar Collector Shipments, by Type and Market (Thousand SF, unless noted) (1)

Type	1980	1990	2000	2005 (2)	2005 Value of Shipments ($million)
Solar Thermal Collectors (3)	19,398	11,409	8,354	16,041	45.9
Residential	N.A.	5,851	7,473	14,681	N.A.
Commercial	N.A.	295	810	1,160	N.A.
Industrial	N.A.	(4)	57	31	N.A.
Utility	N.A.	5,236	5	114	N.A.
Other	N.A.	26	10	56	N.A.
Photovoltaics (kW) (5)	(6) 6,897	13,837	88,221	226,916	701.7

Note(s): 1) Includes imports and exports; 2001 solar thermal collector imports were 3.5 million square feet, and exports were 0.8 million square feet. 2) Preliminary. 3) Solar thermal collectors: receive solar radiation, convert it to thermal energy, and are typically used for space heating, water heating, and heating swimming pools. 4) Industrial is included in Other. 5) Generate electricity by the conversion of solar radiation to electrical energy. 6) 1982.

Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 37 and Table 38, p. 21 and 22 for 2004-2005 collector data, Table 47, p. 31 for 2000-2005 PV shipments, and Table 50, p. 34 for PV value of shipments; EIA, Renewable Energy Annual 2001, Nov. 2002, Table 18, p. 19 for 2000 collector data; EIA, Annual Energy Review 1991, June 1992, Table 111, p. 251 for 1990 collector sector; and EIA, Annual Energy Review 2004, Aug. 2005, Table 10.5, p. 291 for 1980-1990 PV shipments.

5.8.2 Thermal Solar Collector Shipments, by End Use (including imports and exports) (Thousand SF) (1)

Type	2000	2003	2004	2005 (2)
Pool Heating	7,863	10,800	13,634	15,041
Hot Water	367	511	452	640
Space Heating	99	76	13	228
Space Cooling	-	-	-	2
Combined Space/Water Heating	2	23	16	16
Process Heating	20	34	-	-
Electricity Generation	3	-	-	114
Total (3)	**8,354**	**11,444**	**14,114**	**16,041**

Note(s): 1) 5.8% of shipments are exported. 2) Approximately 51,000 systems in 2005.

Source(s): EIA, Renewable Energy Annual 2001, Nov. 2002, Table 18, p. 19 for 2000; EIA, Renewable Energy Annual 2003, June 2005, Table 18, p. 10 for 2003; and EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 38, p. 22 for 2004-2005, Table 30, p. 14 for Note 1, and Table 39, p. 23 for Note 2.

5.8.3 2005 Top Five Destinations of Thermal Solar Collector Shipments

State	Percent of U.S. Unit Shipments
New Jersey	32%
California	31%
Florida	6%
Tennessee	1%
Arizona	1%

Source(s): EIA, Renewable Energy Annual 2005, July 2007, Table 32, p. 16.

5.8.4 Thermal Solar Collector Manufacturer Statistics (1)

- Number of Manufacturers in 2005: 21
- Percentage of Shipped Solar Collectors Produced by Top 5 Manufacturers: 92%
- Percentage of Shipped Solar Collectors Produced by Top 10 Manufacturers: 98%

Note(s): 1) Preliminary.

Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 41, p. 25.

5.8.5 Shipments of Photovoltaic Cells and Modules, by Market (Peak Kilowatts) (1)

Market	1995	2000	2003	2004	2005 (2)
Industrial	7,198	28,808	27,951	30,493	22,199
Residential	6,272	24,814	23,389	53,928	75,040
Commercial	8,100	13,692	32,604	74,509	89,459
Transportation	2,383	5,502	11,089	1,380	1,621
Utility	3,759	6,298	8,474	3,233	143
Government	2,000	4,417	5,538	3,257	28,683
Other	1,347	4,690	313	14,316	9,772
Total	**31,059**	**88,221**	**109,357** (3)	**181,116**	**226,916**

Note(s): 1) Includes imports and exports. 2) Preliminary. 3) Due to rounding, sum does not equal total.

Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 51, p. 35; EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2003, Sept. 2004, Table 30, p.14; 'EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2001, Nov. 2002, Table 30, p. 23; and EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 1997, Feb. 1998, Table 29, p. 31.

5.8.6 Annual Shipments of Photovoltaic Cells and Modules (Peak Kilowatts)

Year	Number of Companies	Domestic	Exports	Total
1995	24	11,188	19,871	31,059
1996	25	13,016	22,448	35,464
1997	21	12,561	33,793	46,354
1998	21	15,069	35,493	50,562
1999	19	21,225	55,562	76,787
2000	21	19,838	68,382	88,220
2001	19	36,310	61,356	97,666
2002	19	45,313	66,778	112,091
2003	20	48,664	60,693	109,357
2004	19	78,346	102,770	181,116
2005 (1)	29	134,465	92,451	226,916

Note(s): 1) Preliminary.

Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2004, Nov. 2005, Table 45 and Table 47, p. 23 and p.25 for 1995 data; and EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 45 and Table 47, p. 29 and p.31 for 1996-2005 data.

5.8.7 2005 Top 5 Destinations of U.S. Photovoltaic Cell and Module Export Shipments, by Country

Country	Peak Kilowatts	Percent of U.S. Exports
Germany	49,250	53%
Netherlands	11,997	13%
Singapore	8,560	9%
Canada	3,227	3%
Hong Kong	2,935	3%
All Countries	**92,451**	100%

Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 53, p. 37.

5.9.1 2001 Total Lighting Technology Electricity Consumption, by Sector (Billion kWh per Year) (1)

	Residential		Commercial		Industrial		Other (2)		Total	
Incandescent										
Standard	176	87%	103	26%	2	2%	5	10%	287	38%
Halogen	6	3%	21	5%	0	0%	1	2%	28	4%
Fluorescent										
T5	N.A.		0	0%	0	0%	N.A.		0	0%
T8	N.A.		50	13%	23	21%	0	0%	72	10%
T12	N.A.		157	40%	49	45%	0	0%	206	27%
Compact	1	1%	13	3%	1	1%	N.A.		14	2%
Miscellaneous	18	9%	0	0%	0	0%	1	1%	19	3%
HID										
Mercury Vapor	1	0%	7	2%	3	3%	12	21%	22	3%
Metal Halide	N.A.		34	9%	25	23%	4	7%	62	8%
HP Sodium	0	0%	6	1%	5	5%	30	54%	41	5%
LP Sodium	N.A.		0	0%	0	0%	3	5%	3	0%
Total (3)	**202**	100%	**391**	100%	**108**	100%	**56**	100%	**756**	100%

Note(s): 1) Lumens-hour is a measure of lighting output; Watt-hour is a measure of electrical input for lighting. A value of zero indicates less than 0.5 billion kWh/year. 2) Includes stationary aviation, billboard, and traffic and street lighting. 3) Lighting consumed 756 10^9 kWh of energy in 2001. This amount is equivalent to 99% of the energy generated by all 104 nuclear power plants in the same year.

Source(s): BTS/Navigant Consulting, U.S. Lighting Market Characterization Phase I National Lighting Inventory and Energy Consumption Estimate, July 2002; EIA, Annual Energy Review 2003, Table 9.2 Nuclear Power Plant Operations, p. 271, for note 3.

5.9.2 2001 Total Lighting Technology Light Output, by Sector (Trillion Lumen-hour per Year)(1)

	Residential		Commercial		Industrial		Other (2)		Total	
Incandescent										
Standard	2,504	66%	1,384	6%	22	0%	87	2%	3,997	10%
Halogen	102	3%	392	2%	13	0%	23	0%	530	1%
Fluorescent										
T5	N.A.		13	0%	0	0%	N.A.		13	0%
T8	N.A.		4,208	20%	1,925	24%	1	0%	6,134	16%
T12	N.A.		11,752	54%	3,781	47%	2	0%	15,535	41%
Compact	57	1%	735	3%	35	0%	N.A.		827	2%
Miscellaneous	1,103	29%	24	0%	3	0%	39	1%	1,169	3%
HID										
Mercury Vapo	23	1%	261	1%	149	2%	532	11%	965	3%
Metal Halide	N.A.		2,202	10%	1,605	20%	249	5%	4,055	11%
HP Sodium	8	0%	587	3%	562	7%	3,381	72%	4,539	12%
LP Sodium	N.A.		18	0%	4	0%	408	9%	430	1%
Total	**3,797**	100%	**21,574**	100%	**8,100**	100%	**4,722**	100%	**38,194**	100%

Note(s): 1) Lumens-hour is a measure of lighting output; Watt-hour is a measure of electrical input for lighting. A value of zero indicates less than 0.5 billion kWh/year. 2) Includes stationary aviation, billboard, and traffic and street lighting.

Source(s): BTS/Navigant Consulting, U.S. Lighting Market Characterization Phase I National Lighting Inventory and Energy Consumption Estimate, July 2002.

5.9.3 2001 Lamp Wattage, Number of Lamps, and Hours of Usage (Weighted Average)

	Lamp Wattage (Watts per lamp)				Number of Lamps per Building				Hours of Usage per Day			
	Res	Com	Ind	Other (1)	Res	Com	Ind		Res	Com	Ind	Other
Incandescent												
Standard	66	88	115	115	37	70	12		2	9	14	8
Halogen	202	102	447	167	0	12	1		2	10	14	8
Fluorescent												
T5	N.A.	8	10	N.A.	N.A.	1	0	(2)	N.A.	13	18	N.A.
T8	N.A.	32	30	105	N.A.	93	671		N.A.	10	13	7
T12	N.A.	51	66	190	N.A.	191	646		N.A.	10	13	7
CFL	17	19	27	N.A.	1	32	13		2	11	14	N.A.
Miscellaneous	41	18	34	83	6	1	2		2	10	11	11
HID												
Mercury Vapor	179	331	409	239	0	1	8		3	10	12	11
Metal Halide	N.A.	472	438	23	N.A.	4	47		N.A.	10	14	10
HP Sodium	79	260	394	216	0	1	12		3	10	13	11
LP Sodium	N.A.	104	90	180	N.A.	0	0		N.A.	10	12	12

Note(s): 1) Other includes stationary aviation, billboard, and traffic and street lighting. 2) A value of zero indicates less than 0.5.
Source(s): BTS/Navigant Consulting, U.S. Lighting Market Characterization Phase I National Lighting Inventory and Energy Consumption Estimate, July 2002.

5.9.4 1995 Lighting Energy Intensities, by Commercial Building Type

Building Type	Percent of Total Lighted Floorspace	Percent of Total Annual Lighting Energy	Annual Lighting End-Use Intensity per Total Lighted Floorspace (kWh/SF)
Education	13.6%	10.1%	4.6
Food Sales	1.1%	1.8%	9.9
Food Service	2.4%	4.2%	10.8
Health Care	4.1%	7.7%	11.5
Lodging	6.4%	7.0%	6.8
Mercantile and Service	22.4%	24.8%	6.9
Office	18.6%	24.5%	8.2
Public Assembly	7.0%	7.2%	6.4
Public Order and Safety	2.3%	1.7%	4.8
Warehouse and Storage	14.0%	6.9%	2.9
Other	1.8%	2.2%	7.8
Vacant	6.2%	1.9%	1.3
Total	100%	100%	

Note(s): Total lighted floorspace in 1995 was 56.3 billion square feet. Total lighted floorspace for 1999 was 67.3 billion square feet.
Source(s): EIA, A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures, Oct. 1998, Table BC-40, p. 187, Table EU-1, p. 306-310, and Table EU-2, p. 311-315.

5.9.5 2003 Lighted Floorspace for the Stock of Commercial Buildings, by Type of Lamp (1)

Total Lighted Floorspace: 62.06 Billion SF

Type of Lamp	Lighted Floorspace (Billion SF) (2)	Percent of Lighted Floorspace
Standard Fluorescent	59.7	96%
Incandescent	38.5	62%
Compact Fluorescent	27.6	44%
High-Intensity-Discharge	20.6	33%
Halogen	17.7	29%

Note(s): 1) Mall buildings are no longer included in most CBECs tables; therefore, some data are not directly comparable to past CBECs.
2) The percentages of lighted floorspace total more than 100% since most floorspace is lighted by more than one type of lamp.
Source(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Building Characteristics Tables, June 2006, Table B44, p. 220.

5.9.6 Value of Electric Lighting Fixture Shipments ($Million)

Lighting Fixture Type	1985	1990	1995	2000	2001
Residential	786.8	827.6	983.8	1,296.5	983.9
Commercial/Institutional (except spotlight)	1,832.3	2,379.7	2,797.3	3,506.7	3,239.1
Industrial	389.2	529.4	676.3	718.3	628.1
Vehicular (1)	1,001.2	1,620.7	N.A.	N.A.	N.A.
Outdoor	905.5	1,061.5	1,473.0	1,957.4	1,923.2

Note(s): 1) Data for vehicular lighting fixtures was discontinued in 1992.

Source(s): DOC, Electric Lighting Fixtures MA 335L(01)-1, Jan. 2003 for 2000 and 2001; DOC, Current Industrial Reports: Electric Lighting Fixtures, MA335L(99)-1, Dec. 2000, Table 1 for 1990-1999; and DOC, Current Industrial Reports: Electric Lighting Fixtures, MA36L, Oct. 1995, Table 1 for 1985.

5.9.7 Shipments of Fluorescent Lamp Ballasts

	Standard Magnetic Type (1)		Electronic Type		Total		
Year	Quantity (million)	Value ($million)	Quantity (million)	Value ($million)	Quantity (million)	Value ($million)	Electronic Type as a % of Total Units Shipped
1985	70.1	398.9	N.A	N.A.	70.1	398.9	N.A.
1986	69.4	396.1	0.4	11.8	69.8	407.9	1%
1988	74.6	450.9	1.1	25.5	75.7	476.4	1%
1990	78.4	546.3	3.0	69.3	81.4	615.6	4%
1992	83.7	537.7	13.3	274.6	97.0	812.3	14%
1994	83.5	550.0	24.6	390.8	108.1	940.7	23%
1996	67.0	457.8	30.3	451.4	97.3	909.2	31%
1998	63.9	401.4	39.8	512.8	103.7	914.3	38%
2000	55.4	343.0	49.3	555.5	104.8	898.5	47%
2001	46.9	297.1	52.5	580.3	99.4	877.4	53%
2002	40.7	263.3	53.8	573.1	94.5	836.4	57%
2003	35.2	231.8	54.4	557.2	89.7	789.0	61%
2004	30.5	218.4	59.2	579.4	89.7	797.8	66%
2005	22.2	175.1	61.3	594.6	83.5	769.8	73%

Note(s): 1) Standard magnetic type includes uncorrected and corrected power-factor type ballasts.

Source(s): DOC Current Industrial Reports: Fluorescent Lamp Ballasts, MQ335C(05)-5, July 2006 for 2000-2005; DOC, Current Industrial Reports: Fluorescent Lamp Ballasts MQ36C(99)-5, July 2000, Table 1 for 1990-1999; and DOC, Current Industrial Reports: Fluorescent Lamp Ballasts, MQ36C(95), 1996, Table 1 for 1985-1989.

5.9.8 Typical Efficacies and Lifetimes of Lamps (1)

Current Technology	Efficacy (lumens/Watt)	Typical Rated Lifetime (hours)	CRI (2)
Incandescent	10 - 19	750 - 2,500	97
Halogen	14 - 20	2,000 - 3,500	99
Fluorescent - T5	25 - 55	6,000 - 7,500	52 - 75
Fluorescent - T8	35 - 87	7,500 - 20,000	52 - 90
Fluorescent - T12	35 - 92	7,500 - 20,000	50 - 92
Compact Fluorescent	40 - 70	10,000	82
Mercury Vapor	25 - 50	29,000	15 - 50
Metal Halide	50 - 115	30,00 - 20,000	65 - 70
High Pressure Sodium	50 - 124	29,000	22
Low Pressure Sodium	18 - 180	18,000	0
Solid State Lighting	(3)	(4)	70-80

Note(s): 1) Theoretical maximum luminous efficacy of white light is 220 lumens/Watt. 2) CRI = Color Rendition Index, which indicates a lamp's ability to show natural colors. 3) The DOE Solid State Lighting program has set an efficacy goal twice that of fluorescent lights (160 lumen per Watt). 4) Has not been determined.

Source(s): DOE, EERE, Building Technology Program/Navigant Consulting, U.S. Lighting Market Characterization, Volume I: National Lighting Inventory and Energy Consumption Estimate, Sept. 2002, Appendix A, p. 74; DOE/Navigant Consulting, Solid State Lighting Research and Development Portfolio, Mar. 2006, p 55.

5.10.1 Refrigeration System Shipments, by Type (Including Exports)

Appliance Type	1990 (1000s)	2000 (1000s)	2005 (1000s)	2005 Value of Shipments ($million)
Refrigerator-Freezers (1)	7,317	9,462	10,665	5,405
Freezers (chest and upright)	1,328	2,007	2,274	N.A.
Refrigerated Display Cases	359	347	177	N.A.
Unit Coolers	178	207	209	155
Ice-Making Machines	171	385	373	648
Water Cooler	253	348	300 (2)	N.A.
Beverage Vending Machine	229	353	N.A.	N.A.

Note(s): 1) Does not include commercial products value. 2) 2004.

Source(s): Appliance Magazine, 54th Annual Statistical Review, May 2007, p. S1-S4 for refrigerator, freezer, refrigerated display cases, water cooler, and beverage vending machines shipments; The Air Conditioning, Heating and Refrigeration News, Nov. 11, 1995, p. 19 for 1990 unit cooler and ice-making machine shipments; DOC, Current Industrial Reports: Refrigeration, Air Conditioning, and Warm Air Heating Equipment, MA333M(06)-1, July 2007, for 2005 refrigerator-freezer, unit cooler, and ice-making machine data and value of shipments; and AHAM Factbook 2005: A Statistical Overview of the Home Appliance Industry, Table 7, p. 223; and DOC, Current Industrial Reports: Major Household Appliances, MA335f(06)-1, June 2007, Table 2 for 2005 refrigerator-freezer and water cooler data and value of shipments.

5.10.2 Other Major Appliance Shipments, by Type (Including Exports)

Appliance Type	1990 (1000)	2000 (1000)	2005 (1000)	2005 Value of Shipments (5) ($million)
Room Air Conditioners	**3,799**	**6,496**	**8,024**	**1,050**
Ranges (total)	**5,873**	**8,202**	**9,963**	**4,491**
Electric Ranges	3,350	5,026	6,201	2,753
Gas Ranges	2,354	3,176	3,762	1,738
Microwave Ovens/Ranges	**7,693**	**12,644**	**13,862**	**1,377**
Clothes Washers	**5,591**	**7,495**	**9,394**	**3,373**
Clothes Dryers (total)	**4,160**	**6,575**	**8,114**	**2,486**
Electric Dryers	3,190	5,095	6,408	N.A.
Gas Dryers	970	1,480	1,706	N.A.
Water Heaters (total)	**7,252**	**9,329**	**9,455**	**1,609**
Electric (1,2)	3,246	4,299	4,572	638
Gas and Oil (2)	4,005	5,006	4,884	970
Solar (3)	N.A.	24	N.A.	N.A.
Office Equipment				
Personal Computers (4)	N.A.	47,168	59,259	33,028
Copiers	N.A.	1,989	2,013	N.A.
Printers	N.A.	27,945	19,232	1,614
Scanners	N.A.	9,400	N.A.	238

Note(s): 1) Sales of heat pump water heaters were less than 2,000 units in 1994, down from its peak of 8,000 in 1985. 2) Includes residential and small commercial units. 3) Shipments and value of shipments of entire systems. 4) Includes workstations, laptops, and notebooks. 5) Value of shipments are based on Census unit shipment data, which is about 31 million units lower than industry data shown.

Source(s): AHAM, AHAM Fact Book 2000, 2000, Tables 7 and 8, for 1990 data except water heaters; AHAM, AHAM 2005 Fact Book, 2006, Table 7 for 2000-2005 shipments and Table 6, p. 19 for value of shipments of ranges, microwave ovens, laundry equipment, and room air conditioners; GAMA, Statistical Highlights: Ten Year Summary, 1987-1996; GAMA, Statistical Highlights: Ten Year Summary, 1994- 2003 for water heater shipments; GAMA, Statistical Highlights, Dec. 2006 for 2005 water heater shipments; DOC, Current Industrial Reports: Major Household Appliances, MA335F(02)-1, July 2003, Table 2 for value of water heater shipments; EIA, 2000 Solar Thermal and Photovoltaic Collector Manufacturing Activities, July 2001, Table 17, p. 20 for solar water heater data; BTS/OBE, Market Disposition of High-Efficiency Water Heating Equipment, Nov. 1996, p. I-8 for HPWH note; DOC, Current Industrial Reports: Computers and Office and Accounting Machines, MA334R(05)-1, Aug. 2006, Table 2 for value of computer shipments; Appliance, 52nd Annual Statistical Review, May 2005, p. S1-S4 for office equipment shipments; and DOC, Current Industrial Reports: Major Household Appliances, MA335f(06)-1, June 2007, Table 2 for 2005 water heater value of shipments.

5.10.3 Minimum Efficiency Standards for Appliances and Equipment

Refrigerator-Freezers (Auto Defrost) (1)	Adjusted Volume (2) (Cu. Ft.)	Rated Maximum Electricity Use (kWh) 1990	1993	2001
Top freezer w/o through-the-door ice service and all-refrigerators—auto defrost	21	955	685	478
Side freezer w/o through-the-door ice service	25	1,183	797	631
Bottom freezer w/o through-the-door ice service	25	1,183	781	574
Top freezer w/ through-the-door ice service	18	1,015	711	542
Side freezer w/ through-the-door ice service	29	1,428	992	694

Freezers (1)	Adjusted Volume (2) (Cu. Ft.)	Rated Maximum Electricity Use (kWh) 1990	1993	2001
Upright Freezers w/ Manual Defrost	25.7	702	529	452
Upright Freezers w/ Automatic Defrost	30.0	1,103	838	699
Chest Freezers and all other Freezers except Compact Freezers	24.8	590	433	389

Room Air-Conditioners (3)	Minimum EER	Typical Maximum Electricity Use (kWh) (4)
Less than 6,000 Btu/h	9.7	464
6,000 to 7,999 Btu/h	9.7	541
8,000 to 13,999 Btu/h	9.8	842
14,000 to 19,999 Btu/h	9.7	1,314
20,000 Btu/h or more	8.5	1,765

Clothes Dryers (3)	Minimum EF (lbs./kWh)	Typical Maximum Energy Use
Electric, Standard	3.01	835 kWh
Gas	2.67	32 therms

Clothes Washers (3)	Minimum EF (cu. Ft./kWh per cycle) 1994	Minimum Modified EF (cu. Ft./kWh per cycle) 2004	2007	Typical Maximum Electricity Use (kWh) (5)
Top Loading, Standard	1.18	1.04	1.26	1,265
Horizontal-Axis	N.A.	1.04	1.26	731

Dishwashers (3)	Minimum EF (cycles/kWh)	Typical Maximum Electricity Use (kWh)
Standard Dishwasher	0.46	498

Water Heaters (6)	Minimum EF (7) 1990	1991	2004	Typical Maximum Energy Use 1990	1991	2004
Gas-Fired	0.54	0.54	0.59	208 therms	208 therms	191 therms
Oil-Fired	0.51	0.51	0.51	155 gallons	155 gallons	155 gallons
Electric Resistance	0.90	0.88	0.92	3456 kWh	3534 kWh	3380 kWh

Note(s): 1) DOE regulations mandate maximum electrical consumption for appliance based on its size. 2) AV = Adjusted Volume = Refrigerator Compartment + 1.63 * Freezer Compartment. 3) DOE regulations mandate minimum efficiency for appliance. 4) Electric use based on 750 hours of operation. 5) Includes electricity for water heater and clothes dryer. 6) DOE regulations mandate minimum efficiency for appliance based on its size. 7) Based on a 40-gallon tank.

Source(s): DOC/GPO, 2001 CFR, Title 10, Chapter 2, Part 430, Section 430.32, Jan. 1, 2001, p. 258-264 for minimum efficiencies; AHAM, 2000 Major Home Appliance Industry Factbook, Nov. 2000, Table 21, p. 28, for refrigerator and freezer sizes; DOE/EE, Final Rule Technical Support Document: Energy Efficiency Standards for Consumer Products: Clothes Washers, Dec. 2000, p. 10-8; LBNL, Energy Data Sourcebook for U.S. Residential Sector, May 1997, p. 102-103 for clothes dryers, p. 94 for dishwashers; DOE/EE, Technical Support Document: Energy Efficiency Standards for Consumer Products: Water Heaters, Apr. 2000, p. 9-14.

5.10.4 Refrigerator-Freezer Sizes and Energy Factors (Shipment-Weighted Averages)

	Average Volume (cu. ft.)	Consumption/Unit (kWh/yr)	Best-Available (kWh/yr)
1972	18.2	1,726	N.A.
1980	19.6	1,278	N.A.
1985	19.5	1,058	N.A.
1990	20.5	916	N.A.
1991	19.8	857	761
1992	19.8	821	N.A.
1993	20.1	660	631
1994	20.0	653	592
1995	20.0	649	555
1996	20.3	661	524
1997	20.4	669	524
1998	N.A.	N.A.	524
1999	20.6	690	559
2000	21.9	704	523
2001	21.9	565	438
2002	22.2	520	428
2003	22.3	514	428
2004	21.5	500	402

Note(s): The average stock energy uses for refrigerator-freezers was 1,220 kWh/yr in 1990, 1,319 kWh/yr in 1997, and 1,462 kWh/yr in 2001.

Source(s): AHAM, 2000 Major Home Appliance Industry Fact Book, 2000, Table 25, p. 30 for 1972-1985; AHAM, 2005 AHAM Fact Book, 2006, Table 17, p. 40 for 1990-2004; AHAM, 1991, 1993-1999 Directory of Certified Refrigerators and Freezers for 1993-1999 best-available data (at 19.6 or more cu. ft.); LBNL, Center for Building Science News, Summer 1995, p. 6 for 1990 portion of note; EIA, A Look at Residential Energy Consumption in 2001; Apr. 2004, Table CE5-1c for 2001 portion of note; EIA, A Look at Residential Energy Consumption in 1997, Nov. 1999, Table CE5-2c, p. 205 for 1997 portion of note; and ENERGY STAR certified products lists for 2001-2004 best available, http://www.energystar.gov/ia/products/prod_lists/appliances_prod_list.xls.

5.10.5 Room Air Conditioner Capacities and Energy Efficiencies (Shipment-Weighted Averages)

	Average Capacity (Btu/hr)	EER	Best-Available (EER)
1972	10,227	5.98	N.A.
1980	10,607	7.02	N.A.
1985	10,287	7.70	N.A.
1990	10,034	8.73	N.A.
1991	10,846	8.80	N.A.
1992	10,100	8.88	N.A.
1993	10,264	9.05	N.A.
1994	10,087	8.97	12.0
1995	10,099	9.03	12.0
1996	9,928	9.08	12.0
1997	10,015	9.09	12.0
1998	N.A.	N.A.	11.7
1999	9,596	9.07	11.7
2000	9,739	9.30	11.7
2001	9,874	9.63	11.7
2002	9,800	9.75	11.7
2003	9,203	9.75	11.7
2004	9,735	9.71	11.7

Source(s): AHAM, 1997 Major Appliance Industry Fact Book, Oct. 1997, Table 27, p. 32 for 1972; AHAM, AHAM 2003 Fact Book, 2003, Table 25, p. 45 for 1980-1985 average capacity and EER; AHAM, AHAM 2005 Fact Book, 2006, Table 19, p. 42 for 1990-2004 average capacity and EER; AHAM, 1994-1999 Directory of Certified Room Air Conditioners, Mar. 2000 for 1994-2000 best available; and ENERGY STAR certified products lists for 2001-2004 best available, http://www.energystar.gov/ia/products/prod_lists/appliances_prod_list.xls.

5.10.6 Water Heater Efficiencies

Residential Type	Efficiency Parameter (1)	2005 Stock Efficiency	Minimum New Efficiency (2)	2005 Best-Available New Efficiency
Electric Storage	EF	0.88	0.92	0.95
Electric Instantaneous	EF	(3)	0.93	0.99
Electric Heat Pump	EF	(3)	0.92	2.28
Gas-Fired Storage	EF	0.56	0.59	0.65
Gas-Fired Instantaneous	EF	(3)	0.54	0.85
Oil-Fired Storage	EF	0.55	0.51	0.68
Solar	SEF	N.A.	0.80	4.80
Commercial Type				
Electric Storage	Thermal Efficiency	98%	98%	98%
Gas-Fired Storage	Thermal Efficiency	82%	80%	94%
Oil-Fired Storage	Thermal Efficiency	77%	78%	82%

Note(s): 1) EF = energy factor and SEF = solar energy factor, which is the hot water energy delivered by the solar system divided by the electric or gas energy input to the system. 2) Based on a 40-gallon residential type tank. 3) Included in storage stock efficiency.

Source(s): EIA, Supplement to the AEO 2007, Feb. 2007, Table 21 and Table 22 for stock efficiencies; GAMA, Consumer's Directory of Certified Efficiency Ratings for the Residential and Water Heating Equipment, Aug. 2005 for best-available efficiencies and minimum efficiencies; and SRCC, Summary of SRCC Certified Solar Collector and Water Heating System Ratings, Apr. 2000, p. S16 - S20 for SEFs, Table 2.2, p. 4.

5.10.7 Other Major Appliance Efficiencies

Residential Appliance Type	Efficiency Parameter (1)	2003 Stock Efficiency	2004 U.S. Average New Efficiency	2005 Best Available New Efficiency
Dishwashers	EF	0.40	0.60	1.50
Clothes Washers (2)	MEF	0.92	1.35	2.66

Commercial Appliance Type	Efficiency Parameter (1)	2005 Stock Efficiency	U.S. Average New Efficiency	2001 Best Available New Efficiency	
Cooking Equipment:					
Electric Appliances	EF	0.71			
Gas Appliances	EF	0.51			
Laundry Equipment:					
Electric Drying	EF/COP			0.98	(3)
Gas Drying	EF			0.36	(3)
Motors	EF			0.65	(3)
Office Equipment:					
Linear Power Supplies	EF			0.30 - 0.60	(3)
Switching Power Supplies	EF			0.80 - 0.95	(3)
Motors	EF			0.60 - 0.70	(3)

Note(s): 1) EF = Energy Factor. MEF = Modified Energy Factor. COP = Coefficient of Performance. 2) EF does not include remaining moisture content (RMC) of clothes. MEF includes RMC which shows how much the clothes dryer will be needed. 3) 1992.

Source(s): AHAM, AHAM 2005 Fact Book, 2006, Tables 21, p. 44 and Table 22, p. 45 for residential efficiencies; DOE/EPA, Energy Star Appliances, www.energystar.gov, Aug. 2005 for best-available dishwashers and clothes washers; EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2004, p. 34-37 for residential stock; EIA, Supplement to the AEO 2006, Feb. 2006, Table 22 for average cooking efficiency; and BTS/OBE, Characterization of Commercial Building Appliances, Aug. 1993 for commercial efficiencies.

5.10.8 2005 Room Air Conditioner Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
LG Electronics (Goldstar)	30%
Fedders	14%
Electrolux (Frigidaire)	14%
Whirlpool	14%
Haier	5%
Samsung	5%
Sharp	4%
Matsushita	2%
Friedrich	4%
Others	8%
Total	100%

Total Units Shipped: 8,032,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2.

5.10.9 2005 Refrigerator Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
GE	29%
Electrolux (Frigidaire)	25%
Whirlpool	25%
Maytag (Admiral)	11%
Haier	2%
W.C. Wood	1%
Others	7%
Total	100%

Total Units Shipped: 11,134,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-3.

5.10.10 2005 Range Manufacturer Market Shares (Percent of Products Produced)

Company	Electric Market Share (%)	Gas Market Share (%)
GE	49%	37%
Whirlpool	23%	11%
Maytag	10%	17%
Electrolux (Frigidaire)	10%	25%
Peerless Premier	4%	6%
Others	4%	4%
Total	100%	100%

Total Electric Units Shipped: 6,194,000

Total Gas Units Shipped: 3,756,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2.

5.10.11 2005 Microwave Oven Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
LG Electronics (Goldstar)	35%
Sharp	20%
Samsung	12%
Daewoo	9%
Matsushita	8%
Whirlpool	4%
Galanz	3%
Midea	2%
Others	7%
Total	100%

Total Units Shipped: 14,081,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-3.

5.10.12 2005 Clothes Washer Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
Whirlpool	51%
Maytag	19%
GE	17%
Electrolux (Frigidaire)	9%
Others	4%
Total	100%

Total Units Shipped: 9,225,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-3.

5.10.13 Sales of ENERGY STAR Labeled Appliances, by Year (1000s) and Percent of Total Sales

	Room Air Conditioners		Refrigerators		Clothes Washer		Dishwashers	
	ENERGY STAR	% of Total	ENERGY STAR	% of Total	ENERGY STAR	% of Total	ENERGY STAR	% of Total
1997	474	12%	2,008	25%	226	4%	265	6%
1998	589	13%	1,705	19%	392	6%	955	19%
1999	835	13%	2,218	24%	624	9%	664	12%
2000	1,230	19%	2,489	27%	697	9%	595	11%
2001	642 (1)	12%	1,610 (2)	17%	758	10%	1,119	20%
2002	2,195	36%	1,956	20%	1,262	16%	2,262	36%
2003	2,369	29%	2,570	26%	1,879	23%	1,290	20%
2004	2,859	35%	3,625	33%	2,405	27%	5,437	78%
2005	4,186	52%	3,667	33%	3,362	36%	5,980	82%
2006	3,634	36%	3,452	31%	3,603	38%	6,571	92%

Note(s): 1) On Oct. 1, 2000, ENERGY STAR room air conditioner criteria changed to 10% more efficient than the 2000 federal standard.
2) On Jan. 1, 2001, ENERGY STAR refrigerator criteria changed to 10% more efficient than the 2001 federal standard.

Source(s): Appliance Magazine, US Appliance Industry Shipment Statistics: Factory Unit Shipments for Dec. 2004, May 2005, May 2007, p.S-1 to S-4 for 2004 sales data; and D&R International, Resources for Appliance Manufacturers and Retailers, www.energystar.gov, Mar. 2005, June 2006, May 2007.

5.10.14 2005 Clothes Dryer Manufacturer Market Shares (Percent of Products Produced)

Company	Electric Market Share (%)	Gas Market Share (%)
Whirlpool	56%	55%
Maytag	18%	25%
GE	14%	11%
Electrolux (Frigidaire)	10%	7%
Others	2%	3%
Total	100%	100%

Total Electric Units Shipped: 6,451,000

Total Gas Units Shipped: 1,707,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-3.

5.10.15 2005 Water Heater Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
Rheem Manufacturing	39%
A.O. Smith/State Industries	26%
American Water Heater	19%
Bradford-White	15%
Others	1%
Total	100%

Total Units Shipped: 9,319,786

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-3.

5.10.16 2005 Facsimile and Copier Machine Manufacturer Market Shares (Percent of Products Produced)

Company	Facsimile Machine Market Share (%)	Copier Market Share (%)
Hewlett-Packard	33%	10%
Brother	22%	-
Panasonic Panafax	17%	-
Sharp	11%	9%
Lexmark	8%	-
Canon	4%	26%
Xerox	1%	9%
Ricoh	-	8%
Others	4%	38%
Total	100%	100%

Total Facsimile Machine Units Shipped: 3,838,000

Total Copier Units Shipped: 2,013,000

Note(s): In 2004, 95% of facsimile machines sales were ENERGY STAR compliant and 90% are estimated to remain ENERGY STAR enabled.
In 2004, 90% of copier machine sales were ENERGY STAR compliant and 34% are estimated to remain ENERGY STAR enabled.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2; and EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2004, p. 70 for note.

5.10.17 2005 Personal Computer Manufacturer Market Shares (Percent of Products Produced)

Company	Desktop Computer Market Share (%)	Portable Computer Market Share (%)
Dell	35%	31%
Hewlett-Packard	20%	18%
Gateway	7%	-
Levono (IBM)	2%	5%
Apple	3%	6%
Toshiba	-	11%
Others	33%	29%
Total	100%	100%

Total Desktop Computer Units Shipped: 39,698,000

Total Portable Computer Units Shipped: 19,551,000

Note(s): In 2004, 80% of desktop computer sales were ENERGY STAR compliant and 25% are estimated to remain ENERGY STAR enabled.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2; and EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2004, p. 70 for note.

5.10.18 2005 Printer Manufacturer Market Shares (Percent of Products Produced)

Company	Ink Jet Printer Market Share (%)	Laser Printer Market Share (%)	Dot Matrix Market Share (%)
Hewlett-Packard	39%	56%	-
Lexmark	18%	7%	10%
Epson	12%	-	23%
Canon	14%	-	-
Dell	18%	12%	
Samsung	-	4%	-
Brother	-	6%	-
Konica-Minolta	-	5%	-
Okidata	-	-	49%
Panasonic	-	-	6%
Genicom (Tally)	-	-	6%
Others	-	10%	6%
Total	100%	100%	100%

Total Ink Jet Units Shipped: 14,463,000

Total Laser Units Shipped: 4,477,000

Total Dot Matrix Units Shipped: 292,000

Note(s): In 2004, 99% of laser printer sales were ENERGY STAR compliant and 47% are estimated to remain ENERGY STAR enabled.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2006, p. P-2; and EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2004, p. 70 for note.

5.10.19 Major Residential and Small Commercial Appliance Lifetimes, Ages, and Replacement Picture

Appliance Type	Typical Service Lifetime Range (years)	Average Lifetime (years)	2001 Average Stock Age (years)	Units to be Replaced During 2007 (1000s)
Refrigerators (1)	10 - 18	14	8	8,109
Freezers	8 - 16	12	12	1,691
Room Air Conditioners	7 - 13	10	8	3,836
Microwave Ovens	7 - 10	9	N.A.	10,895
Ranges (2)				
Electric	12 - 19	16	N.A.	3,459
Gas	14 - 22	18	N.A.	2,414
Clothes Washers	7 - 14	11	N.A.	7,279
Clothes Dryers				
Electric	8 - 15	12	N.A.	4,020
Gas	8 - 15	12	N.A.	1,205
Water Heaters				
Electric	4 - 20	12	9	3,917
Gas	3 - 15	9	9	4,671
Facsimile Machines	3 - 6	4	N.A.	4,541
Portable Computers	2 - 4	3	N.A.	14,887

Note(s): 1) Excluding compact refrigerators. 2) Ranges include free-standing, built-in, high-oven and cooktop/oven combination units.

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sep. 2006, p. P5 - P6 for service and average lifetimes and units to be replaced; EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table HC4-1a and Table HC5-1a for average stock ages.

5.10.20 Major Appliance Ownership (Millions of Households and Percent of U.S. Households)

Appliance Type	1982 Households		1990 Households		1996 Households		2001 Households		2005 Households	
Room Air Conditioners	22.6	27%	30.2	32%	30.4	31%	26.9	26%	27.4	25%
Refrigerators	83.4	100%	91.2	98%	96.8	98%	100.0	96%	104.7	96%
Freezers	35.7	43%	42.4	45%	41.9	42%	42.8	41%	36.1	33%
Electric Ranges/Cooktops	48.4	58%	58.4	63%	65.3	66%	69.2	66%	71.0	65%
Gas Ranges/Cooktops	35.7	43%	36.1	39%	38.3	39%	39.4	38%	42.2	39%
Microwave Ovens	21.4	26%	77.2	83%	89.5	91%	94.6	91%	97.2	89%
Clothes Washers	61.5	74%	86.4	93%	94.3	95%	96.9	93%	90.1	83%
Electric Clothes Dryers	42.3	51%	56.1	60%	60.4	61%	61.8	59%	67.6	62%
Gas Clothes Dryers	12.3	15%	19.1	21%	21.1	21%	19.8	19%	20.7	19%
Personal Computers	N.A.	N.A.	N.A.	N.A.	43.5	44%	N.A.	N.A.	N.A.	N.A.
Number of U.S. Households	**83.6**		**94.0**		**98.9**		**107.0**		**108.8**	

Source(s): AHAM, AHAM 2005 Fact Book, 2006, Table 93, p. 28 for 1982, 1990, 2001 and 2005; AHAM, 2000 Major Home Appliance Industry Fact Book, Nov. 2000, Table 13, p. 21 for 1996; Consumer Electronic Manufacturers Association's Home Page, 1999 for 1997 personal computers; EIA, AEO 1995, Jan. 1995, Table B4, p. 104 for 1990 households; EIA, AEO 2004, Jan. 2004, Table A4 for 2001 households.

6.1.1 Key Definitions

Quad: Quadrillion Btu (10^15 or 1,000,000,000,000,000 Btu)

Generic Quad for the Buildings Sector: One quad of primary energy consumed in the buildings sector (includes the residential and commercial sectors), apportioned between the various primary fuels used in the sector according to their relative consumption in a given year. To obtain this value, electricity is converted into its primary energy forms according to relative fuel contributions (or shares) used to produce electricity in the given year.

Electric Quad (Generic Quad for the Electric Utility Sector): One quad of primary energy consumed at electric utility power plants to supply electricity to end-users, shared among various fuels according to their relative contribution in a given year. (Note: The consumption of an electric quad results in the delivery of just under 1/3 the electric quad due to generation and transmission losses.)

Primary Energy: The total energy consumed by an end-user, including the energy used in the generation and transmission of electricity. Also referred to as "source" energy.

Delivered Energy: The energy consumed by an end-user on site, not including electricity generation and transmission losses.

6.1.2 Consumption Comparisons in 2004

One quad equals:

- 49 million short tons of coal
  - = enough coal to fill a train of railroad cars 4,450 miles long (about one and a half times across the U.S.)
- 971 billion cubic feet natural gas
- 8 billion gallons of gasoline = 21 days of U.S. gasoline use
  - = 19.8 million passenger cars each driven 12,500 miles
  - = 17.0 million light-duty vehicles each driven 12,200 miles
  - = all new passenger cars and light-duty trucks sold, each driven 11,500 miles
  - = 12.7 million stock passenger cars, each driven 11,500 miles = 9% of all passenger cars, each driven 11,500 miles
  - = all new passenger cars each making 6 round-trips from New York to Los Angeles
- 172 million barrels of crude oil = 15 days of U.S. imports = 177 days of oil flow in the Alaska pipeline at full capacity
  - = the amount of crude oil transported by 483 supertankers
- 21 hours of world energy use
- the electricity delivered from 235 coal-fired power plants (200-MW each) in one year
- the electricity delivered from 37 nuclear power plants (1000-MW each) in one year
- average annual per capita consumption of 2.9 million people in the U.S.
- the approximate annual primary consumption of any one of the following states: Arkansas, Connecticut, Iowa, Kansas, Mississippi, Oregon, or West Virginia

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139, Table A7, p. 149-150, Table A8, p. 151-152, Table A9, p. 153-154, Table A11, p. 156-157 for consumption, Table G1, p. 229 for heat rates; EIA, State Energy Data 2004: Consumption, June 2007, Table S3, p. 5, Table R1, p. 13, and Table R2, p. 14; EIA, Electric Power Annual 2005, September 2006, Table 2.2, p. 19; EIA, International Energy Outlook 2007, May 2007, Table A1, p. 83; DOC, Statistical Abstract of the United States 2007, Oct. 2006, No. 1031, p. 658, No. 1074, p. 686, and No. 1080, p. 690; and Newport News Shipbuilding Web site.

6.1.3 Carbon Emission Comparisons

One million metric ton of carbon-equivalent emissions equals:

- the combustion of 1.92 million short tons of coal
- the coal input to 3 coal plants (200-MW) in one year
- the combustion of 67 billion cubic feet of natural gas
- the combustion of 430 million gallons of gasoline = the combustion of gasoline for 26 hours in the U.S.
  - = 1.0 million new cars, each driven 12,500 miles
  - = 889 thousand new light-duty vehicles, each driven 12,200 miles
  - = 853 thousand new light trucks, each driven 11,000 miles
  - = 0.5 million new passenger cars, each making 5 round trips from New York to Los Angeles
- the combustion of 694 million gallons of LPG
- the combustion of 388 million gallons of kerosene
- the combustion of 375 million gallons of distillate fuel
- the combustion of 321 million gallons of residual fuel
- 72 minutes of world energy emissions
- 5 hours of U.S energy emissions
- 14 hours of U.S. buildings energy emissions
- 26 hours of U.S. residential energy emissions
- 31 hours of U.S. commercial energy emissions
- 3 days of U.S. buildings lighting energy emissions
- average annual per capita emissions of 181,000 people in the U.S.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, Table A7, p. 149-150 for consumption, Table A18, p. 167 for emissions, and Table G1, p. 229 for heat rates; EIA, Electric Power Annual 2005, September 2006, Table 2.2, page 19; EIA, International Energy Outlook 2007, May 2007, Table A10, p. 93; EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for carbon coefficients; and DOC, Statistical Abstract of the United States 2006, Jan. 2006, No. 2, p. 8 and No. 1084, p. 715.

6.1.4 Average Annual Carbon Dioxide Emissions for Various Functions

	Annual Unit Energy Consumption		Carbon Emissions (MTCE)	Carbon Emissions (lb CO2)
Stock Refrigerator	1,249	kWh - Electricity	0.22	1,800
Stock Electric Water Heater	2,549	kWh - Electricity	0.45	3,600
Stock Gas Water Heater	20	million Btu - Natural Gas	0.29	2,300
Stock Oil Water Heater	28	million Btu - Fuel Oil	0.56	4,500
Single-Family Home	107	million Btu	3.09	25,000
Mobile Home	76	million Btu	2.18	17,700
Multi-Family Unit in Large Building	41	million Btu	1.18	9,500
Multi-Family Unit in Small Building	78	million Btu	2.25	18,200
School Building	2,125	million Btu	71.54	578,400
Office Building	1,376	million Btu	46.32	374,500
Hospital, In-Patient	60,152	million Btu	2,025	16,372,500
Stock Vehicles				
Passenger Car	541	gallons - Gasoline	1.3	10,400
Van, Pickup Truck, or SUV	686	gallons - Gasoline	1.6	13,200
Heavy Truck	1,414	gallons - Diesel Fuel	3.5	28,100
Tractor Trailer Truck	11,697	gallons - Diesel Fuel	28.7	232,200

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139 for consumption and Table A18, p. 164 for emissions, and Table G1, p. 229 for gasoline heat rate; EIA, A Look at Residential Energy Consumption in 2001, May 2004, Table CE4-1c for water heater energy consumption, Table HC5-1a for refrigerators and Table CE5-1c for refrigerator energy, and Table CE1-4c for household consumption; EIA, 2003 Commercial Buildings Energy Consumption Survey, June 2006, Table C3, p. 247 for commercial buildings; ORNL, Transportation Energy Data Book: Edition 26, 2007, Table 4.1, p. 4-2, Table 4.2, p. 4-3, Table 5.1, p. 5-2 and Table 5.2, p. 5-3 for vehicles; and EIA, Assumptions to the AEO 2007, Mar. 2007, Table 2, p. 9 for carbon coefficients.

6.2.1 2005 Impacts of Saving an Electric Quad (1)

Plant Fuel Type	Utility Fuel Input Shares (%)	Average-Sized Utility Unit (MW) in 2005	Aggregate Number of Units to Provide the Fuel's Share of the Electric Quad (2)
Natural Gas	15%	79	141
Petroleum	3%	17	95
Coal	52%	221	38
Nuclear	21%	1,015	3
Renewable (3)	9%	21	148
Total	100%		**424**

Note(s): 1) This table displays the breakdown of electric power plants that could be eliminated by saving an electric quad, in exact proportion to the actual primary fuel shares for electricity produced nationwide in 2005. Use this table to estimate the avoided capacity implied by saving one electric quad. 2) Based on the fact that typical U.S. power plants operate less than fully loaded throughout the year. 3) Includes pumped storage.

Source(s): EIA, Electric Power Annual 2005, Sept. 2006, Table 2.2, p. 19; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for consumption and Table A8, p. 151-152 for electricity supply.

6.2.2 2005 Existing Capacity by Energy Source (GW)

Plant Fuel Type	Number of Generators	Generator Nameplate Capacity	Net Summer Capacity	Net Winter Capacity
Coal	1,522	336	313	316
Petroleum	3,753	65	59	63
Natural Gas	5,467	437	383	412
Other Gases	102	2	2	2
Nuclear	104	106	100	102
Hydroelectric Conventional	3,993	77	78	77
Other Renewables	1,671	24	21	21
Pumped Storage	150	20	21	21
Other	45	1	1	1
Total	**16,807**	**1,067**	**978**	**1,015**

Source(s): EIA, Electric Power Annual 2005, Oct. 2006, Table 2.2, pg. 19.

6.2.3 Electric Capacity Factors, by Year and Fuel Type

	Coal	Petroleum	Natural Gas	Nuclear	Conventional Hydroelectric	Solar/PV	Wind
1990	59%	29%	25%	66%	45%	13%	18%
1995	63%	19%	29%	77%	45%	17%	21%
2000	71%	21%	31%	88%	40%	15%	27%
2001	69%	22%	29%	89%	31%	16%	20%
2002	70%	18%	25%	90%	38%	16%	27%
2003	72%	22%	21%	88%	40%	15%	21%
2004	72%	23%	22%	90%	39%	17%	25%
2005	73%	24%	23%	89%	40%	15%	23%
2006 (1)	72%	12%	24%	90%	42%	14%	26%

Note(s): 1) Preliminary.

Source(s) EIA, Annual Energy Review 2006, June 2007, 8.2a, pg. 226, Table 8.11a, pg. 260.

6.2.4 Electric Conversion Factors and Transmission and Distribution (T&D) Losses

	2005	2010	2015	2020	2025	2030
Average Utility Delivery Efficiency (1, 2)	31.4%	31.7%	32.2%	32.4%	32.9%	33.4%
Average Utility Delivery Ratio (Btu/kWh) (2, 3)	10,851	10,757	10,601	10,516	10,368	10,210

Transmission and Distribution (T&D) losses as a:

Percent of Electric Generator Fuel Input	3.1%
Percent of Net Electricity Generated (4)	9.5%

Note(s): 1) Use these values to convert primary energy of electric generator fuel input to*delivered* energy. 2) Accounts for fuel conversion losses, plant use of electricity, and T&D losses. 3) Use these values to convert*delivered* electric energy to primary energy. 4) After fuel conversion losses and plant use of electricity.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 for generator consumption and Table A8, p. 151-152 for electricity sales; and EIA, Annual Energy Review 2005, July 2006, Diagram 5, p. 223 for T&D losses.

6.2.5 Characteristics of New and Stock Generating Capacities, by Plant Type

	2006 Heat Rate	2015 Heat Rate	2006 Installed Capital Costs of a Typical Power Plant		
			Price	Size	Cost
New Plant Type	(Btu/kWh)	(Btu/kWh)	($2005 thousand per MW)	(MW)	($2005 million)
Pulverized Coal	8,844	8,661	1,290	600	774
Coal-Gasification Comb. Cycle	8,309	7,477	1,491	550	820
Combined Cycle	7,163	6,866	603	250	151
Advanced Combined-Cycle	6,717	6,403	594	400	238
Combustion Turbine	10,807	10,486	420	160	67
Advanced Combustion Turbine	9,166	8,612	398	230	92
Fuel Cell	7,873	6,960	4,520	10	45
Wind	10,280	10,280	1,206	50	60
Advanced Nuclear	10,400	10,400	2,081	1,350	2,809

Stock Plant Type	2005	2010	2015	2020	2025	2030
Fossil Fuel Steam Heat Rate (Btu/kWh)	10,662	10,455	10,311	10,181	10,024	9,825
Nuclear Energy Heat Rate (Btu/kWh)	10,421	10,421	10,421	10,421	10,421	10,421

Note(s): This table provides comparisons of electric generating plants. Plant use of electricity is included; however, transmission and distribution losses of the electric grid are excluded.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139, and Table A8, p. 151-152; EIA, Assumptions to the AEO 2007, March 2007, Table 48, p. 89 for fossil fuel heat rates, Table 39, p. 77 for other generator data.

6.2.6 Characteristics of New Commercial Distributed Generating Technologies, by Plant Type

	Efficiency (HHV)		2005 Installed Capital Costs of Typical DG Technologies			Service
		Electrical	Price	Size	Cost	Life
New Plant Type	Electrical	+ Thermal	($2005 per kW)	(kW)	($2005 thousand)	(years)
Solar Photovoltaic	0.16	N.A.	6,329	25	158	30
Fuel Cell	0.36	0.72	5,485	200	1,097	20
Natural Gas Engine	0.32	0.77	1,192	200	238	20
Oil-Fired Engine	0.31	0.82	1,308	200	262	20
Natural Gas Turbine	0.23	0.66	1,908	1000	1,908	20
Natural Gas Microturbine	0.30	0.63	1,709	200	342	20

Source(s): Discovery Insights, Final Report: Commercial and Industrial CHP Technology Cost and Performance Data Analysis for EIA's NEMS, Jan. 2006, Table 7, p. 12; and EIA, Annual Energy Review 2005, July 2006, Appendix D, p. 373.

6.2.7 Cost of an Electric Quad Used in the Buildings Sector ($2005 Billion)

	2005	2010	2015	2020	2025	2030
Residential	8.67	8.54	8.37	8.56	8.76	8.94
Commercial	7.94	7.77	7.51	7.77	7.97	8.11
Buildings Sector	**8.32**	**8.16**	**7.94**	**8.16**	**8.36**	**8.51**

Note(s): This table provides the consumer cost of an electric quad. Use this table to estimate the savings to consumers when a primary quad is saved in the form of delivered electricity.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A3, p. 140-141.

6.3.1 Cost of a Generic Quad Used in the Buildings Sector ($2005 Billion) (1)

	2005	2010	2015	2020	2025	2030
Residential	9.89	9.53	9.13	9.34	9.58	9.82
Commercial	8.64	8.15	7.74	7.99	8.21	8.38
Buildings Sector	**9.31**	**8.89**	**8.47**	**8.69**	**8.90**	**9.08**

Note(s): 1) See Table 6.1.1 for generic quad definition. This table provides the consumer cost of a generic quad in the buildings sector. Use this table to estimate the average consumer cost savings resulting from the savings of a generic (primary) quad in the buildings sector.
Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A17, p. 163 for energy consumption and Table A3, p. 140-141 for energy prices.

6.3.2 Shares of U.S. Buildings Generic Quad (Percent) (1)

					Renewables				
		Natural Gas	Petroleum	Coal	Hydro.	Other	Total	Nuclear	Total
2005	(2)	**31%**	**8%**	**38%**	**5%**	**3%**	**8%**	**15%**	**100%**
2010		31%	7%	38%	5%	4%	9%	14%	100%
2015		32%	7%	38%	5%	4%	9%	14%	100%
2020		31%	6%	39%	5%	4%	9%	14%	100%
2025		29%	6%	42%	5%	4%	9%	14%	100%
2030		27%	6%	45%	4%	4%	8%	13%	100%

Note(s): 1) See Table 6.1.1 for generic quad definition. 2) The total 2005 Buildings sector primary energy consumption was 39.69 quads.
Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A17, p. 163 for energy consumption.

6.3.3 Shares of U.S. Residential Buildings Generic Quad (Percent) (1)

					Renewables				
		Natural Gas	Petroleum	Coal	Hydro.	Other	Total	Nuclear	Total (3)
2005	(2)	**33%**	**9%**	**36%**	**5%**	**4%**	**8%**	**14%**	**100%**
2010		33%	8%	36%	5%	5%	10%	13%	100%
2015		33%	8%	36%	5%	5%	9%	13%	100%
2020		32%	7%	37%	5%	5%	9%	14%	100%
2025		31%	7%	40%	4%	4%	9%	13%	100%
2030		29%	7%	43%	4%	4%	9%	13%	100%

Note(s): 1) See Table 6.1.1 for generic quad definition. 2) The total 2005 Residential buildings sector primary energy consumption was 21.78 quads.
Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A17, p. 163 for energy consumption.

6.3.4 Shares of U.S. Commercial Buildings Generic Quad (Percent) (1)

					Renewables				
		Natural Gas	Petroleum	Coal	Hydro.	Other	Total	Nuclear	Total (3)
2005	(2)	**29%**	**7%**	**41%**	**5%**	**3%**	**8%**	**16%**	**100%**
2010		29%	6%	41%	5%	4%	9%	15%	100%
2015		30%	5%	41%	5%	4%	9%	15%	100%
2020		29%	5%	42%	5%	4%	9%	15%	100%
2025		27%	5%	44%	5%	4%	9%	15%	100%
2030		26%	5%	47%	5%	4%	8%	14%	100%

Note(s): 1) See Table 6.1.1 for generic quad definition. 2) The total 2005 Commercial buildings sector primary energy consumption was 17.91 quads.
Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A17, p. 163 for energy consumption.

6.4.1 Electric Quad Average Carbon Emissions with Average Stock Utility Fuel Mix and Projected New Marginal Capacity Fuel Mix (Million Metric Tons) (1)

	Stock	Projected New Marginal Capacity				
	2005	2010	2015	2020	2025	2030
Petroleum	0.69	0.00	0.00	0.00	0.00	0.00
Natural Gas	2.20	2.34	3.24	2.38	0.99	0.03
Coal	13.39	11.73	12.63	13.75	17.58	20.24
Nuclear	0.00	0.00	0.00	0.00	0.00	0.00
Renewable Energy (2)	0.08	0.06	0.11	0.07	0.06	0.05
Total	**16.36**	**14.13**	**15.97**	**16.20**	**18.63**	**20.33**

Note(s): 1) This table provides estimates of the carbon emissions resulting from consumption of a primary quad at electric utilities. Projected (2010-2030) new marginal capacity emissions will result from natural gas- and coal-fired power plants. Electric generation capacity is projected to increase for biomass, wind, and nuclear power. Biomass and wind power electric generation will increase 2007-2010. Nuclear electric generation capacity will increase 2016-2019. Electricity imports from utility consumption were ignored since this energy was produced outside of the U.S. "Average" means the weighted average of different fuels (e.g., petroleum is the average of residual and distillate fuel oils). The combustion of fossil fuels produces carbon in the form of carbon dioxide and carbon monoxide; however, carbon monoxide emissions oxidize in a relatively short time to form carbon dioxide. 2) Emissions from renewable energy include emissions released from geothermal power and non-biogenic emissions from municipal solid waste.

Source(s): EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139 and Table A18, p. 164.

6.4.2 Average Carbon Emissions from a Generic Quad in the Buildings Sector with Stock Fuel Mix and Projected Fuel Mix of New Marginal Utility Capacity and Site Energy Consumption (Million Metric Tons) (1)

	Stock			Projected Fuel Mix of New Marginal Utility Capacity and Site Consumption								
	2005			2010			2020			2030		
	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.
Electricity (2)	11.11	12.55	11.76	12.58	13.55	13.08	14.01	13.75	13.86	18.32	16.26	17.04
Petroleum	1.33	0.85	1.11	0.32	0.07	0.20	0.33	0.09	0.20	0.36	0.09	0.19
Natural Gas	3.30	2.54	2.96	2.04	1.62	1.83	1.77	2.14	1.98	1.35	2.04	1.78
Renew. En. (3)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal	0.02	0.15	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**15.76**	**16.08**	**15.90**	**14.94**	**15.25**	**15.10**	**16.12**	**15.98**	**16.04**	**20.03**	**18.40**	**19.01**

Note(s): 1) This table provides estimates of the carbon emissions resulting from consumption of a generic quad in the buildings sector, at current and projected fuel shares. Projected increases in *site* energy will be primarily met by electricity and natural gas. Projected new marginal emissions will result from natural gas- and coal-fired power plants. Electricity imports from utility consumption were not included since this energy was produced outside of the U.S. "Average" means the weighted average of different fuels (e.g., petroleum is the average of residual and distillate fuel oils, LPG, kerosene, and motor gasoline). The combustion of fossil fuels produces carbon in the form of carbon dioxide and carbon monoxide; however, carbon monoxide emissions oxidize in a relatively short time to form carbon dioxide. 2) Includes renewables. 3) Emissions exclude wood since it is assumed that the carbon released from combustion is reabsorbed in a future carbon cycle.

Source(s): EIA, Annual Energy Outlook (AEO) 2007, Feb. 2007, Table A2, p. 137-139 and Table A17, p. 163 for energy consumption and Table A18, p. 164 for carbon emissions; and EIA, Assumptions to the AEO 2007, March 2007, Table 2, p. 9.

7.1.1 Program Definitions

DOE Weatherization: Department of Energy's Weatherization Assistance Program

DOE Weatherization Eligible Households: Households with incomes at or below 125% of the Federal poverty level, which varies by family size; however, a State may instead elect to use the LIHEAP income standard if its state LIHEAP income standard is at least 125% of the Federal poverty level. Data listed in this chapter include previously weatherized units. DOE Weatherization Eligible Households are a subset of Federally Eligible Households.

DOE Weatherization Recipient Households: Households that have received weatherization under DOE Weatherization funding.

Federally Eligible Households: Households with incomes below the Federal maximum standard of 150% of the poverty line or 60% of the state median income, whichever is higher.

HHS: Department of Health and Human Services

LIHEAP: HHS's Low Income Home Energy Assistance Program

LIHEAP Eligible Households: Households with incomes below the Federal maximum poverty income level, i.e., 150% of the Federal poverty guidelines or 60% of state median income, whichever is higher.

LIHEAP Recipient Households: Households that received fuel subsidies for home heating, cooling, or energy crisis benefits in the year previous to a particular household survey.

Source(s): ORNL, Scope of the Weatherization Assistance Program: Profile of the Population in Need, Mar. 1994, p. 1.2 for Weatherization eligible, Weatherization recipient, and LIHEAP eligible households; EIA, Housing Characteristics 1993, June 1995, p. 336 for Federally eligible for weatherization; and HHS, LIHEAP Report to Congress FY 2001, Feb. 2003, Table E-1, p. 105 and Figure 1, p. iii for LIHEAP recipient household.

7.1.2 Energy Burden Definitions

Energy burden is an important statistic for policy makers who are considering the need for energy assistance. Energy burden can be defined broadly as the burden placed on household incomes by the cost of energy, or more simply the ratio of energy expenditures to household income. However, there are different ways to compute energy burden, and different interpretations and uses of the energy burden statistics. DOE Weatherization primarily uses mean individual burden and mean group burden since these statistics provide data on how an "average" individual household fares against an "average" group of households (that is, how burdens are distributed for the population). DOE Weatherization (and HHS) also uses the median individual burden which shows the burden of a "typical" individual.

Mean Individual Burden: This statistic is calculated by first computing the energy burden for each household using RECS data and then taking a mean of the household-level energy burden estimates. It furnishes the most complete information about how a burden is distributed for the population.

Mean Group Burden: This statistic calculates energy expenditures for all households in the group and divides by the average of all incomes for the group. This statistic is calculated as the ratio between aggregate energy expenditures of a group (from RECS and CPS) and aggregate group income (from CPS).

Median Individual Burden: This statistic is computed by taking a median of the RECS household-level energy burden estimates (the point at which 50% of households have a higher burden value and 50% have a lower value).

Source(s): HHS, LIHEAP Report to Congress FY 2000, Apr. 2002, p. 45 for energy burden definition; HHS, Characterizing the Impact of Energy Expenditures on Low-Income Households: An Analysis of Alternative National Energy Burden Statistics, Nov. 1994, p. vii and ix for burdens; and ORNL, Scope of the Weatherization Assistance Program: Profile of the Population in Need, Mar. 1994, p. xii for mean individual and mean group burdens.

7.1.3 Households, by Weatherization Eligibility and Year (Million) (1)

	Weatherization Recipient			Federally	Federally	Below 125%	Total
	DOE	Other	Total	Eligible (2)	Ineligible	Poverty Line	Households
1977	0.03	-	0.03	N.A.	N.A.	N.A.	74.8
1980	0.18	-	0.18	N.A.	N.A.	N.A.	79.6
1985	0.13	0.17	0.30	N.A.	N.A.	N.A.	87.9
1987	0.10	0.21	0.31	N.A.	N.A.	18.2	90.5
1990	0.09	0.16	0.25	27.9	66.1	18.2	94.2
1991	0.11	0.13	0.23	N.A.	N.A.	N.A.	95.3
1992	0.11	0.12	0.22	N.A.	N.A.	N.A.	96.4
1993	0.09	0.12	0.21	30.7	65.9	19.4	96.6
1994	0.10	0.15	0.25	N.A.	N.A.	N.A.	98.7
1995	0.10	0.13	0.23	N.A.	N.A.	N.A.	100.0
1996	0.06	0.09	0.15	N.A.	N.A.	N.A.	101.0
1997	0.07	0.08	0.15	34.1	67.4	19.7	101.5
1998	0.07	0.09	0.16	N.A.	N.A.	N.A.	102.8
1999	0.07	0.09	0.16	N.A.	73.2	N.A.	104.1
2000	0.08	0.11	0.19	N.A.	N.A.	N.A.	105.2
2001	0.08	0.13	0.20	33.8	73.2	20.1	107.0
2002	0.10	0.10	0.20	N.A.	N.A.	N.A.	110.5
2003	0.10	0.09	0.19	N.A.	N.A.	N.A.	112.0
2004	0.10	0.07	0.17	N.A.	N.A.	N.A.	113.6
2005	0.09	0.08	0.17	N.A.	N.A.	N.A.	115.4
1977-2005	**2.91**	**2.93**	**5.84**	**N.A.**	**N.A.**	**N.A.**	**N.A.**

Note(s): 1) Year of receiving funding follows DOE Weatherization's Program Year of Apr. 1-Mar. 31. 2) Federally eligible for DOE and HHS (LIHEAP) Weatherization. Includes previously weatherized units.

Source(s): DOE for weatherization recipients; EIA, Housing Characteristics 1987, May 1989, Table 9, p. 20 for 1987 data; EIA, Housing Characteristics 1990, May 1992, Table 17, p. 54-55 for 1990 data; EIA, Housing Characteristics 1993, June 1995, Table 3.3a, p. 38-42 for 1993 data; EIA, Annual Energy Outlook (AEO) 1996, Jan. 1996,Table A4, p. 82-83 for 1992 and 1994 households; EIA, AEO 1998, Dec. 1997, Table A4, p. 106-107 for 1995-1996 households; EIA, AEO 2001, Dec.2000, Table A4, p. 133-134 for 1998-2000 households; EIA, AEO 2005, Feb. 2005, Table A4, p. 125-126 for 2002 households; EIA, AEO 2006, Feb. 2006, Table A4, p. 139-140 for 2003-2004 households; EIA, A Look at Residential Energy Consumption in 1997, Nov. 1999, Table HC1-3a, p. 38-39; EIA, RECS 1997 for eligible households; EIA, Residential Energy Consumption 2001, Apr. 2004, Table HC2-3a for 2001 eligible households; National Association for State Community Services programs: Weatherization Assistance Program PY 2005 Funding Survey for 2005 data; EIA, RECS 2001 for eligible households; and DOC, Income, Poverty, and Valuation of Noncash Benefits: 1994, Apr. 1996, Table B-1, for 1991 households.

7.1.4 Weatherization Population Facts

- Roughly 25% of Federally eligible households move in and out of poverty "classification" each year.
- The average income of Federally eligible households in FY 2005 was $16,264, based on RECS and Bureau of the Census' Current Population Survey (CPS) data.
- States target the neediest, especially the elderly, persons with disabilities, and families with children.
- Since the inception of the Weatherization Assistance Program in 1976, over 5.8 million households have received weatherization services.
- In FY 2005, the energy burden on Federally eligible households was over four and a half times the burden on Federally ineligible households (14.6% versus 3.2%).
- DOE weatherization saves an average of 13-34% on home energy bills (depending on main heating fuel). This equates to $1.54 in energy benefits being produced for every $1.00 invested. These services reduce average annual energy costs by $358 per household.

Note(s): For weatherization eligibility terminology, see Table 7.1.10. For acronyms, see Key Terminology.

Source(s): ORNL, Weatherization Works: Final Report on the National Weatherization Evaluation, Sept. 1994, p. 1 for migrating poor; ORNL, 1996 for targeting; HHS, LIHEAP Home Energy Notebook for FY 2005, May 2007, Table A-2a, p. 59 for Federally eligible average income and Table A-2b, p. 60 for energy burdens; ORNL, Progress Report of the National Weatherization Assistance Program, Sept. 1997, DOE, Weatherization Works, Progress Report of the National Weatherization Assistance Program, Feb. 1998; and EERE/OWIP, Weatherization Assistance Program Briefing Book, May 2006 for weatherization savings.

7.1.5 Weatherization Program Facts

- PY 2005 weatherization funding breakdown: DOE 36%, LIHEAP 36%, others 28%. (1)
- The Federal Government's outlay for fuel subsidies runs from $4.0 to 4.4 billion per year. The major two agencies dispensing fuel subsidies are HUD and HHS (through LIHEAP).
- HUD spends over $1.48 billion annually to pay all or part of the total utility bills (including water/sewer) for 1.2 million low-income households. Approximately 22% of public housing authorities' expenditures are for utilities (including water). In addition, HUD estimates tenant expenditures on utilities (excluding water) at about $278 million in 1997.
- LIHEAP spends 85% of its funding for direct fuel subsidies and weatherization. Up to 15% can be spent for weatherization activities and the remainder is spent on fuel subsidies. A maximum of 25% of funding is available for weatherization activities if HHS approves a waiver. LIHEAP weatherization funding has ranged from 8-19% of total LIHEAP funds. Since 2002, LIHEAP weatherization funding has been about 12% of total funds.

Note(s): 1) Program year is Apr. 1 - Mar. 31.

Source(s): National Association for State Community Services programs: Weatherization Assistance Program PY 2005 Funding Survey for spending; HHS, LIHEAP Report to Congress FY 1995, Aug. 1997, p. vii for LIHEAP weatherized households and Table 5, p. 15 for LIHEAP cost splits; HUD, Public Housing Operating Cost Study, June 2003, p. 67-68 for public housing utility costs; and HUD, Congressional Justifications for 2007 Estimates: Public Housing Operating Fund, Mar. 2006 for HUD spending.

7.1.6 Weatherization Costs and Savings

- DOE Weatherization program requires that States spend no more than an average of $2,885 per household in PY 2007. All States are using energy audits to determine the most cost-effective weatherization measures.
- In spite of funding reductions that reduced production, technical advances have produced 80% higher energy savings on a per-dwelling basis. Increases in energy savings were achieved through improvements in: diagnostic technology and techniques, weatherization materials and installation techniques, training, and audit tools.
- DOE weatherization creates an average energy savings of $358 per household, reduces household annual gas heating consumption 31% with a benefit-cost ratio of 1.53.

Source(s): EERE/OWIP, Weatherization Program Notice 07-1, Dec. 1, 2006 for average expenditures; ORNL, Weatherization Plus Progress Report: Poised to Move Forward, June 2001; and EERE/OWIP, Weatherization Assistance Program Briefing Book, May 2007 for savings.

7.1.7 Residential Energy Burdens, by Weatherization Eligibility and Year

	1987	1990		FY 2000 (1)			FY 2005 (2)		
	Mean Group	Mean Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group
Total U.S. Households	4.0%	6.8%	3.2%	6.1%	3.5%	2.4%	6.8%	3.7%	2.9%
Federally Eligible	**13.0%**	**14.4%**	**10.1%**	**12.1%**	**7.9%**	**7.7%**	**14.6%**	**8.6%**	**9.1%**
Federally Ineligible	4.0%	3.5%	N.A.	3.0%	2.6%	2.0%	3.2%	2.8%	2.3%
Below 125% Poverty Line	13.0%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Note(s): 1) Data are derived from RECS 1997, adjusted to reflect FY 2000 HDD, CDD, and fuel prices. 2) Data are derived from RECS 2001, adjusted to reflect FY 2004 HDD, CDD, and fuel prices.

Source(s): EIA, Household Energy Consumption and Expenditures 1987, Oct. 1989, Table 13, p. 48-50 for 1987 mean group burdens; ORNL, The Scope of the Weatherization Program: Profile of the Population in Need, Mar. 1994, p. xi. for 1990 Federally ineligible mean individual burden; HHS, Characterizing the Impact of Energy Expenditures on Low-Income Households: An Analysis of Alternative National Energy Burden Statistics, Nov. 1994, p. viii for 1990 total U.S. Households and Federally eligible burdens; HHS, LIHEAP Home Energy Notebook for FY 2000, Apr. 2000, Tables A-2a, A-2b, and A-2c, p. 48-50 for FY 2000; and HHS, LIHEAP Home Energy Notebook for FY 2005, May 2007, Tables A-2a, A-2b, and A-2c, p. 59-61.

7.1.8 FY 2005 Residential Energy Burdens, by Region (1)

	Northeast			South			Midwest			West		
	Mean Indvdl	Mdn Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group	Mean Indvdl	Mdn Indvdl	Mean Group
Total U.S. Households	8.9%	4.6%	3.3%	7.1%	3.9%	3.0%	6.6%	3.8%	3.1%	4.7%	2.8%	2.0%
Federally Eligible	**18.9%**	**10.2%**	**10.6%**	**15.7%**	**9.6%**	**9.9%**	**14.3%**	**8.9%**	**10.0%**	**9.4%**	**5.4%**	**6.0%**
Federally Ineligible	3.8%	3.4%	2.6%	3.2%	2.9%	2.5%	3.3%	3.0%	2.4%	2.5%	2.2%	1.7%

Note(s): 1) Data are derived from RECS 2001, adjusted to reflect FY 2004 HDD, CDD, and fuel prices. See Table 7.1.4 for totals and Table 7.1.10 for definitions.

Source(s): HHS, LIHEAP Home Energy Notebook for FY 2005, May 2007, Tables A-2a, A-2b, and A-2c, p. 59-61.

7.1.9 2001 Housing Unit Ownership, by Income Level and Weatherization Eligibility (in Millions)

	Single-Family		Multi-Family Unit		Mobile Home	
2001 Household Income	Own	Rent	Own	Rent	Own	Rent
Less than $15,000	5.7	2.9	0.3	8.0	1.2	0.4
$15,000 to $30,000	10.9	2.5	1.0	5.7	2.3	0.4
$30,000 to $49,999	16.4	2.8	1.2	5.2	1.3	0.2
All Households	63.2	10.5	3.9	22.6	5.7	1.1
Federally Eligible	**12.8**	**5.0**	**0.9**	**11.8**	**2.6**	**0.7**
Federally Ineligible	50.4	5.5	3.0	10.8	3.1	0.4
Below 100% Poverty Line	3.8	2.8	0.3	6.5	1.1	0.5

Source(s): EIA, 2001 Residential Energy Consumption Survey: Housing Characteristics Tables, Apr. 2004, Table HC1-3a.

7.1.10 2001 Average Energy Expenditures per Household Member and per Square Foot, by Weatherization Eligibility ($2005)

	Per Household Member	Members/ Hhold	Per Square Foot	Square Feet/ Hhold
Total U.S. Households	642	2.6	0.84	1,975
Federally Eligible	**527**	**2.7**	**0.98**	**1,435**
Federally Ineligible	697	2.5	0.79	2,225
Below 100% Poverty Line	489	2.6	1.02	1,227

Source(s): EIA, 2001 Residential Energy Consumption Survey: Household Energy Consumption and Expenditures Tables, Apr. 2004, Table CE1-5.1u and Table CE1-5.2u; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for implicit price deflators.

7.2.1 Operating Characteristics of Electric Appliances in the Residential Sector

	Power Draw (W) (1)			Annual Usage (hours/year)			Annual Consumption (kWh/year)	Annual Cost ($) (2)
	Active	Idle	Off	Active	Idle	Off		
Kitchen								
Coffee Maker	1,000	70	0	38	229	8,493	58	5
Dishwasher	(3) 0	0		(4) 365	0		120	11
Microwave Oven	1,500	0	3	70	0	8,690	131	12
Refrigerator-Freezer							730	69
Freezer							540	51
Lighting								
18-W Compact Fluorescent	18	0	0	1,189	0	0	20	2
60-W Incandescent Lamp	60	0	0	672	0	0	40	4
100-W Incandescent Lamp	100	0	0	672	0	0	70	7
Torchiere Lamp-Halogen	300	0	0	1,460	0	0	440	41
Bedroom and Bathroom								
Hair Dryer	710	0	0	50	0	0	40	4
Waterbed Heater	350	0	0	3,051	0	0	1,070	101
Laundry Room								
Clothes Dryer				(4) 359			1,000	94
Clothes Washer	(3) 0	0	0	(4) 392	0	0	(3) 110	10
Home Electronics								
CPU & Monitor	182/30	0	1337/632		0		260	24
Stereo Systems	33	30	3	1,510	1,810	5,440	119	11
Television	113		4	1,460		7,300	193	18
Analog, <40"	86			(5) 1,095			184	17
Analog, >40"	156			(5) 1,825			312	29
Digital, ED/HD TV, <40"	150			(5) 1,095			301	28
Digital, ED/HD TV, >40"	234			(5) 1,825			455	43
Set-top box	20	0	20	6,450	0	2,310	178	17
DVD/VCR	17	13	3	170	5,150	3,430	78	7
Heating and Cooling								
Dehumidifier	600	0		1,620	0		970	91
Furnace Fan	295	0		1,350	0		400	38
Ceiling Fan (only fan motor)	35			2,310			81	8
Water Heating								
Water Heater-Family of 4	4,500			(6) 64	N.A.	0	4,770	448
Water Heater-Family of 2	4,500			(6) 32	N.A.	0	2,340	220
Portable Spa	4,350	275	0	25	8,735	0	2,525	237
Miscellaneous								
Pool Pump	1,000	0		792	0		790	74
Well Pump	725	0		115	0		80	8
Total Standby	0	57		0	8,760		500	47

Note(s): 1) Power draw will vary due to appliance components and modes of operation. 2) $0.094/kWh. 3) Excludes electricity for water heating and drying. 4) Cycles/year. 5) TVs <40" are estimated on 3 hours/day and TVs >40" are estimated on 5 hours/day. 6) Gallons/day.

Source(s): BTS/A.D. Little, Electricity Consumption by Small End Uses in Residential Buildings, Aug. 1998, Exhibit 6-8, p. 6-10 for clothes washer, computer, dehumidifier, dishwasher, furnace fan, pool pump, torchiere lamp-halogen, waterbed heater, and well pump; LBNL, Energy Data Sourcebook for the U.S. Residential Sector, LBNL-40297, Sept. 1997, p. 100-102 for clothes dryers, Table 10.2, p. 108 for lighting, and p. 62-67 for water heaters; LBNL, Miscellaneous Electricity Use in the U.S. Residential Sector, LBNL-40295, Apr. 1998, Appendix D for hair dryer; EIA, Supplement to AEO 2007, Feb. 2007, Table 21 for refrigerator and freezer; GAMA, Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, Apr. 2000 for water heater power draw; EIA/TIAX, Commercial and Residential Sector Miscellaneous Electricity Consumption: Y2005 and Projections to 2030, Sept. 2006, p. 41-60 for coffee maker, microwave oven, stereo systems, TVs, set-top box, DVD/VCR, ceiling fan, and portable spa; and LBNL for total standby.

7.2.2 Operating Characteristics of Natural Gas Appliances in the Residential Sector

	Average Capacity (10^3 Btu/hr)	Appliance Usage		Annual Consumption (10^6 Btu/year)	Annual Cost ($) (1)
Range	10			4	52
Clothes Dryer		359	(2)	4	53
Water Heating					
Water Heater-Family of 4	40	64	(3)	26	320
Water Heater-Family of 2	40	32	(3)	12	152

Note(s): 1) $1.24/therm. 2) Cycles/year. 3) Gallons/day.

Source(s): A.D. Little, EIA-Technology Forecast Updates - Residential and Commercial Building Technologies - Reference Case, Sept. 2, 1998, p. 30 for range and clothes dryer; LBNL, Energy Data Sourcebook for the U.S. Residential Sector, LBNL-40297, Sept. 1997, p. 62-67 for water heating; GAMA, Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, Apr. 2002, for water heater capacity; and AGA, Gas Facts 1998, Dec. 1999, www.aga.org for range and clothes dryer consumption.

7.2.3 Operating Characteristics of Electric Equipment in the Commercial Sector

	Power Draw (kW) (1)			Annual Usage (hours/year)			Annual Consumption	
	Active	Standby	Off	Active	Standby	Off	(kWh/year)	($) (2)
Medical Imaging Equipment								
MRI	25.0	11.0	7.0	340	3,310	5,110	81,000	6,966
CT	21.0	N.A.	1.7	3,000	N.A.	5,760	73,000	6,278
X-ray	4.0	N.A.	1.6	4,380	N.A.	4,380	24,800	2,133
Vertical Transport								
Elevator	10.0	0.5	0.3	300	8,460	0	7,400	636
Escalator	4.7	N.A.	0.0	4,380	N.A.	4,380	20,500	1,763
Distribution Transformer (3)								
Dry	10.3 W/kVA			8,760	N/A	N/A		
Liquid	4.2 W/kVA			8,760	N/A	N/A		
Water Systems								
Distribution				17,700	billion gallons per year		2,230 kWh/10^6 gal	178
Purification				16,500	billion gallons per year		65 kWh/10^6 gal	5.2
Treatment				14,280	billion gallons per year		1,649 kWh/10^6 gal	132

Note(s): 1) Power draw will vary due to modes of operation. 2) $0.086/kWh. 3) Losses from stepping down power distributed at higher voltages to lower voltages.

Source(s): EIA/TIAX, Commercial and Residential Sector Miscellaneous Electricity Consumption: Y2005 and Projections to 2030, Sept. 2006, p. 16-37; and EIA, Annual Energy Outlook 2007, Feb. 2007, Table A3, p. 140-141 for electricity price.

7.3.1 2001 *Delivered* Energy End-Uses for an Average Household, by Region (Million Btu per Household)

	Northeast	Midwest	South	West	National
Space Heating	63.1	66.8	27.7	29.7	43.9
Space Cooling	3.3	5.1	11.5	5.4	7.7
Water Heating	18.0	17.4	13.9	15.1	15.8
Refrigerator	4.2	4.9	6.0	4.0	5.0
Other Appliances & Lighting	20.1	23.7	24.3	20.2	22.5
Total (1)	**106.6**	**116.7**	**82.5**	**70.1**	**92.2**

Note(s): 1) Due to rounding, sums do not add up to totals.
Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table CE1-9c, Table CE1-10c, Table CE1-11c, and Table CE1-12c.

7.3.2 2001 End-Use Carbon Dioxide Emissions Splits for an Average Household, by Region (Pounds of CO2)

	Northeast	Midwest	South	West	National
Space Heating	9,083	8,690	4,890	4,467	6,475
Space Cooling	1,467	2,063	4,742	2,170	3,197
Water Heating	2,936	2,625	3,135	2,530	2,914
Refrigerator	1,444	2,041	2,463	1,796	2,068
Other Appliances & Lighting	6,957	8,694	9,224	7,125	8,177
Total	**21,888**	**24,113**	**24,455**	**18,089**	**22,830**

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Tables CE(2-5)-(9-12)c; EIA, Annual Energy Outlook 2007, Feb. 2007, Table A2, p. 137-139, Table A17, p. 163 for consumption data, and Table A18, p. 164 for emissions data; and EIA, Assumptions to the AEO 2007, Feb. 2007, Table 2, p. 9 for coefficients.

7.3.3 2001 Energy End-Use Expenditures for an Average Household, by Region ($2005)

	Northeast	Midwest	South	West	National
Space Heating	777	681	402	358	529
Space Cooling	122	135	311	173	217
Water Heating	248	203	237	202	224
Refrigerator	165	134	159	131	149
Other Appliances & Lighting	654	570	596	542	589
Total (1)	**1,917**	**1,697**	**1,684**	**1,286**	**1,644**

Note(s): 1) Due to rounding, end-uses do not sum to totals.
Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table CE1-9e, Table CE1-10e, Table CE1-11e, and Table CE1-12e; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price deflators.

7.3.4 Materials Used in the Construction of a 2,272-Square-Foot Single-Family Home, 2000

13,837 board-feet of lumber
13,118 square feet of sheathing
19 tons of concrete
3,206 square feet of exterior siding material
3,103 square feet of roofing material
3,061 square feet of insulation
6,050 square feet of interior wall material
2,335 square feet of interior ceiling material
226 linear feet of ducting
19 windows
4 exterior doors (3 hinged, 1 sliding)
2,269 square feet of flooring material
12 interior doors
6 closet doors
2 garage doors
1 fireplace
3 toilets; 2 bathtubs; 1 shower stall
3 bathroom sinks
15 kitchen cabinets; 5 other cabinets
1 kitchen sink
1 range; 1 refrigerator; 1 dishwasher; 1 garbage disposer; 1 range hood
1 washer; 1 dryer
1 heating and cooling system

Source(s): NAHB, 2004 Housing Facts, Figures and Trends, Feb. 2004, p. 7; D&R International for appliances and HVAC.

7.3.5 Characteristics of a Typical Single-Family Home (1)

Year Built	late 1960s		Building Equipment	Type	Fuel	Age (5)
Occupants	3		Space Heating	Central Warm-Air Furnace	Natural Gas	12
Floorspace			Water Heating	50 Gallons	Natural Gas	9
Heated Floorspace	2047		Space Cooling	Central Air Conditioner		9
Cooled Floorspace	2061					
Garage	2-Car					
Stories	1		Appliances	Type / Fuel / Number	Size	Age (5)
Foundation	Basement		Refrigerator	2-Door	19 Cubic Feet	8
Total Rooms (2)	6		Clothes Dryer	Electric		
Bedrooms	3		Clothes Washer	Top Loading		
Other Rooms	3		Range/Oven	Electric		
Full Bathroom	2		Microwave Oven			
Half Bathroom	0		Dishwasher			
Windows			Color Televisions	3		
Area (3)	235		Ceiling Fans	3		
Number (4)	16		Computer			
Type	Single-Pane		Printer			
Frame	Nonmetal					
Insulation: Well or Adequate						

Note(s): 1) This is a weighted-average house that has combined characteristics of the Nation's stock homes. Although the population of homes with similar traits may be few, these are likely to be the most common. 2) Excludes bathrooms. 3) 11.5% of floorspace. 4) Based on a nominal 3' X 5' window. 5) Years.

Source(s): EIA, A Look at Residential Energy Consumption in 2001, Apr. 2004, Table HC1-4a, HC2-4a, Table HC3-4a, Table HC4-4a, Table HC5-4a, Table HC6-4a, Table HC7-4a, Table CE2-4c, and Table CE3-4c; and EIA, Housing Characteristics 1993, June 1995, Table 3.29a, p. 168-173 for windows area.

7.4.1 1995 Commercial Buildings *Delivered* Energy End-Use Intensities, by Building Activity (Thousand Btu per SF) (1)

	Education	Food Sales	Food Service	Health Care	Lodging	Mercantile & Service	Office
Space Heating	32.8	27.5	30.9	55.2	22.7	30.6	24.3
Space Cooling	4.8	13.4	19.5	9.9	8.1	5.8	9.1
Ventilation	1.6	4.4	5.3	7.2	1.7	2.5	5.2
Water Heating	17.4	9.1	27.5	63.0	51.4	5.1	8.7
Lighting	15.8	33.9	37.0	39.3	23.2	23.4	28.1
Cooking	1.4	5.6	77.5	11.2	6.6	1.5	1.1
Refrigeration	1.0	110.9	31.6	4.7	2.3	0.9	0.4
Office Equipment	1.5	1.3	2.6	15.5	3.8	2.9	15.1
Other	2.9	7.4	13.7	34.4	7.5	3.7	5.2
Total	**79.3**	**213.5**	**245.5**	**240.4**	**127.3**	**76.4**	**97.2**

	Public Assembly	Public Order & Safety	Religious Worship	Warehouse & Storage	Other	Vacant	All Buildings
Space Heating	53.6	27.8	23.7	15.7	59.6	11.9	29.0
Space Cooling	6.3	6.1	1.9	0.9	9.3	0.6	6.0
Ventilation	3.5	2.3	0.9	0.3	8.3	0.3	2.8
Water Heating	17.5	23.4	3.2	2.0	15.3	2.4	13.8
Lighting	21.9	16.4	5.0	9.8	26.7	3.6	20.4
Cooking	2.8	N.A.	0.5	-	N.A.	N.A.	3.7
Refrigeration	1.8	0.2	0.6	1.7	0.7	0.2	3.1
Office Equipment	2.4	5.8	0.4	4.4	15.2	0.5	5.7
Other	3.8	12.7	1.1	3.4	35.9	1.9	6.1
Total	**113.7**	**97.2**	**37.4**	**38.3**	**172.2**	**21.5**	**90.5**

Note(s): 1) Due to rounding, end-uses do not sum to total.

Source(s): EIA, A Look at Commercial Buildings in 1995: Characteristics, Energy Consumption, and Energy Expenditures, Oct. 1998, Table EU-2, p. 311.

7.4.2 Typical Office Building (1)

	Large (>= 25,000 SF)	Small (<25,000 SF)
Stock Floor Area (billion SF)	**8.22**	**4.29**
Floor-Area Weighted Averages		
Building Area (thousand SF)	90 - 137	5.5 - 6.6
Floors	39,240	39,084
Shell		
Percent Glass	40 - 50	15 - 20
Window R-Value	1.39 - 1.71	1.34 - 1.99
Window Shading Coefficient	0.69 - 0.8	0.71 - 0.82
Wall R-Value	2.5 - 6.0	3.9 - 6.3
Roof R-Value	9.1 - 12.6	10.5 - 13.3
Wall Material	masonry	masonry
Roof Material	built-up	built-up
Occupancy		
Average Occupancy (SF/person)	390 - 460	420 - 470
Weekday Hours (hrs/day)	12	11
Weekend Hours (hrs/day)	5	4
Equipment		
Average Power Density (W/SF)	1	1
Full Lighting Hours (hrs/year)	3,580	3,360
Lighting		
Average Power Density (W/SF)	1.3 - 1.8	1.7 - 2.2
Full Lighting Hours (hrs/year)	4,190	3,340
System and Plant		
System and Distribution Type	Constant Volume w/ Reheat VAV w/ Economizer	Packaged Single-Zone Packaged Single-Zone w/ Economizer
Heating Plant	Gas Boiler	Gas Furnace
Cooling Plant	Hermetic Centrifugal Chiller	Direct Expansion
Service Hot Water	Gas Boiler	Gas Water Heater

Note(s): 1) The prototypes are synthetic buildings compiled from statistical data from building surveys or conclusions from previous studies. The physical characteristics, system characteristics, and usage patterns are based upon various surveys, studies, engineering estimates, or engineering judgment.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, Nov. 1999, Table 10, p. 31.

7.4.3 Typical School Building (1) (2)

	Pre-1980	Post-1980
Stock Floor Area (billion SF)	7.5	0.6
Floor-Area Weighted Averages		
Building Area (thousand SF)	22 - 47	16 - 26
Floors	2	2
Shell		
Percent Glass	27.0	18.0
Window R-Value	1.39 - 1.6	1.67 - 1.71
Window Shading Coefficient	0.80 - 0.83	0.71 - 0.73
Wall R-Value	2.7 - 3.4	5.3 - 5.7
Roof R-Value	10.1 - 10.9	12.6 - 13.3
Wall Material	masonry	masonry
Roof Material	built-up	built-up
Occupancy		
Average Occupancy (SF/person)	105	105
Weekday Hours (hrs/day)	8.0	8.0
Weekend Hours (hrs/day)	2.0	2.0
Equipment		
Average Power Density (W/SF)	0.8	0.8
Full Equipment Hours (hrs/year)	1,136	1,136
Lighting		
Average Power Density (W/SF)	1.8	1.7
Full Lighting Hours (hrs/year)	2,436	2,436
System and Plant		
System and Distribution Type	6 (Classrooms, Gym, Auditorium, Dining, Kitchen) Unit Ventilators	1 Central System Packaged Multi-Zone w/ Economizer
Heating Plant	Gas Boiler	Gas Boiler
Cooling Plant	Hermetic Centrifugal Chiller	Hermetic Centrifugal Chiller
Service Hot Water	Gas Boiler	Gas Boiler

Note(s): 1) The prototypes are synthetic buildings compiled from statistical data from building surveys or conclusions from previous studies. The physical characteristics, system characteristics, and usage patterns are based upon various surveys, studies, engineering estimates, or engineering judgment. 2) For additional data on Educational Facilities, see Section 7.5.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, June 1998, Table 15, p. 36; and D&R for hours of occupancy.

7.4.4 Typical Mercantile & Service (Retail) Building (1)

	Retail (>= 25,000 SF)	Retail (<25,000 SF)
Stock Floor Area (billion SF)	5.88	6.53
Floor-Area Weighted Averages		
Building Area (thousand SF)	80	5.3 - 6.4
Floors	2	1
Shell		
Percent Glass	15	15
Window R-Value	1.39 - 1.71	1.24 - 1.71
Window Shading Coefficient	0.74 - 0.79	0.85
Wall R-Value	3.1 - 6.4	2.5 - 6.6
Roof R-Value	10.6 - 14.0	9.5 - 13.2
Wall Material	masonry	masonry
Roof Material	built-up	built-up
Occupancy		
Average Occupancy (SF/person)	390 - 460	1,635 - 2,085
Weekday Hours (hrs/day)	12	12
Weekend Hours (hrs/day)	5	4
Equipment		
Average Power Density (W/SF)	0.40	0.50
Full Equipment Hours (hrs/year)	4,750 - 5,850	3,480
Lighting		
Average Power Density (W/SF)	1.6 - 2.1	1.7 - 2.2
Full Lighting Hours (hrs/year)	4,500 - 5,245	3,786 - 4,412
System and Plant		
System and Distribution Type	Constant Volume w/ Reheat VAV w/ Economizer	Packaged Single-Zone Packaged Single-Zone w/ Economizer
Heating Plant	Gas Boiler	Gas Furnace
Cooling Plant	Hermetic Centrifugal Chiller	Direct Expansion
Service Hot Water	Gas Boiler	Gas Water Heater

Note(s): 1) The prototypes are synthetic buildings compiled from statistical data from building surveys or conclusions from previous studies. The physical characteristics, system characteristics, and usage patterns are based upon various surveys, studies, engineering estimates, or engineering judgment.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, June 1998, Table 11, p. 32.

7.4.5 Typical Hospital Building (1)

	Pre-1980	Post-1980
Stock Floor Area (billion SF)	1.43	0.21
Floor-Area Weighted Averages		
Building Area (thousand SF)	66.2	156
Floors	6	12
Shell		
Percent Glass	25	25
Window R-Value	1.79	1.96
Window Shading Coefficient	0.71	0.66
Wall R-Value	0.3	6.9
Roof R-Value	12.3	11.5
Wall Material	masonry	masonry
Roof Material	built-up	built-up
Occupancy		
Average Occupancy (SF/person)	190	190
Weekday Hours (hrs/day)	24	24
Weekend Hours (hrs/day)	24	24
Equipment		
Average Power Density (W/SF)	2.20	2.20
Full Equipment Hours (hrs/year)	6,962	6,962
Lighting		
Average Power Density (W/SF)	2.1	2.1
Full Lighting Hours (hrs/year)	6,752	6,752
System and Plant		
System and Distribution Type	4-Pipe Fan-Coil in Rooms Reheat in Lobby & Core Single-Zone Reheat in Kitchen Dual-Duct in Kitchen	4-Pipe Fan-Coil in Rooms VAV in Lobby & Core Single-Zone Reheat in Kitchen Dual-Duct in Kitchen
Heating Plant	Gas Boiler	Gas Boiler
Cooling Plant	Hermetic Centrifugal Chiller	Direct Expansion
Service Hot Water	Gas Boiler	Gas Boiler

Note(s): 1) The prototypes are synthetic buildings compiled from statistical data from building surveys or conclusions from previous studies. The physical characteristics, system characteristics, and usage patterns are based upon various surveys, studies, engineering estimates, or engineering judgment.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, June 1998, Table 14, p. 35.

7.5.1 1995 Energy End-Use Intensities and Consumption of Educational Facilities, by Building Activity (1)

	(10^12 Btu)		(1000 Btu/SF)
Space Heating	254	41%	32.8
Space Cooling	37	6%	4.8
Ventilation	13	2%	1.6
Water Heating	134	22%	17.4
Lighting	122	20%	15.8
Cooking	11	2%	1.4
Refrigeration	8	1%	1.0
Office Equipment	11	2%	1.5
Other	22	4%	2.9
Total (2)	**614**	100%	**79.3**

Note(s): 1) Educational facilities include K-12 as well as higher education facilities. 2) Due to rounding, sum does not add up to total.
Source(s): EIA, Commercial Building Energy Consumption and Expenditures 1995, Apr. 1998, Table 1 for total energy consumption, Table 2 for energy intensities, and Table 4 for expenditures.

7.5.2 2003-2004 Number of Public K-12 Schools in the United States and Students per School

Number of Schools (2004-2005)		Average Number of Students per School (2003-2004)(3)	
Regular (1)	86,487	Elementary	438
Special	1,635	Middle	616
Vocational	326	High	758
Alternative	4,847	Other	266
Total (2)	**93,295**		

Note(s): 1) Regular schools are those responsible for providing free public education for school age children residing within their jurisdiction. 2) Data is based on total number of schools reporting current student enrollment, which varies from the actual number of schools, 96,296. "Special" focuses primarily on special education with materials and instructional approaches to meet the needs of the students. A "vocational" school focuses on technical or career skills and training. An "alternative" school addresses the needs of students that typically cannot be met in a traditional school setting. 3) Averages are for "regular" schools.
Source(s): U.S. Department of Education/National Center for Educational Statistics (NCES), Public Elementary and Secondary Students, Staff, Schools, and School Districts: School Year 2003-04, Feb. 2006, Table 1, p. 3 and Table 8, p. 19.

7.5.3 National Enrollment and Expenditures for Public K-12 Facilities ($2005)

	Enrollment (millions)	Expenditures ($ billion)	Expenditures per Pupil
1986	39.42	277.7	7,045
1990	40.54	330.4	8,149
1995	44.11	361.3	8,191
2000	46.86	426.3	9,098
2003	48.18	474.1	9,840
2005	48.56	496.9	10,293
2010	49.27	555.8	11,403
2015	50.74	653.3	12,878

Source(s): NCES, Projections of Educational Statistics to 2016, Sept. 2006, Table 33, p. 82 for 1990-2014; NCES, Projections of Educational Statistics to 2011, Oct. 2001, Table 33, p. 88 for 1986; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

7.5.4 Total Expenditures for K-12 Plant Operations and Maintenance, by Function ($2005 Billion)

	1990		1995		2000		2002	
Salaries and Benefits	15.9	54%	16.6	53%	19.4	51%	20.6	52%
Purchased Services	7.9	27%	9.4	30%	10.9	28%	10.7	27%
Supplies	5.2	18%	5.2	16%	7.7	20%	8.2	20%
Other	0.4	2%	0.3	1%	0.3	1%	0.4	1%
Total	**29.4**	100%	**31.5**	100%	**38.4**	100%	**39.8**	100%

Note(s): 1) Operation and maintenance services include salaries, benefits, supplies, and contractual fees for supervision of operations and maintenance, operating buildings (heating, lighting, ventilating, repair and replacement), care and upkeep of grounds and equipment, vehicle operation and maintenance (other than student transportation), security and other operations and maintenance services.

Source(s): NCES, Digest of Educational Statistics 2005, July 2006, Table 160, p. 263-264; EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377 for price inflators.

7.5.5 New Construction and Renovations Expenditures for Public K-12 Schools ($2006 Billion)

	New Schools	Additions	Modernizations	Total
1996	6.08	4.12	3.35	13.55
1997	7.43	4.34	3.29	15.06
1998	9.49	6.18	4.88	20.55
1999	7.08	6.01	5.93	19.01
2000	13.36	4.73	6.93	25.02
2001	12.68	4.79	12.87	30.34
2002	13.01	6.34	7.81	27.17
2003	19.15	5.80	6.48	31.44
2004	14.02	5.91	10.89	30.82
2005	12.64	6.33	4.65	23.63
2006	13.70	3.29	8.34	25.33

Source(s): American School and University, 23rd Annual Official Education Report, May 1997 for 1996; American School and University, 24th Annual Official Education Report, May 1998 for 1997; American School and University, 25th Annual Official Education Report, May 1999 for 1998; American School and University, 26th Annual Official Education Report, May 2000 for 1999; American School and University, 27th Annual Official Education Report, May 2001, Table 1, p. 26 for 2000; American School and University, 28th Annual Official Education Report, May 2002, Table 1, p. 24 for 2001; American School and University, 29th Annual Official Education Report, May 2003, Table 1, p. 29 for 2002; American School and University, 30th Annual Official Education Report, May 2004, Table 1, p. 24 for 2003; American School and University, 31st Annual Official Education Report, May 2005, Table 1, p. 29 for 2004; American School and University, 32nd Annual Official Education Report, May 2006, Table 1, p. 24 for 2005; American School and University, 33rd Annual Official Education Report, May 2007, Table 1, p. 30 for 2006; and EIA, Annual Energy Review 2006, June 2007, Appendix D, p. 377.

7.5.6 Percentage of Public K-12 Schools with Inadequate Building Features (1)

	Small		Medium		Large	
	1995	1999	1995	1999	1995	1999
Roofs	26%	24%	25%	22%	32%	22%
Framing, floors, and foundations	18%	19%	18%	12%	17%	14%
Exterior walls, finishes, windows, and doors	26%	31%	26%	21%	28%	23%
Interior finishes	23%	20%	23%	16%	27%	18%
Plumbing	33%	28%	28%	27%	30%	20%
HVAC	36%	29%	35%	32%	39%	26%
Electrical power	28%	23%	25%	21%	27%	22%
Electrical lighting	25%	19%	24%	17%	26%	16%

Note(s): 1) Small school is defined as having 1-299 students, medium 300-599 students, and a large school has 600 or more students.

Source(s): National Center for Education Statistics, Digest of Educational Statistics 2005, July 2006, Table 100, p. 176-177 for 1999; and U.S. GAO, Health, Education, and Human Services Division, America's Schools Report Differing Conditions, GAO/HEHS-96-103, June 1996, Table II.9, p. 45 for 1995.

Thermal Conversion Factors

Fuel	Units	Approximate Heat Content
Coal		
Production	million Btu per short	20.363
Consumption	million Btu per short	20.231
Coke Plants	million Btu per short	26.291
Industrial	million Btu per short	22.178
Residential and Commercial	million Btu per short	22.264
Electric Power Sector	million Btu per short	19.970
Imports	million Btu per short	25.009
Exports	million Btu per short	25.431
Coal Coke	million Btu per short	24.800
Crude Oil		
Production	million Btu per barrel	5.800
Imports	million Btu per barrel	5.977
Petroleum Products		
Consumption	million Btu per barrel	5.373
Motor Gasoline	million Btu per barrel	5.218
Jet Fuel	million Btu per barrel	5.670
Distillate Fuel Oil	million Btu per barrel	5.799
Residual Fuel Oil	million Btu per barrel	6.287
Liquefied Petroleum Gas	million Btu per barrel	3.620
Kerosene	million Btu per barrel	5.670
Petrochemical Feedstocks	million Btu per barrel	5.523
Unfinished Oils	million Btu per barrel	5.825
Imports	million Btu per barrel	5.496
Exports	million Btu per barrel	5.741
Natural Gas Plant Liquids		
Production	million Btu per barrel	3.724
Natural Gas		
Production, Dry	Btu per cubic foot	1,030
Consumption	Btu per cubic foot	1,030
End-Use Sectors	Btu per cubic foot	1,030
Electric Power Sector	Btu per cubic foot	1,029
Imports	Btu per cubic foot	1,024
Exports	Btu per cubic foot	1,009
Electricity Consumption	Btu per kilowatthour	3,412

Note(s): Conversion factors vary from year to year.

Source(s): DOE, EIA, Annual Energy Outlook 2007, Feb. 2007, Table G1, p. 229.

buildingsdatabook.eere.energy.gov