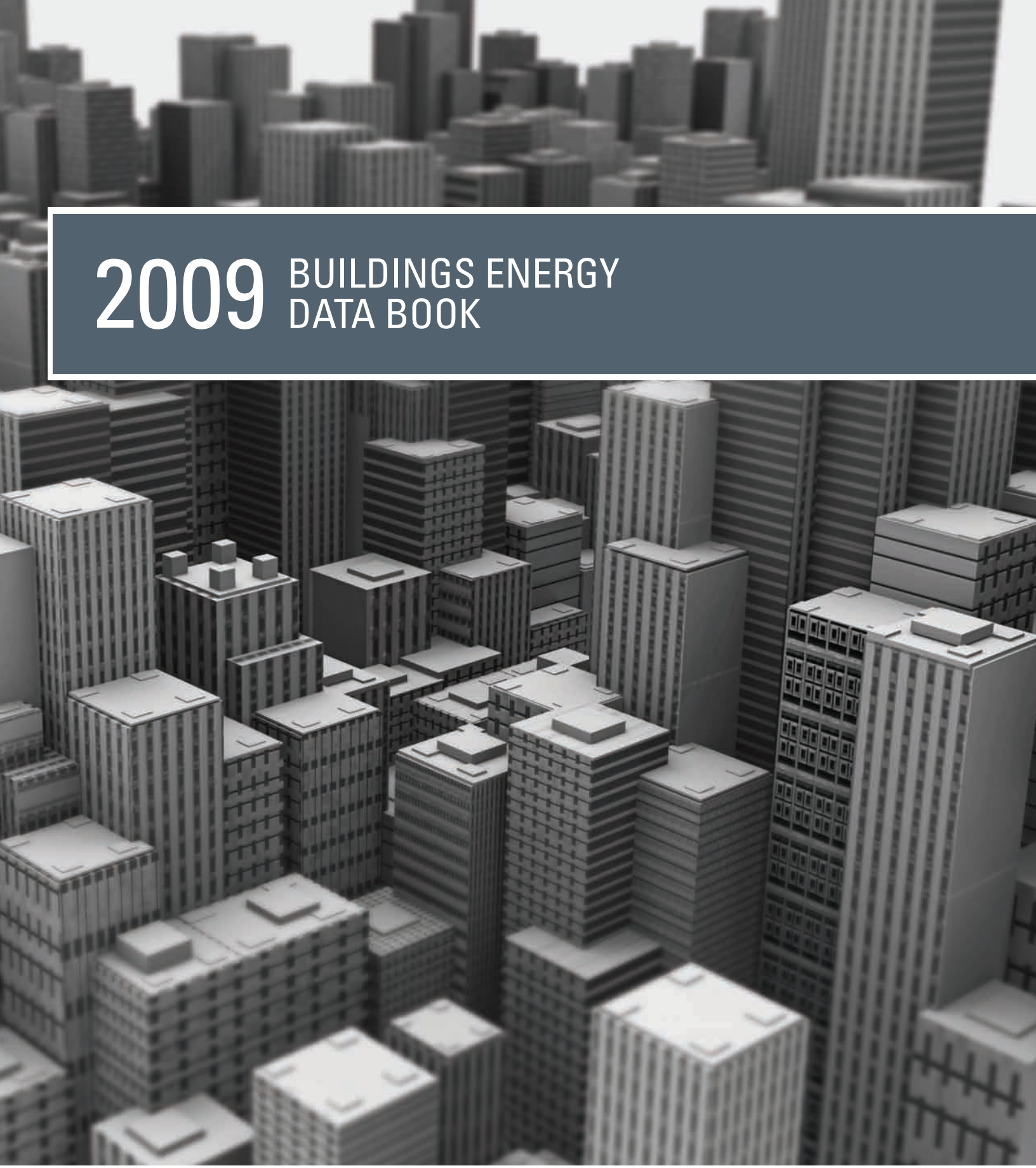

2009 BUILDINGS ENERGY DATA BOOK

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

2009 Buildings Energy Data Book

October 2009

Prepared for the
Buildings Technologies Program
Energy Efficiency and Renewable Energy
U.S. Department of Energy

by
D&R International, Ltd.

under contract to
Research and Development Solutions, LLC
and
National Energy Technology Laboratory

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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.

Data is organized into nine chapters; Chapter 1 – Buildings Sector, Chapter 2 – Residential Sector, Chapter 3 – Commercial Sector, Chapter 4 – Federal Sector, Chapter 5 – Envelope and Equipment, Chapter 6– Energy Supply, Chapter 7 – Energy Codes, Standards, and Laws, Chapter 8 – Water Data, and Chapter 9 – Market Transformation. The emphasis of our work on the 2009 edition was to update the market data available. New data tables on commercial building energy benchmarks were added to their relevant sections. New data tables were also developed from an updated report on commercial refrigeration. You will also find updated market transformation data from the ENERGY STAR program and the U.S. Green Building Council. We continue to refine and provide water data.

We hope you find the *2009 Buildings Energy Data Book* useful. You are encouraged to comment on errors, omissions, emphases, and organization of this report to the person 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 *2009 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 and 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 and Sean McDonald of the Pacific Northwest National Laboratory. Daniel Vida, Matthew Jones, and Ray Long collectively worked to provide data. Thank you all for your efforts.

Introduction

The *2008 Buildings Energy Data Book* is a statistical compendium prepared and published under contract with the National Energy Technology Laboratory (NETL) and Research and Development Solutions, LLC (RDS) with support from the U.S. Department of Energy's 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 2004; Oak Ridge National Laboratory 2005-2006, and NETL began publishing the *Buildings Energy Data Book* in 2007.

The Department of Energy's Office of Energy Efficiency and Renewable Energy has developed this *2009 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. Please provide full source references along with all data.

The *Buildings Energy Data Book* is a compendium of data and does not provide original data. Much of the data gathered is from government documents, models, and analysis. All data sources are included with each data table.

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Glossary

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

Glossary

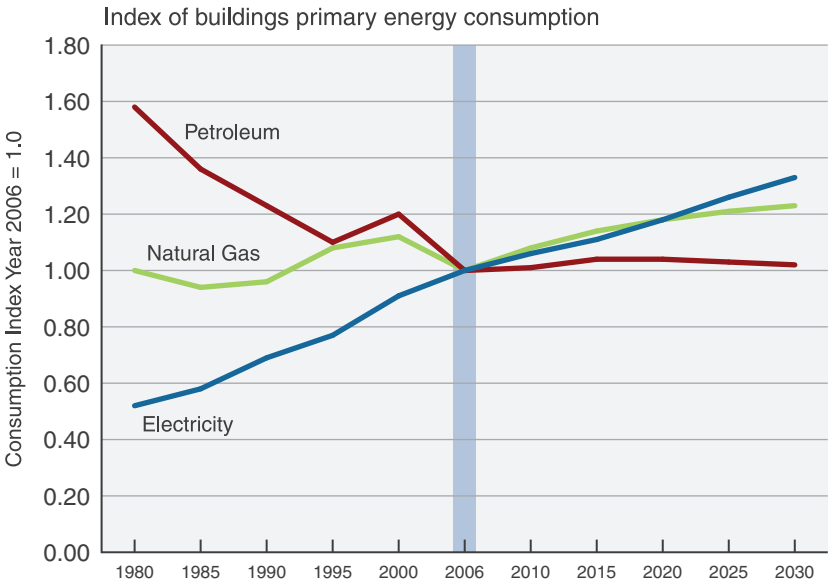
GDP	Gross Domestic Product
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
HHS	U.S. Department of Health and Human Services
HSPF	Heating Season Performance Factor (Btu/watt-hour)
HUD	U.S. Department of Housing and Urban Development
HVAC/R	Heating, ventilating, and air-conditioning/refrigeration
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
MMT CO2	Million metric tons of carbon dioxide (includes only energy consumption effects, unless otherwise noted)
N.A.	Not Available
N/A	Not Applicable
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

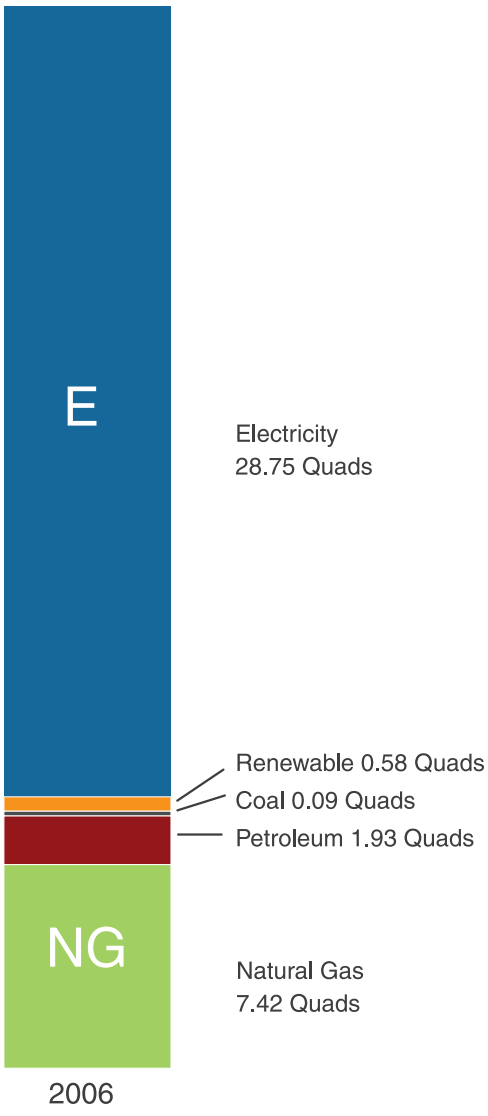
Glossary

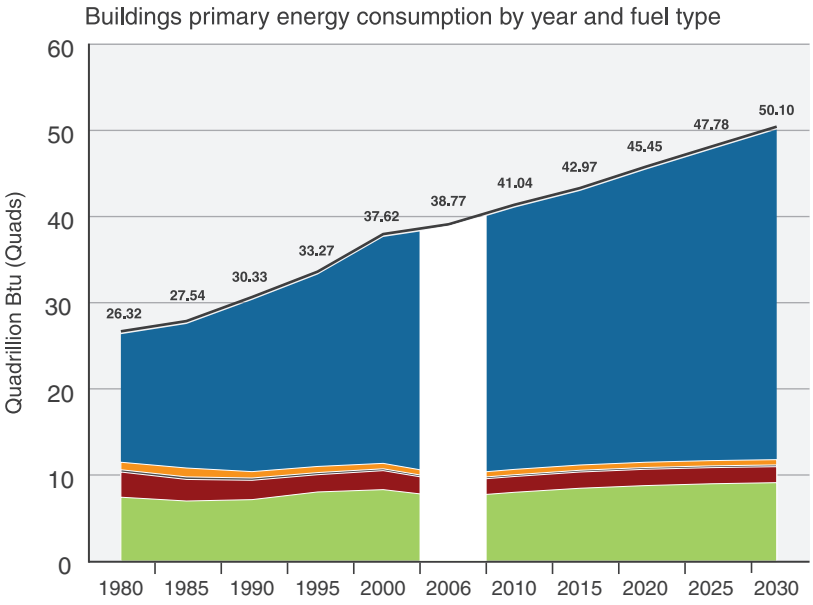
Primary	Refers to energy used at the source (including fuel input to electric power plants)
PV	Photovoltaic
PY	Program Year
Quad	Quadrillion Btu (10^15 Btu)
R-value	Thermal resistance measured in (Btu/Hr-SF-^{o}F)$^{-1}$
RECS	EIA's Residential Energy Consumption Survey
SEDS	State Energy Data System
SEER	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

PRIMARY ENERGY IN THE BUILDINGS SECTOR

The Buildings Sector consumed 39% (38.77 Quads) of U.S. primary energy in 2006. Electricity made up the overwhelming majority of consumption, representing 74% of all primary energy used in the Buildings Sector. Electricity is also the fastest growing fuel, with a projected increase of 33% by 2030.







Buildings Primary Energy Consumption, 1980–2030
Quadrillion Btu (Quads)

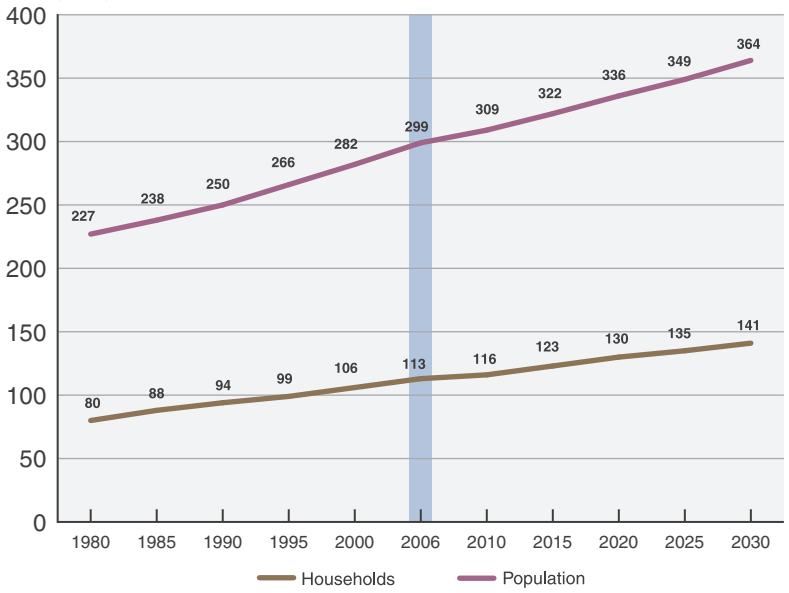
	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	14.86	16.72	19.93	22.28	26.28	28.75	30.38	31.81	33.96	36.11	38.32
Renewable	0.87	1.03	0.74	0.71	0.63	0.58	0.62	0.61	0.61	0.61	0.61
Coal	0.15	0.18	0.15	0.13	0.10	0.09	0.09	0.09	0.09	0.09	0.09
Petroleum	3.04	2.62	2.36	2.12	2.32	1.93	1.95	2.00	2.01	1.99	1.97
Natural Gas	7.42	6.98	7.14	8.03	8.30	7.42	7.99	8.46	8.77	8.98	9.11

DELIVERED ENERGY IN THE BUILDINGS SECTOR

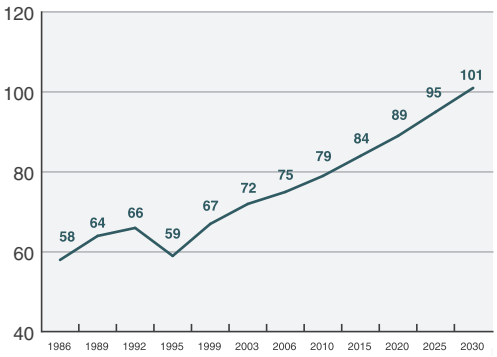
The Buildings Sector consumed 19.06 Quads of delivered energy in 2006. Delivered energy does not include energy lost during production, transmission, and distribution to customers. In the case of electricity, delivered energy excludes that used by the electric generating and distribution companies.

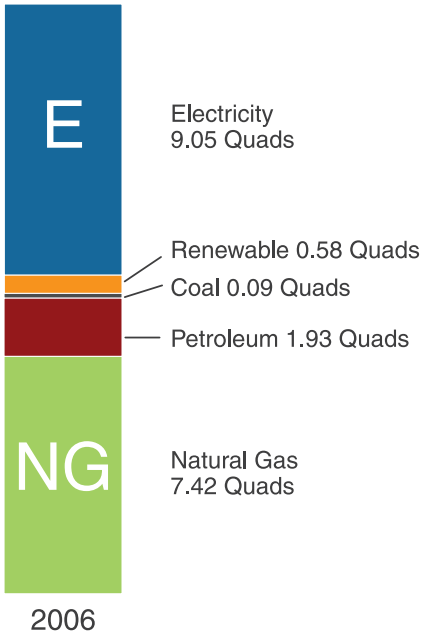
The growth in total Buildings sector energy consumption is fueled by the growth in households, population, and commercial floorspace. From 2006 to 2030, the U.S. population is expected to increase by 21% while the number of households will increase 25%. Commercial floorspace is expected to increase 35% over the same period.

U.S. household and population growth

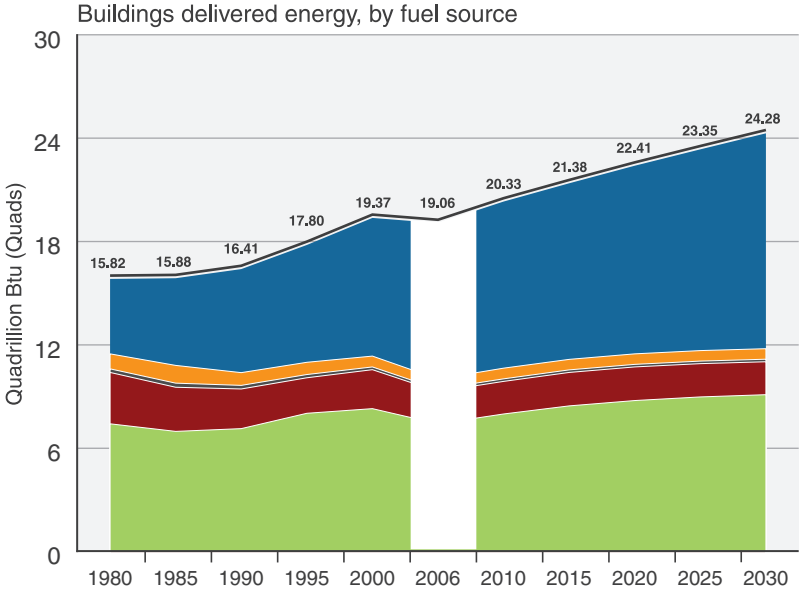


Total commercial floorspace





Buildings delivered energy, by fuel source



Buildings delivered energy, by fuel source, 1980–2030
Quadrillion Btu (Quads)

	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	4.35	5.06	6.01	6.81	8.02	9.05	9.67	10.22	10.92	11.68	12.50
Renewable	0.87	1.03	0.74	0.71	0.63	0.58	0.62	0.61	0.61	0.61	0.61
Coal	0.15	0.18	0.15	0.13	0.10	0.09	0.09	0.09	0.09	0.09	0.09
Petroleum	3.04	2.62	2.36	2.12	2.32	1.93	1.95	1.95	2.01	1.99	1.97
Natural Gas	7.42	6.98	7.14	8.03	8.30	7.42	7.99	7.99	8.77	8.98	9.11

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 2006-Year
1980	7.52	28%	3.04	11%	0.15	0.6%	0.87	3.3%	4.35	10.51	14.86	56.2%	26.43	100%	-
1990	7.22	24%	2.36	8%	0.15	0.5%	0.74	2.4%	6.01	13.92	19.93	65.6%	30.41	100%	-
2000	8.35	22%	2.32	6%	0.10	0.3%	0.63	1.7%	8.02	18.26	26.28	69.8%	37.68	100%	-
2006	**7.42**	**19%**	**1.93**	**5%**	**0.09**	**0.2%**	**0.58**	**1.5%**	**9.05**	**19.70 (3)**	**28.75**	**74.2%**	**38.77**	**100%**	**-**
2010	7.99	19%	1.95	5%	0.09	0.2%	0.62	1.5%	9.67	20.71	30.38	74.0%	41.04	100%	1.4%
2015	8.46	20%	2.00	5%	0.09	0.2%	0.61	1.4%	10.22	21.59	31.81	74.0%	42.97	100%	1.1%
2020	8.77	19%	2.01	4%	0.09	0.2%	0.61	1.3%	10.92	23.04	33.96	74.7%	45.45	100%	1.1%
2025	8.98	19%	1.99	4%	0.09	0.2%	0.61	1.3%	11.68	24.44	36.11	75.6%	47.78	100%	1.1%
2030	9.11	18%	1.97	4%	0.09	0.2%	0.61	1.2%	12.50	25.82	38.32	76.5%	50.10	100%	1.1%

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) 2006 *site* -to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2005: Consumption, February 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 and Table A17, p. 143-144 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)	GSHP (4)	Total	Growth Rate 2006-Year
1980	0.858	0.000	0.000	0.000	0.858	-
1990	0.609	0.056	0.000	0.003	0.668	-
2000	0.559	0.024	0.000	0.017	0.599	-
2006	**0.538**	**0.038**	**0.001**	**0.003**	**0.581**	**-**
2010	0.570	0.043	0.004	0.004	0.621	1.7%
2015	0.547	0.052	0.004	0.006	0.609	0.5%
2020	0.533	0.059	0.006	0.008	0.607	0.3%
2025	0.520	0.066	0.010	0.011	0.607	0.2%
2030	0.508	0.073	0.016	0.014	0.611	0.2%

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 2005: Consumption, February 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A17, p. 143-144 for 2006-2030; Annual Energy Outlook 2006, Feb. 2006, Table A17 p. 159; EIA, Annual Energy Outlook 2005, Jan. 2005, Table A17 p.163; EIA; Annual Energy Outlook 2004, Jan. 2004, Table A18 p. 157; EIA, Annual Energy Outlook 2002, Dec. 2001, Table A18 p.148 For 1999-2004 Solar

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)	27.4%	18.3%	**45.7%**	36.0%	18.3%	100%	57.9
1990	22.4%	17.5%	**40.0%**	38.9%	21.1%	100%	76.1
2000	21.1%	17.7%	**38.8%**	36.1%	25.2%	100%	97.2
2006	**20.9%**	**18.0%**	**38.9%**	**32.7%**	**28.4%**	**100%**	**99.5**
2010	21.5%	18.1%	**39.7%**	32.2%	28.1%	100%	103.3
2015	21.0%	19.0%	**40.0%**	31.6%	28.4%	100%	107.3
2020	21.1%	19.8%	**40.9%**	30.9%	28.2%	100%	110.8
2025	21.1%	20.6%	**41.6%**	30.5%	27.9%	100%	114.5
2030	21.2%	21.2%	**42.4%**	29.6%	28.0%	100%	118.0

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

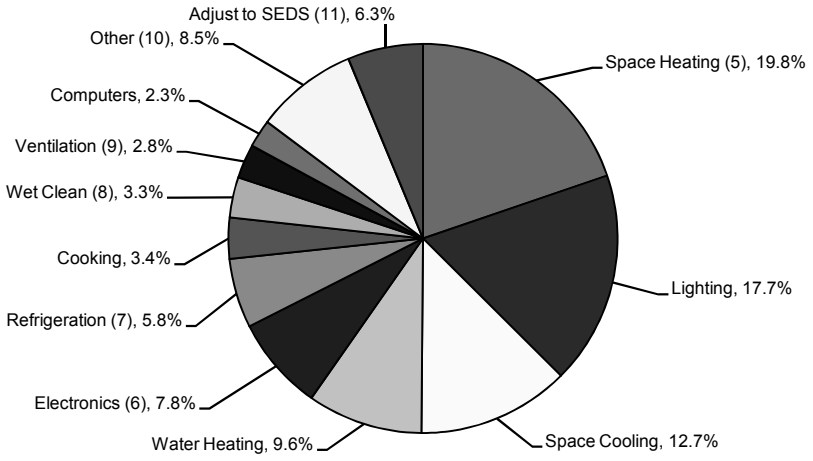
Source(s): EIA, State Energy Data 2005: Consumption, February 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 data and Table A17, p. 143-144 for non-marketed renewable energy.

1.1.4 2006 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)	4.31	0.84	0.23	0.18	0.41	0.53	6.50	34.1%	1.69	7.66	19.8%
Lighting						2.16	2.16	11.3%	6.86	6.86	17.7%
Space Cooling	0.02					1.54	1.56	8.2%	4.89	4.91	12.7%
Water Heating	1.63	0.15	0.06		0.04	0.58	2.45	12.9%	1.85	3.72	9.6%
Electronics (6)						0.96	0.96	5.0%	3.04	3.04	7.8%
Refrigeration (7)						0.70	0.70	3.7%	2.23	2.23	5.8%
Cooking	0.45		0.03			0.27	0.75	3.9%	0.85	1.33	3.4%
Wet Clean (8)	0.07					0.38	0.46	2.4%	1.22	1.30	3.3%
Ventilation (9)						0.35	0.35	1.8%	1.10	1.10	2.8%
Computers						0.28	0.28	1.5%	0.89	0.89	2.3%
Other (10)	0.27	0.02	0.23	0.05	0.13	0.82	1.52	8.0%	2.60	3.30	8.5%
Adjust to SEDS (11)	0.67	0.23				0.48	1.37	7.2%	1.54	2.43	6.3%
Total	**7.42**	**1.24**	**0.55**	**0.23**	**0.58**	**9.05**	**19.06**	100%	**28.75**	**38.77**	100%

Note(s): 1) Includes distillate fuel oil (1.12 quad) and residual fuel oil (0.9 quad). 2) Kerosene (0.12 quad) and coal (0.09 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.41 quad), biomass (0.13 quad), solar water heating (0.03 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 (0.21 quad). 6) Includes color television (1.05 quad) and other office equipment (0.64 quad). 7) Includes refrigerators (1.24 quad) and freezers (0.49 quad). Includes commercial refrigeration. 9) Includes clothes washers (0.11 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.81 quad) and dishwashers (0.3 quad). Does not include water heating energy. 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System (NEMS) for AEO 2008, Mar. 2008; 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, Annual Energy Outlook 1998, Dec. 1997, Table A5, p. 108-109 for 1995 ventilation; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63; and EIA, Supplement to the AEO 2008, April 2008, Table 22.

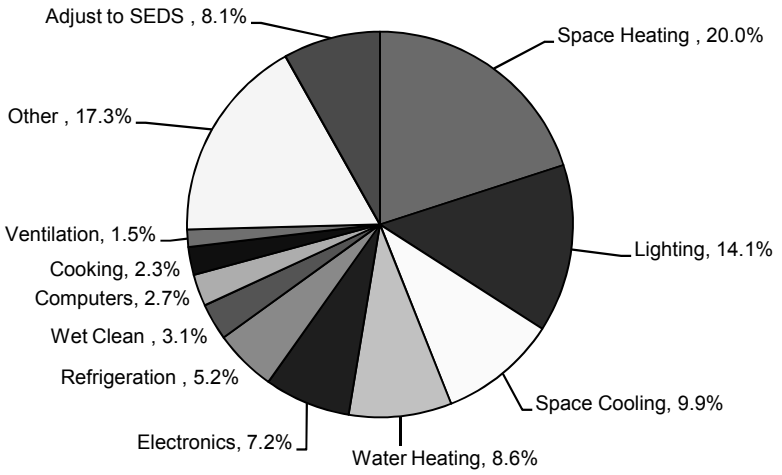


1.1.5 2010 U.S. Buildings Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	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	0.89	0.24	0.19	0.44	0.50	7.13	35.1%	1.59	8.21	20.0%
Lighting						1.29	1.29	6.3%	5.78	5.78	14.1%
Space Cooling	0.02					0.19	0.21	1.0%	4.04	4.06	9.9%
Water Heating	1.62	0.14	0.05		0.04	0.54	2.39	11.7%	1.69	3.54	8.6%
Electronics (6)						1.84	1.84	9.0%	2.96	2.96	7.2%
Refrigeration (7)						0.68	0.68	3.4%	2.14	2.14	5.2%
Wet Clean (8)	0.07					0.94	1.02	5.0%	1.19	1.27	3.1%
Computers						0.35	0.35	1.7%	1.10	1.10	2.7%
Cooking	0.47		0.03			0.38	0.88	4.3%	0.46	0.96	2.3%
Ventilation (9)						0.15	0.15	0.7%	0.60	0.60	1.5%
Other (10)	0.29	0.02	0.25	0.05	0.13	2.02	2.76	13.6%	6.35	7.09	17.3%
Adjust to SEDS (11)	0.66	0.19				0.80	1.64	8.1%	2.50	3.34	8.1%
Total	**7.99**	**1.23**	**0.57**	**0.24**	**0.62**	**9.67**	**20.33**	100%	**30.38**	**41.04**	100%

Note(s): 1) Includes distillate fuel oil (1.13 quad) and residual fuel oil (0.10 quad). 2) Kerosene (0.08 quad) and coal (0.09 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.44 quad), biomass (0.13 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) = 3.14. 5) Includes furnace fans (0.20 quad). 6) Includes color television (1.23 quad). 7) Includes refrigerators (1.89 quad) and freezers (0.25 quad). Includes commercial refrigeration. 8) Includes clothes washers (0.09 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.80 quad) and dishwashers (0.29 quad). Does not include water heating energy. 9) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 10) Includes residential smallelectric 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System (NEMS) for AEO 2008, Mar. 2008; and EIA, Supplement to the AEO 2008, April 2008, Table 22.



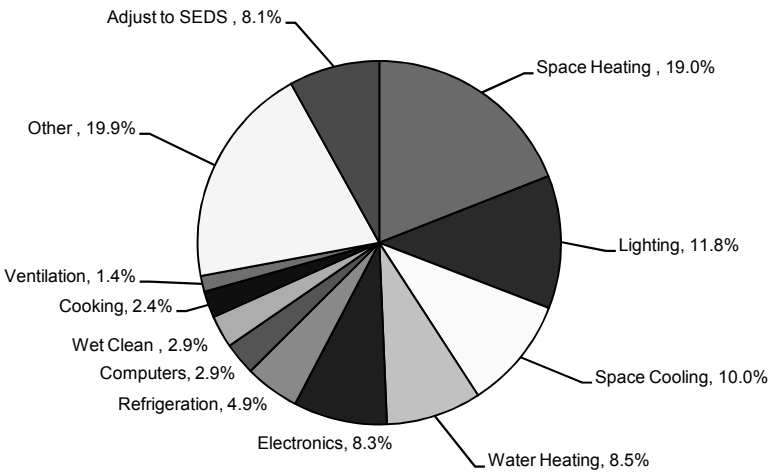
1.1.6 2020 U.S. Buildings Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	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)	5.23	0.90	0.24	0.19	0.41	0.54	7.51	33.5%	1.68	8.65	19.0%
Lighting						1.73	1.73	7.7%	5.37	5.37	11.8%
Space Cooling	0.02					1.46	1.48	6.6%	4.53	4.55	10.0%
Water Heating	1.80	0.13	0.05		0.06	0.58	2.62	11.7%	1.81	3.85	8.5%
Electronics (6)						1.22	1.22	5.4%	3.79	3.79	8.3%
Refrigeration (7)						0.71	0.71	3.2%	2.21	2.21	4.9%
Computers						0.42	0.42	1.9%	1.31	1.31	2.9%
Wet Clean (8)	0.08					0.39	0.47	2.1%	1.22	1.30	2.9%
Cooking	0.54		0.03			0.16	0.73	3.3%	0.50	1.08	2.4%
Ventilation (9)						0.21	0.21	0.9%	0.65	0.65	1.4%
Other (10)	0.38	0.02	0.30	0.05	0.14	2.62	3.51	15.6%	8.14	9.03	19.9%
Adjust to SEDS (11)	0.72	0.19				0.88	1.80	8.0%	2.74	3.66	8.1%
Total	**8.77**	**1.25**	**0.61**	**0.25**	**0.61**	**10.92**	**22.41**	100%	**33.96**	**45.45**	100%

Note(s): 1) Includes distillate fuel oil (1.14 quad) and residual fuel oil (0.10 quad). 2) Kerosene (0.08 quad) and coal (0.09 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.40 quad), biomass (0.13 quad), solar water heating (0.06 quad), geothermal space heating (0.01 quad), and solar photovoltaics (PV) less than 0.01 quad). 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.11. 5) Includes furnace fans (0.23 quad). 6) Includes color television (1.33 quad). 7) Includes refrigerators (1.93 quad) and freezers (0.29 quad). Includes commercial refrigeration. 8) Includes clothes washers (0.09 quad), natural gas clothes dryers (0.08 quad), electric clothes dryers (0.84 quad) and dishwashers (0.30 quad). Does not include water heating energy. 9) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123, Table A5, p. 124-125, and Table A17, p. 143-144; and EIA, National Energy Modeling System for AEO 2008, Mar. 2008.

2020 U.S. Buildings Energy End-Use Splits, by Fuel Type

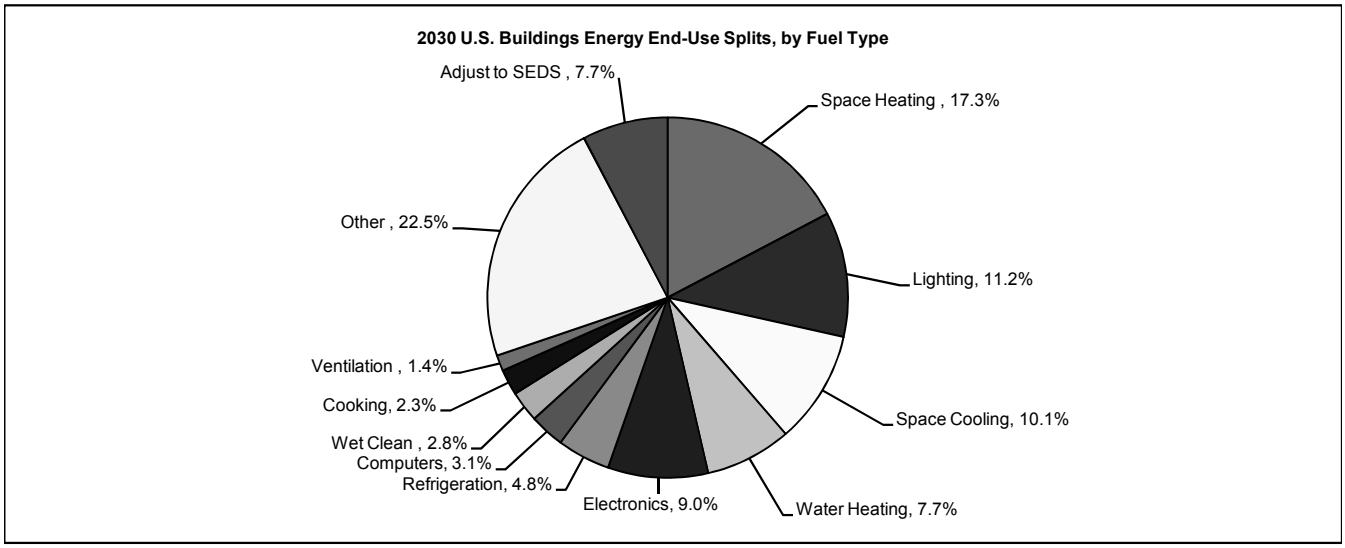


1.1.7 2030 U.S. Buildings Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	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)	5.30	0.84	0.23	0.19	0.39	0.56	7.51	30.9%	1.71	8.67	17.3%
Lighting						1.83	1.83	7.5%	5.61	5.61	11.2%
Space Cooling	0.02					1.65	1.67	6.9%	5.06	5.08	10.1%
Water Heating	1.82	0.12	0.04		0.07	0.59	2.65	10.9%	1.81	3.87	7.7%
Electronics (6)						1.47	1.47	6.0%	4.50	4.50	9.0%
Refrigeration (7)						0.78	0.78	3.2%	2.40	2.40	4.8%
Computers						0.51	0.51	2.1%	1.56	1.56	3.1%
Wet Clean (8)	0.08					0.43	0.51	2.1%	1.31	1.40	2.8%
Cooking	0.59		0.03			0.17	0.80	3.3%	0.54	1.16	2.3%
Ventilation (9)						0.23	0.23	1.0%	0.71	0.71	1.4%
Other (10)	0.62	0.02	0.34	0.05	0.15	3.30	4.47	18.4%	10.11	11.28	22.5%
Adjust to SEDS (11)	0.67	0.19				0.97	1.84	7.6%	2.99	3.85	7.7%
Total	**9.11**	**1.17**	**0.64**	**0.25**	**0.61**	**12.50**	**24.28**	100%	**38.32**	**50.09**	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 (0.38 quad), biomass (0.13 quad), solar water heating (0.07 quad), geothermal space heating (less than 0.01 quad), and solar photovoltaics (PV) 0.02 quad). 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.07. 5) Includes furnace fans (0.25 quad). 6) Includes color television (1.69 quad) and other office equipment (2.81 quad). 7) Includes refrigerators (2.10 quad) and freezers (0.34 quad). Includes commercial refrigeration. 8) Includes clothes washers (0.08 quad), natural gas clothes dryers (0.08 quad), electric clothes dryers (0.91 quad) and dishwashers (0.33 quad). Does not include water heating energy. 9) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123, Table A5, p. 124-125, and Table A17, p. 143-144; and EIA, National Energy Modeling System for AEO 2008, Mar. 2008



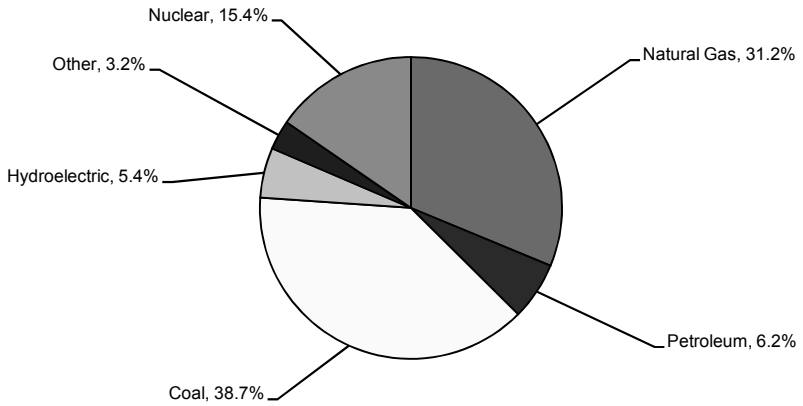
1.1.8 Shares of U.S. Buildings Generic Quad (Percent) (1)

				Renewables (2)				
	Natural Gas	Petroleum	Coal	Hydroelectric	Other	Total	Nuclear	Total
1980	37%	18%	29%	7%	4%	10%	6%	100%
1990	31%	11%	35%	6%	4%	10%	13%	100%
2000	32%	8%	37%	5%	3%	8%	14%	100%
2006	**31%**	**6%**	**39%**	**5%**	**3%**	**9%**	**15%**	**100%**
2010	32%	6%	38%	5%	4%	10%	15%	100%
2015	31%	6%	38%	5%	5%	10%	14%	100%
2020	29%	5%	39%	5%	6%	11%	15%	100%
2025	28%	5%	41%	5%	6%	11%	15%	100%
2030	26%	5%	43%	5%	6%	11%	15%	100%

Note(s): 1) A generic quad is primary energy apportioned between the various primary fuels according to their relative consumption.
2) Electric imports included in renewables. 3) Indepentant rounding.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption and Table A17, p. 143-144 for non-marketed renewable energy.

2006 Share of U.S. Buildings Generic Quad



1.1.9 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%	7.15
1990	34%	31%	**65%**	35%	0%	100%	9.26
2000	35%	34%	**69%**	31%	0%	100%	11.67
2006	**37%**	**36%**	**72%**	**27%**	**0%**	**100%**	**12.49**
2010	37%	36%	**73%**	27%	0%	100%	13.20
2015	36%	38%	**74%**	26%	0%	100%	13.85
2020	36%	39%	**75%**	25%	0%	100%	14.54
2025	36%	40%	**77%**	23%	0%	100%	15.26
2030	37%	41%	**78%**	22%	0%	100%	16.05

Note(s): 1) Buildings accounted for 81% (or $272 billion) of total U.S. electricity expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 137-139 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

1.1.10 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%	**48%**	49%	3%	20.38
1990	**37%**	43%	17%	3%	**47%**	49%	3%	19.75
2000	**35%**	40%	22%	3%	**50%**	47%	3%	23.80
2006 (1)	**33%**	**35%**	**29%**	**3%**	**54%**	**43%**	**3%**	**22.30**
2010	**33%**	35%	29%	3%	**55%**	43%	3%	23.93
2015	**35%**	35%	28%	3%	**55%**	42%	3%	24.35
2020	**37%**	35%	25%	3%	**56%**	41%	3%	24.01
2025	**38%**	36%	23%	3%	**56%**	41%	3%	23.66
2030	**39%**	36%	22%	3%	**56%**	41%	3%	23.39

Note(s): 1) Buildings accounted for 58% (or $97 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

1.1.11 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%**	31%	56%	34.2
1990	**7%**	25%	4%	64%	**10%**	26%	64%	33.6
2000	**6%**	24%	3%	67%	**8%**	25%	67%	38.4
2006	**5%**	**25%**	**2%**	**69%**	**6%**	**25%**	**69%**	**40.1**
2010	**5%**	24%	1%	70%	**6%**	24%	70%	40.5
2015	**5%**	23%	1%	71%	**6%**	23%	71%	41.8
2020	**5%**	22%	1%	72%	**6%**	22%	72%	42.2
2025	**5%**	21%	1%	73%	**6%**	22%	73%	42.8
2030	**4%**	21%	1%	73%	**6%**	21%	73%	44.0

Note(s): 1) Buildings accounted for an estimated 7.3% (or $30 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

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

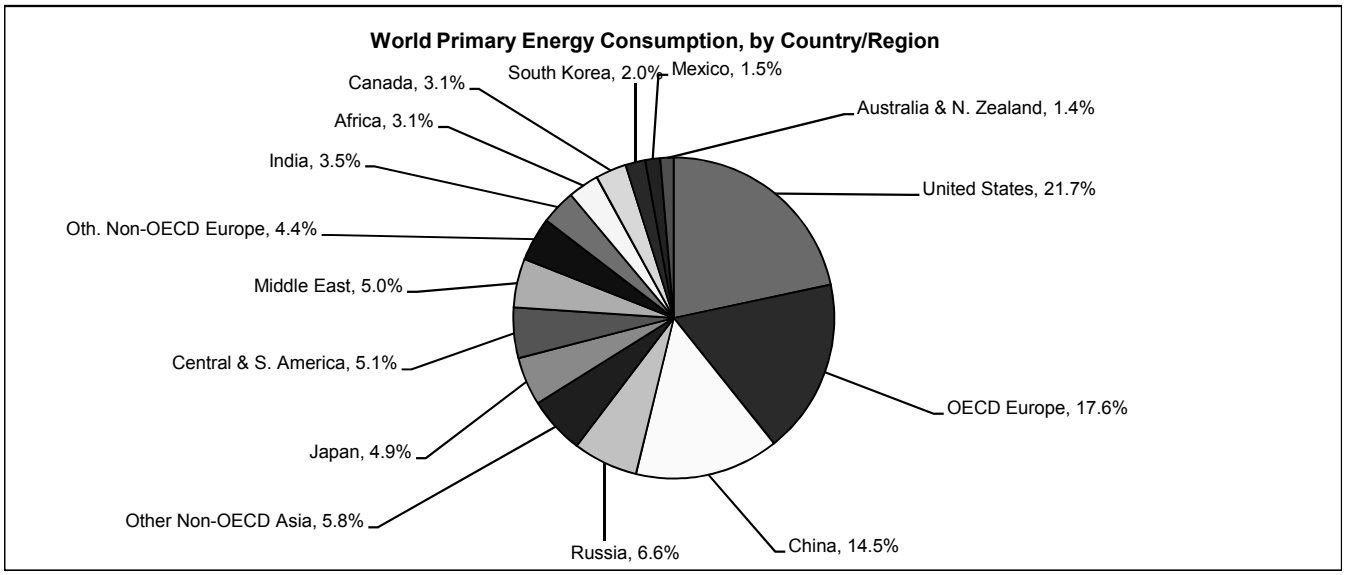
	Buildings					
	Residential	Commercial	**Total**	Industry	Transportation	Total
1980	1.31	0.92	**2.22**	5.30	9.57	19.33
1990	0.96	0.64	**1.60**	4.50	10.89	18.59
2000	1.08	0.56	**1.63**	5.07	13.05	21.39
2006	**0.69**	**0.43**	**1.12**	**4.81**	**13.02**	**20.07**
2010	0.71	0.39	**1.10**	4.67	13.36	20.23
2015	0.72	0.42	**1.14**	4.63	14.00	20.90
2020	0.73	0.43	**1.15**	4.48	14.34	21.13
2025	0.72	0.44	**1.16**	4.41	14.66	21.39
2030	0.72	0.44	**1.16**	4.45	15.19	21.96

Source(s): EIA, Annual Energy Review 2007, June 2008, Table 5.13a for 1980-2005 buildings, Table 5.13b for 1980 to 2005 industry, Table 5.13c for 1980-2005 transportation, and Table 5.13d for 1980-2005 electricity generators; and EIA, Annual Energy Outlook 2008, Mar. 2007, Table A2, p. 117-119 for 2006-2030 consumption; EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005.

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

	Energy Consumption (Quad)				Population (million)				Annual Growth Rate 1990-2005		Annual Growth Rate 2005-2010	
Region/Country	1990	2005		2010	1990	2005		2010	Energy	Pop.	Energy	Pop.
United States	84.7	100.1	21.7%	103.3	254	297	4.6%	311	1.1%	1.0%	0.6%	0.9%
OECD Europe	69.9	81.4	17.6%	83.9	497	536	8.2%	547	1.0%	0.5%	0.6%	0.4%
China	27.0	67.1	14.5%	87.3	1,155	1,313	20.2%	1,352	6.3%	0.9%	5.4%	0.6%
Russia	39.0	30.3	6.6%	32.7	148	144	2.2%	140	-1.7%	-0.2%	1.5%	-0.6%
Other Non-OECD Asia	12.5	26.6	5.8%	30.5	743	984	15.1%	1,060	5.2%	1.9%	2.8%	1.5%
Japan	18.4	22.6	4.9%	22.4	124	128	2.0%	128	1.4%	0.2%	-0.2%	0.0%
Central & S. America	14.5	23.4	5.1%	27.7	360	454	7.0%	483	3.2%	1.6%	3.4%	1.2%
Middle East	11.3	22.9	5.0%	26.4	137	193	3.0%	213	4.8%	2.3%	2.9%	2.0%
Oth. Non-OECD Europe	28.3	20.4	4.4%	22.4	200	198	3.0%	199	-2.2%	-0.1%	1.9%	0.1%
India	8.0	16.2	3.5%	19.4	849	1,134	17.4%	1,220	4.8%	1.9%	3.7%	1.5%
Africa	9.5	14.4	3.1%	16.5	636	922	14.2%	1,032	2.8%	2.5%	2.8%	2.3%
Canada	11.1	14.3	3.1%	15.7	28	32	0.5%	34	1.7%	0.9%	1.9%	1.2%
South Korea	3.8	9.3	2.0%	10.3	43	48	0.7%	49	6.1%	0.7%	2.1%	0.4%
Mexico	5.0	6.9	1.5%	7.4	84	104	1.6%	110	2.2%	1.4%	1.4%	1.1%
Australia & N. Zealand	4.4	6.3	1.4%	6.6	20	24	0.4%	26	2.4%	1.2%	0.9%	1.6%
Total World	**347.3**	**462.2**	100%	**512.5**	**5,278**	**6,512**	100%	**6,903**	1.9%	1.4%	2.1%	1.2%

Source(s): EIA, International Energy Outlook 2008, June 2008, Table A1, p. 83 and Table A14, p. 97.



1.2.1 Building Energy Prices, by Year and Major Fuel Type ($2006 per Million Btu)

	Residential Buildings				Commercial Buildings				Building
	Electricity	Natural Gas	Petroleum (1)	Avg.	Electricity	Natural Gas	Petroleum (2)	Avg.	Avg. (3)
1980	33.86	7.77	15.66	16.35	34.62	7.16	12.17	17.19	16.68
1990	32.78	8.04	12.49	17.32	30.27	6.71	8.49	17.32	17.32
2000	28.12	8.90	13.45	16.85	25.07	7.64	9.43	16.46	16.69
2006	**30.52**	**13.40**	**19.68**	**21.78**	**27.75**	**11.50**	**14.75**	**20.75**	**21.33**
2010	31.37	12.15	20.05	21.56	27.89	10.59	15.48	20.69	21.19
2015	30.04	11.20	17.90	20.19	25.52	9.68	13.29	18.93	19.63
2020	30.20	11.39	18.09	20.45	25.64	9.91	13.64	19.25	19.91
2025	30.33	11.94	18.95	21.04	25.71	10.47	14.24	19.67	20.41
2030	30.63	12.91	20.14	22.00	26.17	11.43	15.22	20.47	21.28

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 $29.16/10^6 Btu or ($0.10/kWh), average natural gas price was $12.655/10^6 Btu ($13.03/1000 CF), and petroleum was $17.94/10^6 Btu ($1.94/gal.). Averages do not include wood or coal prices.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, Tables 2-3, p. 24-25 for 1980-2005 and prices for note, Tables 8-9, p. 18-19 for 1980-2005 consumption; EIA, Annual Energy Outlook 2008 Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121, Table A12, p. 138, and Table A13, p. 139 for 2006-2030 consumption and prices; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

1.2.2 Building Energy Prices, by Year and Fuel Type ($2006)

	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	11.55	77.68	1.46	2.10	11.81	71.63	1.33	1.93
1990	11.18	80.38	1.34	1.59	10.33	67.12	0.73	1.18
2000	9.59	89.00	1.45	1.61	8.55	76.39	0.78	1.21
2006	**10.41**	**133.99**	**1.98**	**2.49**	**9.47**	**115.03**	**1.29**	**2.02**
2010	10.70	121.52	2.16	2.39	9.52	105.95	1.51	2.11
2015	10.25	112.02	2.07	1.98	8.71	96.75	1.19	1.79
2020	10.30	113.94	2.08	1.98	8.75	99.06	1.19	1.84
2025	10.35	119.35	2.11	2.10	8.77	104.67	1.29	1.92
2030	10.45	129.12	2.18	2.26	8.93	114.32	1.38	2.08

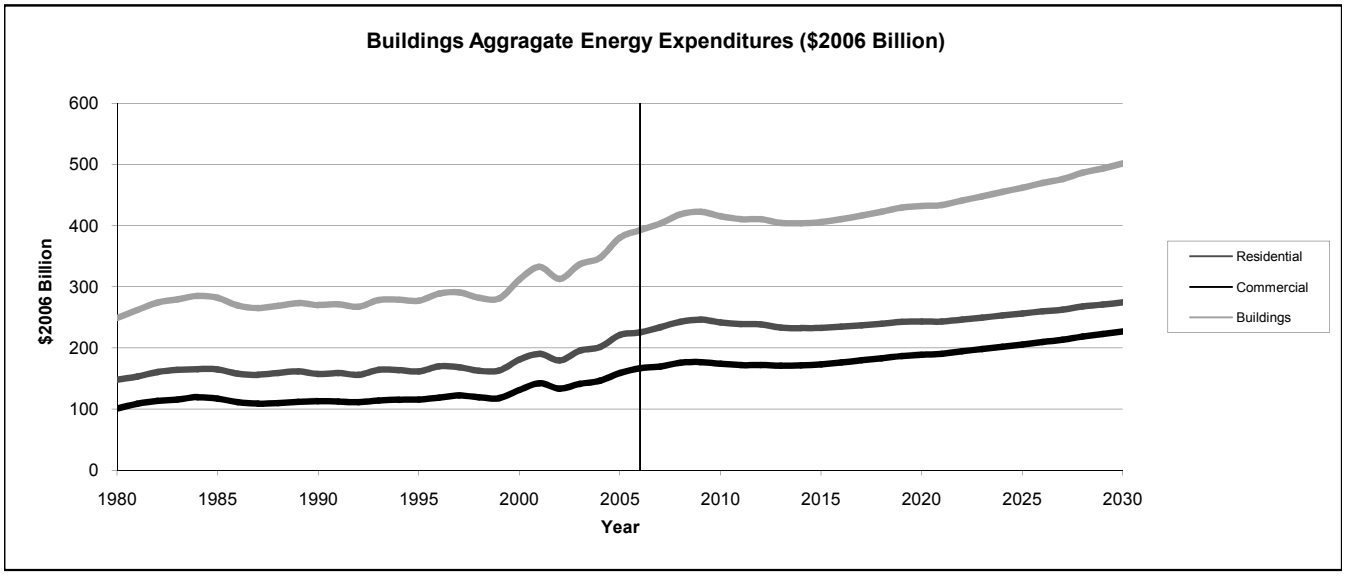
Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. Tables 2-3, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A3, p. 120-121 for 2006-2030 and Table G1, p. 215 for fuels' heat content; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

1.2.3 Buildings Aggregate Energy Expenditures, by Year and Major Fuel Type ($2006 Billion) (1)

	Residential Buildings				Commercial Buildings				Total Building
	Electricity	Natural Gas	Petroleum (2)	Total	Electricity	Natural Gas	Petroleum (3)	Total	Expenditures
1980	82.9	37.7	27.4	148.0	66.0	19.1	15.7	100.7	248.7
1990	103.3	36.3	17.6	157.2	86.6	18.1	8.1	112.8	270.0
2000	114.4	45.4	21.0	180.8	99.2	24.9	7.1	131.2	312.0
2006	**140.8**	**60.3**	**24.5**	**225.6**	**123.1**	**33.6**	**10.0**	**166.7**	**392.2**
2010	155.2	60.2	26.3	241.7	131.9	32.3	9.8	173.9	415.5
2015	150.9	57.8	23.9	232.6	132.6	31.9	8.9	173.3	405.9
2020	158.7	60.4	24.1	243.2	145.3	34.4	9.2	188.9	432.2
2025	167.7	63.8	24.9	256.3	158.1	38.0	9.7	205.8	462.1
2030	180.0	68.7	26.0	274.7	173.3	43.2	10.4	226.9	501.6

Note(s): 1) Expenditures exclude wood and coal. 2006 U.S. energy expenditures were 1.14 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 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A3, p. 120-121 for 2006-2030; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.



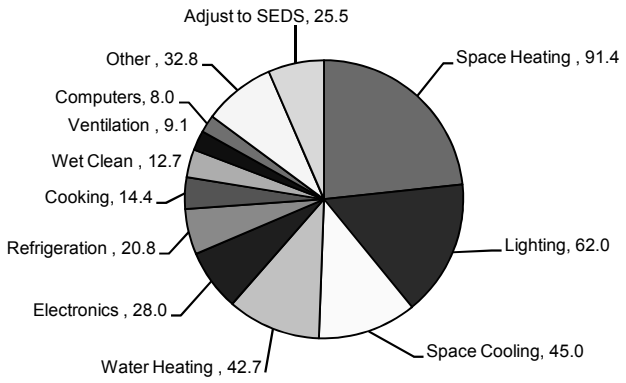
1.2.4 2006 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	55.5	12.6	1.0	5.3	1.4	20.2	0.2	15.5	91.4	23.3%
Lighting								62.0	62.0	15.8%
Space Cooling	0.2							44.8	45.0	11.5%
Water Heating (4)	20.8	2.6		1.3		3.9		18.1	42.7	10.9%
Electronics (5)								28.0	28.0	7.1%
Refrigeration (6)								20.8	20.8	5.3%
Cooking	5.6			0.7		0.7		8.1	14.4	3.7%
Wet Clean (7)	1.0							11.7	12.7	3.2%
Ventilation (8)								9.1	9.1	2.3%
Computers								8.0	8.0	2.0%
Other (9)	3.1	0.3		5.1	1.0	6.5		23.2	32.8	8.4%
Adjust to SEDS (10)	7.7	3.3				3.3		14.5	25.5	6.5%
Total	**93.9**	**18.7**	**1.0**	**12.4**	**2.4**	**34.5**	**0.2**	**263.8**	**392.4**	100%

Note(s): 1) Expenditures include coal and exclude wood . 2) Includes kerosene space heating ($1.2 billion) and motor gasoline other uses ($1.0 billion). 3) Includes furnace fans ($1.7 billion). 4) Includes residential recreation water heating ($1.3 billion). 5) Includes color televisions ($10.1 billion) and other electronics ($17.9 billion). 6) Includes refrigerators ($18.3 billion) and freezers ($2.5 billion). 7) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($1.0 billion), electric clothes dryers ($7.7 billion) and dishwashers ($2.9 billion). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, Table A4, p. 122-123 for residential energy consumption, and Table A5, p. 124-125 for commercial energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for coal prices; EIA, Annual Energy Review 2007, June 2008, 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; and BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63 for commercial lighting.

2006 Bulidings Primary Energy End-Use Expenditures Splits ($2006 Billion)



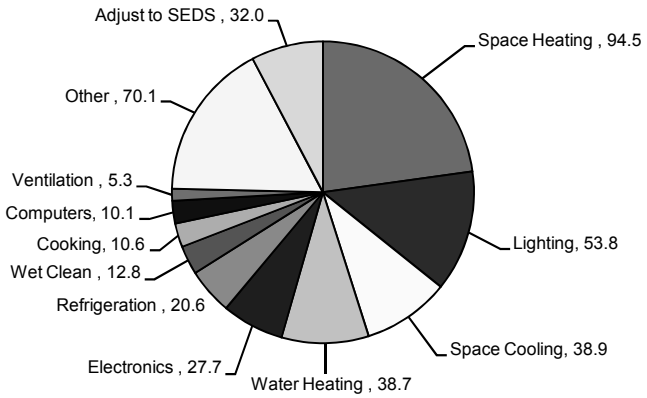
1.2.5 2010 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	57.1	13.4	1.0	6.0	1.5	21.9	0.2	15.4	94.5	22.8%
Lighting								53.8	53.8	13.0%
Space Cooling	0.2							38.6	38.9	9.4%
Water Heating	18.9	2.3		1.2		3.5		16.3	38.7	9.3%
Electronics (4)								27.7	27.7	6.7%
Refrigeration (5)								20.6	20.6	5.0%
Wet Clean (6)	0.9							11.9	12.8	3.1%
Cooking	5.3			0.8		0.8		4.5	10.6	2.5%
Computers								10.1	10.1	2.4%
Ventilation (7)								5.3	5.3	1.3%
Other (8)	2.3	0.3		5.7	1.1	7.0		60.8	70.1	16.9%
Adjust to SEDS (9)	7.0	2.8				2.8		22.2	32.0	7.7%
Total	**91.7**	**18.7**	**1.0**	**13.8**	**2.6**	**36.1**	**0.2**	**287.0**	**415.0**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($1.3 billion) and motor gasoline other uses ($1.1 billion). 3) Includes furnace fans ($2.0 billion). 4) Includes color televisions ($12.3 billion). 5) Includes refrigerators ($18.1 billion) and freezers ($2.5 billion). 6) Includes clothes washers ($1.0 billion), natural gas clothes dryers ($0.9 billion), electric clothes dryers ($8.0 billion) and dishwashers ($2.9 billion). 7) Commercial only; residential fan proportionately in space heating and cooling. 8) 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 incommercial 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, Table A4, p. 122-123 for residential energy consumption, and Table A5, p. 124-125 for commercial energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for coal prices; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2010 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion)



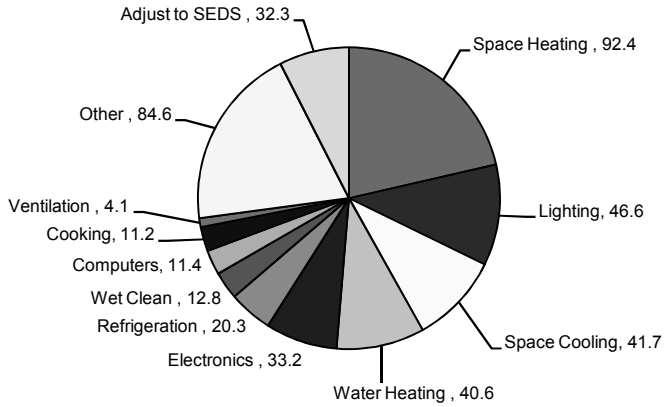
1.2.6 2020 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	57.5	11.2	0.8	5.7	1.4	19.1	0.2	15.7	92.4	21.4%
Lighting								46.6	46.6	10.8%
Space Cooling	0.2							41.5	41.7	9.7%
Water Heating (4)	19.6	1.8		1.1		2.9		18.1	40.6	9.4%
Electronics (5)								33.2	33.2	7.7%
Refrigeration (6)								20.3	20.3	4.7%
Wet Clean (7)	0.9							11.9	12.8	3.0%
Computers								11.4	11.4	2.6%
Cooking	5.7			0.8		0.8		4.7	11.2	2.6%
Ventilation (8)								4.1	4.1	1.0%
Other (9)	2.8	0.3		6.6	1.0	7.9		73.9	84.6	19.6%
Adjust to SEDS (10)	7.2	2.6				2.6		22.6	32.3	7.5%
Total	**93.8**	**15.9**	**0.8**	**14.3**	**2.4**	**33.4**	**0.2**	**304.0**	**431.3**	100%

Note(s): 1) Expenditures include coal and exclude wood . 2) Includes kerosene space heating ($1.4 billion) and motor gasoline other uses ($1.0 billion). 3) Includes furnace fans ($2.2 billion). 5) Includes color televisions ($12.9 billion). 6) Includes refrigerators ($17.6 billion) and freezers ($2.8 billion). 7) Includes clothes washers ($0.8 billion), natural gas clothes dryers ($0.9 billion), electric clothes dryers ($8.2 billion) and dishwashers ($2.9 billion). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, Table A4, p. 122-123 for residential energy consumption, and Table A5, p. 124-125 for commercial energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for coal prices; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators

2020 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion)



1.2.7 2030 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	66.3	11.8	0.9	5.8	1.6	20.2	0.2	16.5	103.1	20.6%
Lighting								50.1	50.1	10.0%
Space Cooling	0.2							47.9	48.1	9.6%
Water Heating (4)	22.5	1.9		1.1		2.9		19.2	44.6	8.9%
Electronics (5)								40.9	40.9	8.2%
Refrigeration (6)								22.7	22.7	4.5%
Wet Clean (7)	1.1							13.1	14.2	2.8%
Cooking	7.1			0.9		0.9		5.2	13.2	2.6%
Computers								14.0	14.0	2.8%
Ventilation (8)								4.2	4.2	0.8%
Other (9)	4.6	0.3		8.1	1.1	9.5		94.0	108.2	21.7%
Adjust to SEDS (10)	7.7	2.8				2.8		25.5	36.0	7.2%
Total	**109.6**	**16.8**	**0.9**	**15.9**	**2.7**	**36.3**	**0.2**	**353.3**	**499.4**	100%

Note(s): 1) Expenditures include coal and exclude wood . 2) Includes kerosene space heating ($1.3 billion) and motor gasoline other uses ($1.1 billion). 3) Includes furnace fans ($2.4 billion). 5) Includes color televisions ($16.9 billion). 6) Includes refrigerators ($19.3 billion) and freezers ($3.4 billion). 7) Includes clothes washers ($0.8 billion), natural gas clothes dryers ($1.1 billion), electric clothes dryers ($9.0 billion) and dishwashers ($3.3 billion). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, Table A4, p. 122-123 for residential energy consumption, and Table A5, p. 124-125 for commercial energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for coal prices; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

1.2.8 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	2006	1.17
1987	0.73	1997	0.95		
1988	0.76	1998	0.96		
1989	0.79	1999	0.98		

Source(s): EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377.

1.3.1 Estimated Value of All U.S. Construction Relative to the GDP ($2006)

- 2006 estimated value of all U.S. construction is $1.77 trillion (including renovation; heavy construction; public works; residential, commercial, and industrial new construction; and non-contract work).
- Compared to the $13.2 trillion U.S. gross domestic product (GDP), all construction holds a 13.4% share.
- In 2006, residential and commercial building renovation (valued at $438 billion) and new building construction (valued at $785 billion) is estimated to account for over 69% (approximately $1.22 trillion) of the $1.77 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, August 2008; DOC, Expenditures for Residential Improvements and Repairs by Property Type, Table S2, August 2008; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators and GDP.

1.3.2 Value of New Building Construction Relative to GDP, by Year ($2006 Billion)

	Value of New Construction Put in Place				Bldgs. Percent of
	Residential	Commercial (1)	All Bldgs. (1)	GDP	Total U.S. GDP
1980	154.4	148.7	303.0	6,013	5.0%
1985	198.5	210.4	408.9	7,053	5.8%
1990	194.1	211.7	405.8	8,286	4.9%
1995	221.8	190.0	411.7	9,357	4.4%
2000	312.2	291.9	604.1	11,437	5.3%
2006	489.6	283.3	784.7	13,187	6.1%

Note(s): 1) New buildings construction differs from Table 1.3.2 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, August 2008 for 1995-2006; DOC, Annual Value of Public Construction Put in Place, August 2008 for 1995-2006; DOC, Expenditures for Residential Improvements and Repairs by Property Type, July 2007; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for GDP and price deflators.

1.3.3 Value of Building Improvements and Repairs Relative to GDP, by Year ($2006 Billion) (1)

	Value of Improvements and Repairs				Bldgs. Percent of
	Residential	Commercial	All Bldgs.	GDP	Total U.S. GDP
1980	99.9	N.A.	N.A.	6,013	N.A.
1985	137.2	130.4 (2)	267.7	7,053	3.8%
1990	164.8	132.6 (3)	297.4	8,286	3.6%
1995	158.1	140.6	298.7	9,357	3.2%
2000	178.2	122.8	301.0	11,437	2.6%
2006	228.2	209.7	437.9	13,187	3.3%

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, Expenditures for Residential Improvements and Repairs by Property Type, Table S2, August 2008 for 1995-2006; 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 2008 for 1995-2006; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for GDP and price deflators.

1.3.4 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**		
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.

1.3.5 1997/1998 International Investment into Construction and Energy R&D

	Construction Percent of Private R&D to Total Private R&D	Gas, and 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.

1.3.6 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 ($1,000s)
National Defense	57.2%	|	DOE	123,170
Health	23.1%	|	EPA	25,317
Other energy, general science,		|	NSF	22,940
natural resources, and environment	**8.0%**	|	PIER (1)	11,100
Space research and technology	6.3%	|	DOC-NIST	7,500
Transportation	1.5%	|	NYSERDA	5,800
Agriculture	1.5%	|	HUD	5,000
Veterans' benefits and services research	0.7%	|	GSA	3,000
Green building	**0.2%**	|	ASHRAE	2,400
Other functions (2)	1.6%			
Total	100%			

Note(s): 1) PIER = Public Interest Energy Research 2) Includes 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.

1.3.7 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	6,976	2002	95.4	28.0	47.7	167.4
2005		235	7,336					
2006		221	7,689					

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.; DOC, Statistical Abstract of the U.S. 2008, May 2008, table 612, p. 401 for 2003-2006 construction employment and Table 598, p. 388 for 2006 Architects Employed

1.3.8 Heating, Cooling, and Ventilation Equipment Trades, by Year (Thousand 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

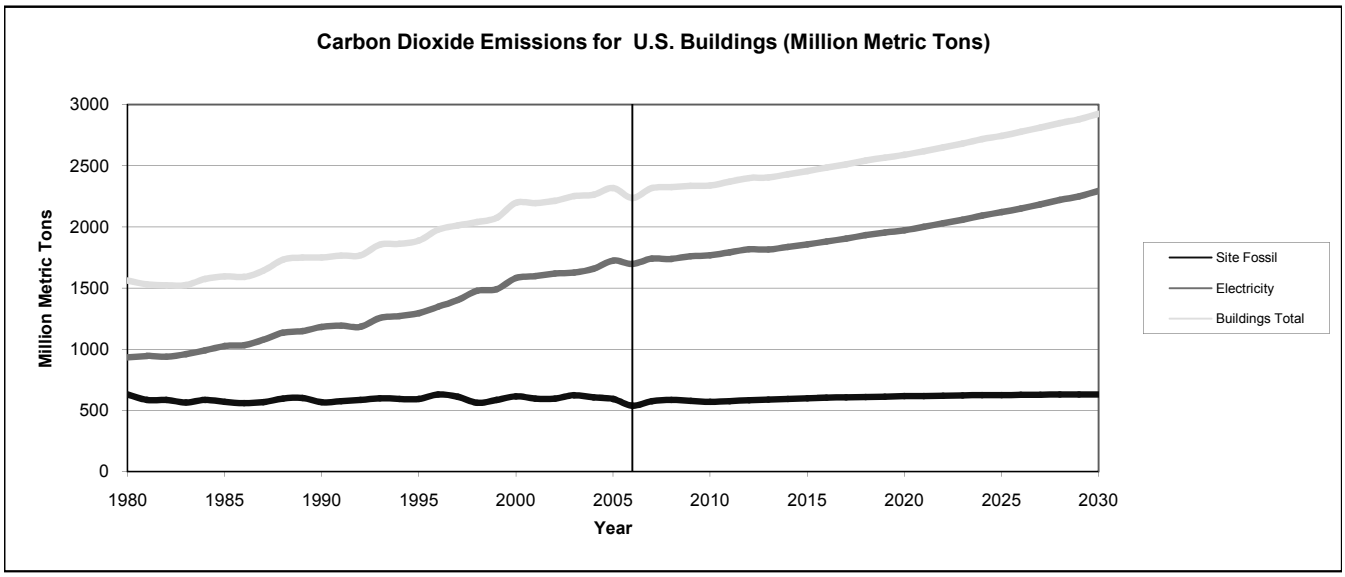
Source(s): ARI, Statistical Profile of the Air-Conditioning, Refrigeration, and Heating Industry (from U.S. Bureau of Labor Statistics), April 2001, Table 3, p. 10, Table 4, p. 11, Table 5, p. 13, Table 6, p. 14, and Table 8, p. 16 for 1980 to 1990 data; ARI, Statistical Profile of the Air-Conditioning,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

1.4.1 Carbon Dioxide Emissions for U.S. Buildings, by Year (Million Metric Tons) (1)

	Buildings				U.S.			
	Site Fossil	Electricity	Total	Growth Rate 2006-Year	Total	Growth Rate 2006-Year	Buildings % of Total U.S.	Buildings % of Total Global
1980	630	933	1562	-	4723	-	33%	8.5%
1990	567	1183	1749	-	5012	-	35%	8.2%
2000	615	1581	2197	-	5847	-	38%	9.2%
2006	**538**	**1698**	**2236**	**-**	**5890**	**-**	**38%**	**7.9%**
2010	570	1768	2338	1.1%	6011	0.5%	39%	7.5%
2015	598	1858	2456	1.0%	6226	0.6%	39%	7.2%
2020	616	1974	2589	1.1%	6384	0.6%	41%	7.0%
2025	625	2121	2745	1.1%	6571	0.6%	42%	6.9%
2030	630	2295	2925	1.1%	6851	0.6%	43%	6.9%

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 2008 and differs from EIA, AEO 2008, Table A18. Buildings sector total varies by 0.7% for year 2006 from EIA, AEO 2008. 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 2008, April 2008, Table 2, p. 10 for carbon coefficients; EIA, AEO 2008, Mar. 2008, Table A2, p. 137-139 for 2005-2030 energy consumption and Table A18, p. 164 for 2005-2030 emissions; EIA, International Energy Outlook 2008, June 2008, Table A10, p. 93 for 2005-2030 global emissions; and EIA, International Energy Annual 2006, July 2006, Table H1, www.eia.doe.gov for 1980-2000 global emission.



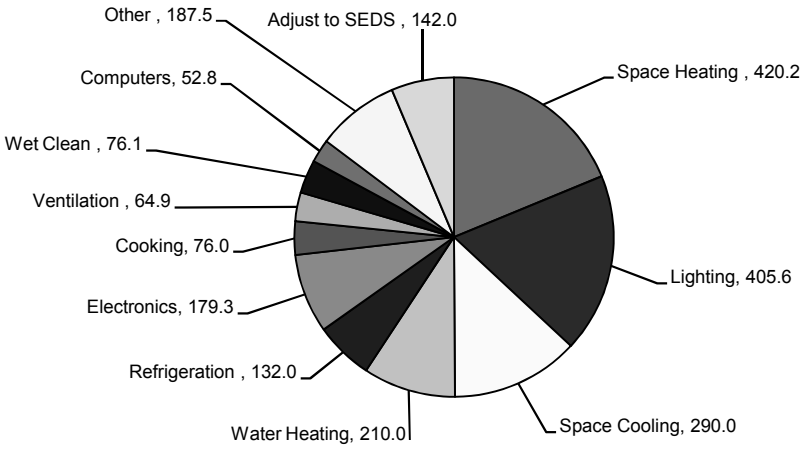
1.4.2 2006 Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	228.7	53.1	8.9	14.4	6.6	83.0	8.9	99.6	420.2	18.8%
Lighting								405.6	405.6	18.1%
Space Cooling	1.1							288.9	290.0	13.0%
Water Heating	86.4	11.1		3.5		14.6		109.0	210.0	9.4%
Refrigeration (5)								132.0	132.0	5.9%
Electronics (6)								179.3	179.3	8.0%
Cooking	23.8			2.0		2.0		50.2	76.0	3.4%
Ventilation (7)								64.9	64.9	2.9%
Wet Clean (8)	3.9							72.2	76.1	3.4%
Computers								52.8	52.8	2.4%
Other (9)	14.5	1.4		14.7	3.5	19.5		153.5	187.5	8.4%
Adjust to SEDS (10)	35.3	16.6				16.6		90.2	142.0	6.4%
Total	**393.7**	**82.1**	**8.9**	**34.6**	**10.1**	**135.7**	**8.9**	**1,698.0**	**2,236.3**	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 2008 and differs from EIA, AEO 2008, Table A18. Buildings sector total varies by 0.7% from EIA, AEO 2008. 2) Includes kerosene space heating (5.4 MMT) and motor gasoline other uses (3.5 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (10.1 MMT). 5) Includes refrigerators (116.5 MMT) and freezers (15.6 MMT). 6) Includes color television (62.2 MMT) and other office equipment. 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers (6.7 MMT), natural gas clothes dryers (3.9 MMT), electric clothes dryers (47.7 MMT), and dishwashers (17.9 MMT). 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 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 132-133 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 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.

2006 Buildings Energy End-Use Carbon Dioxide Emissions (Million Metric Tons)

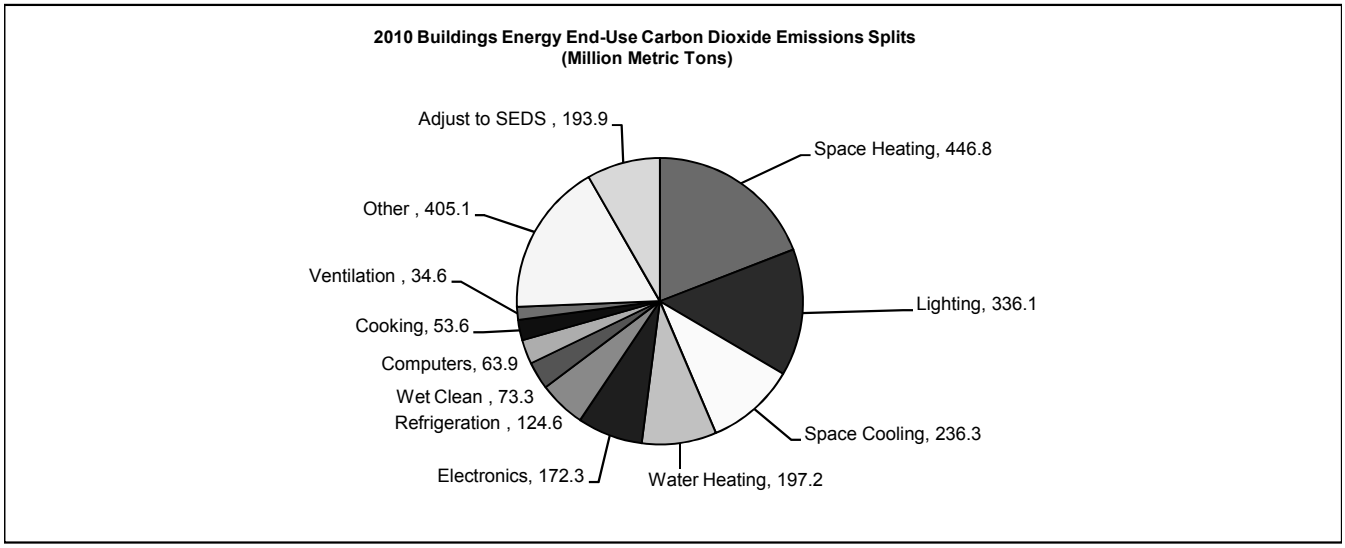


1.4.3 2010 Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	258.1	57.9	7.7	15.1	7.1	87.7	8.8	92.3	446.8	19.1%
Lighting								336.1	336.1	14.4%
Space Cooling	1.1							235.2	236.3	10.1%
Water Heating	86.0	10.0		3.1		13.2		98.1	197.2	8.4%
Electronics (5)								172.3	172.3	7.4%
Refrigeration (6)								124.6	124.6	5.3%
Wet Clean (7)	3.9							69.4	73.3	3.1%
Computers								63.9	63.9	2.7%
Cooking	24.9			2.0		2.0		26.7	53.6	2.3%
Ventilation (8)								34.6	34.6	1.5%
Other (9)	15.3	1.3		15.6	3.5	20.4		369.4	405.1	17.3%
Adjust to SEDS (10)	34.9	13.5				13.5		145.4	193.9	8.3%
Total	**424.2**	**82.8**	**7.7**	**35.8**	**10.6**	**136.8**	**8.8**	**1,768.0**	**2,337.8**	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. 2) Includes kerosene space heating (7.7 MMT) and motor gasoline other uses (3.5 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (11.6 MMT). 6) Includes color television (71.7 MMT) and other office equipment (100.6 MMT). 5) Includes refrigerators (109.8 MMT) and freezers (14.8 MMT). 8) Includes clothes washers (6.0 MMT), natural gas clothes dryers (3.9 MMT), electric clothes dryers (46.5 MMT), and dishwashers (16.9 MMT). Does not include water heating energy. 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients.



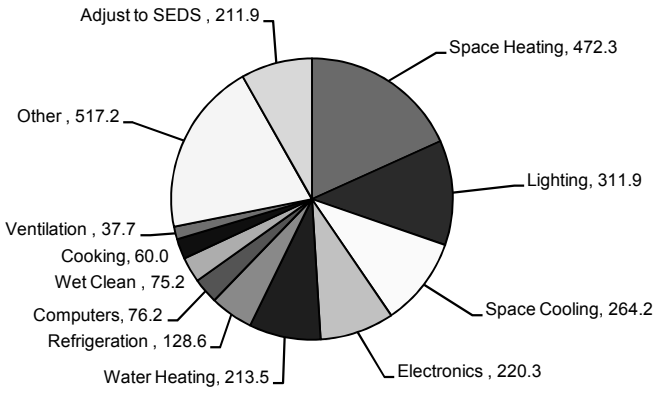
1.4.4 2020 Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	277.4	58.2	8.1	14.9	7.4	88.6	8.7	97.6	472.3	18.2%
Lighting								311.9	311.9	12.0%
Space Cooling	1.1							263.1	264.2	10.2%
Electronics (5)								220.3	220.3	8.5%
Water Heating	95.6	9.6		2.9		12.6		105.4	213.5	8.2%
Refrigeration (6)								128.6	128.6	5.0%
Computers								76.2	76.2	2.9%
Wet Clean (7)	4.2							71.0	75.2	2.9%
Cooking	28.6			2.1		2.1		29.3	60.0	2.3%
Ventilation (8)								37.7	37.7	1.5%
Other (9)	20.3	1.4		18.6	3.7	23.7		473.2	517.2	20.0%
Adjust to SEDS (10)	38.4	14.2				14.2		159.3	211.9	8.2%
Total	**465.5**	**83.5**	**8.1**	**38.5**	**11.1**	**141.2**	**8.7**	**1,973.7**	**2,589.2**	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. 2) Includes kerosene space heating (7.4 MMT) and motor gasoline other uses (3.7 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (13.2 MMT). 5) Includes color television (77.3 MMT) and other office equipment (143.2 MMT). 6) Includes refrigerators (112.1 MMT) and freezers (16.6 MMT). 7) Includes clothes washers (4.8 MMT), natural gas clothes dryers (4.2 MMT), electric clothes dryers (48.9 MMT), and dishwashers (17.3 MMT). Does not include water heating energy. 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients;

2020 Buildings Energy End-Use Carbon Dioxide Emissions Splits
(Million Metric Tons)

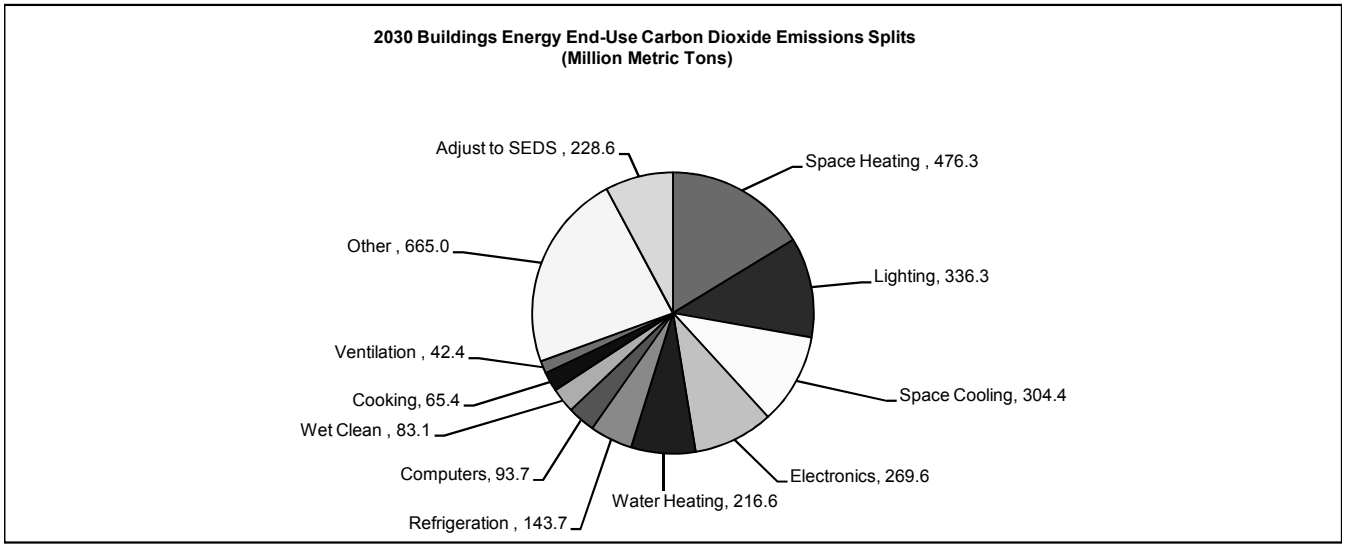


1.4.5 2030 Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	281.2	53.8	8.1	14.5	7.4	83.9	8.6	102.6	476.3	16.3%
Lighting								336.3	336.3	11.5%
Space Cooling	1.1							303.3	304.4	10.4%
Electronics (5)								269.6	269.6	9.2%
Water Heating	96.8	8.7		2.7		11.3		108.5	216.6	7.4%
Refrigeration (6)								143.7	143.7	4.9%
Computers								93.7	93.7	3.2%
Wet Clean (7)	4.4							78.7	83.1	2.8%
Cooking	31.1			2.2		2.2		32.1	65.4	2.2%
Ventilation (8)								42.4	42.4	1.4%
Other (9)	32.7	1.6		21.4	3.8	26.8		605.5	665.0	22.7%
Adjust to SEDS (10)	35.8	13.8				13.8		179.0	228.6	7.8%
Total	**483.2**	**77.9**	**8.1**	**40.7**	**11.2**	**137.9**	**8.6**	**2,295.4**	**2,925.1**	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. 2) Includes kerosene space heating (7.4 MMT) and motor gasoline other uses (3.8 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (14.6 MMT). 5) Includes color television (101.5 MMT) and other office equipment (168.2 MMT). 6) Includes refrigerators (123.2 MMT) and freezers (20.5 MMT). 7) Includes clothes washers (5.0 MMT), natural gas clothes dryers (4.4 MMT), electric clothes dryers (54.2 MMT), and dishwashers (19.5 MMT). Does not include water heating energy. 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients;



1.4.6 World Carbon Dioxide Emissions

	Emissions (million metric tons)				Annual Growth Rate	
Nation/Region	1990	2005		2010	1990-2005	2005-2010
United States	4,989	5,982	21%	6,011	1.2%	0.1%
China	2,241	5,323	19%	6,898	5.9%	5.3%
OECD Europe	4,092	4,383	16%	4,512	0.5%	0.6%
Russia	2,334	1,696	6%	1,789	-2.1%	1.1%
Other Non-OECD Asia	807	1,690	6%	1,938	5.1%	2.8%
Middle East	704	1,400	5%	1,622	4.7%	3.0%
Japan	1,011	1,230	4%	1,196	1.3%	-0.6%
Other Non-OECD Eurasia	1,859	1,169	4%	1,278	-3.0%	1.8%
India	578	1,164	4%	1,349	4.8%	3.0%
Central and S. America	673	1,078	4%	1,308	3.2%	3.9%
Africa	649	966	3%	1,090	2.7%	2.4%
Canada	474	628	2%	669	0.0%	0.0%
South Korea	234	500	2%	559	5.2%	2.3%
Australia and New Zealand	291	444	2%	454	2.9%	0.4%
Mexico	300	398	1%	430	1.9%	1.6%
Total World	**21,223**	**28051**	100%	**31,100**	**1.9%**	**2.1%**

Source(s): EIA, International Energy Outlook 2008, June 2008, Table A10, p. 93.

1.4.7 2006 Methane Emissions for U.S. Buildings Energy Production, by Fuel Type (MMT CO2 Equvalant) (1)

Fuel Type	Residential	Commercial	Buildings Total
Petroleum	1.0	0.5	1.4
Natural Gas	30.8	20.0	50.9
Coal	0.0	0.2	0.3
Wood	2.3	0.4	2.7
Electricity (2)	38.2	36.7	74.9
Total	**72.3**	**57.9**	**130.1**

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

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 2006, Nov. 2007, Table 15, p. 22 for energy production emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, April 2008, Table 3-16, p. 3-25 for stationary combustion emissions; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for energy consumption.

1.4.8 2006 Carbon Dioxide Emission Coefficients for Buildings (MMT CO2 per Quadrillion Btu) (1)

	All Buildings	Residential Buildings	Commercial Buildings
Coal			
Average (2)	95.35	95.35	95.35
Natural Gas			
Average (2)	53.06	53.06	53.06
Petroleum Products			
Distillate Fuel Oil/Diesel	73.15	-	-
Kerosene	72.31	-	-
Motor Gasoline	70.88	-	-
Liquefied Petroleum Gas	63.03	-	-
Residual Fuel Oil	78.80	-	-
Average (2)	70.50	69.30	72.70
Electricity Consumption (3)			
Average - Primary (4)	59.16	59.16	59.16
Average - Site (5)	188.6	188.6	188.6
New Generation			
Gas Combined Cycle - Site (6)	115.5	115.5	115.5
Gas Combustion Turbine - Site (6)	173.8	173.8	173.8
Stock Gas Generator - Site (7)	141.4	141.4	141.4
All Fuels (3)			
Average - Primary	57.75	57.25	58.34
Average - Site	117.8	110.5	126.6

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 2008 and were adjusted using Assumptions to the AEO 2008. 3) Excludes electricity imports from utility consumption. Includes nuclear and renewable (including hydroelectric) generated electricity. 4) Use this coefficient to estimate CO2 emissions resulting from the consumption of energy by electric generators. 5) Use this coefficient to estimate CO2 emissions resulting from the consumption of electricity by end-users. 6) Use this coefficient to estimate emissions of the next-built (2006) 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 2008, Mar. 2008, Table A2, p. 117-119, Table A8, p. 131-132, Table A17, p. 143-144 for consumption and Table A18, p. 145 for emissions; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 10 for coefficients and Table 38, p. 76 for generator efficiencies; EIA, Annual Energy Review 2007, June 2008, Diagram 5, p. 221 for Transmission and Distribution (T&D) losses.

1.4.9 Average Carbon Dioxide 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								
	2006			2010			2020			2030		
	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.	Resid.	Comm.	Bldgs.
Electricity (2)	41.59	46.48	43.85	29.52	40.01	33.52	37.20	47.26	43.36	56.59	55.35	55.82
Petroleum	4.15	2.75	3.51	3.31	0.55	2.26	2.26	0.21	1.00	1.41	0.17	0.64
Natural Gas	11.47	8.65	10.17	16.51	7.42	13.04	16.48	7.10	10.73	10.24	6.46	7.88
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	0.04	0.45	0.23	0.04	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00
Total	**57.25**	**58.34**	**57.75**	**49.39**	**47.98**	**48.85**	**55.93**	**54.58**	**55.10**	**68.24**	**61.98**	**64.34**

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 2008, Mar. 2008, Table A2, p. 117-119 and Table A17, p. 143 for energy consumption and Table A18, p. 144 for carbon emissions; and EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 9.

1.4.10 2006 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	561	6,964 (2)	7,525	13,770	55%
NOx	723	2,597	3,320	18,226	18%
CO	3,265	490	3,755	100,552	4%
VOCs	1,364	37	1,401	17,383	8%
PM-2.5	388	362	750	4,574	16%
PM-10	439	448	887	18,420	5%

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 2008, Mar. 2008, Table A2, p. 140-142; and EPA, 1970-2006 National Emissions Inventory, Average Annual Emissions, All Criteria Pollutants, July 2007.

1.4.11 2006 EPA Criteria Pollutant Emissions Coefficients (Million Short Tons/*Delivered* Quadrillion Btu, unless otherwise noted)

All Buildings

	Electricity (1)	*Site* Fossil Fuel (2)	Electricity (per primary quad) (1)
SO2	0.770	0.056	0.242
NOx	0.287	0.073	0.090
CO	0.054	0.329	0.017

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) Includes natural gas, petroleum liquid fuels, coal, and wood.

Source(s): EPA, 2006 Average Annual Emissions, All Criteria Pollutants, July 2007; and EIA, AEO 2008, Mar. 2008, Table A2, p. 140-142 for energy consumption.

1.4.12 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.

1.4.13 "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 2.2.7 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.

1.4.14 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.

1.5.1 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.

1.5.2 Consumption Comparisons in 2005

One quad equals:

- 49 million short tons of coal
  - = enough coal to fill a train of railroad cars 4,072 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
  - = 20.1 million passenger cars each driven 12,500 miles
  - = 17.2 million light-duty vehicles each driven 12,200 miles
  - = all new passenger cars and light-duty trucks sold, each driven 13,000 miles
  - = 13.1 million stock passenger cars, each driven 11,500 miles = 10% 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 = 14.26 days of U.S. imports = 167 days of oil flow in the Alaska pipeline at full capacity
  - = the amount of crude oil transported by 484 supertankers
- 19 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 2.95 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 2008, Mar. 2008, Table A2, p. 117-119, Table A7, p. 129-130, Table A8, p. 131-132, Table A9, p. 133-134, Table A11, p. 136-137 for consumption, Table G1, p. 215 for heat rates; EIA, State Energy Data 2005: Consumption, Feb. 2008, Table S3, p. 5, Table R1, p. 13, and Table R2, p. 14; EIA, Electric Power Annual 2006, September 2007, Table 2.2, p. 19; EIA, International Energy Outlook 2008, June 2008, Table A1, p. 83; DOC, Statistical Abstract of the United States 2008, May 2008, No. 1031, p. 658, No. 1074, p. 686, and No. 1080, p. 690; and Newport News Shipbuilding Web site.

1.5.3 Carbon Emission Comparisons

One million metric ton of carbon dioxide-equivalent emissions equals:

- the combustion of 518 thousand short tons of coal
- the coal input to 1 coal plant (200-MW) in ten and a half months
- the combustion of 18 billion cubic feet of natural gas
- the combustion of 116 million gallons of gasoline = the combustion of gasoline for 7 hours in the U.S.
  - = 0.28 million new cars, each driven 12,500 miles
  - = 243 thousand new light-duty vehicles, each driven 12,200 miles
  - = 237 thousand new light trucks, each driven 11,000 miles
  - = 0.13 million new passenger cars, each making 5 round trips from New York to Los Angeles
- the combustion of 188 million gallons of LPG
- the combustion of 107 million gallons of kerosene
- the combustion of 101 million gallons of distillate fuel
- the combustion of 87 million gallons of residual fuel
- 19 minutes of world energy emissions
- 90 minutes of U.S energy emissions
- 3.9 hours of U.S. buildings energy emissions
- 7 hours of U.S. residential energy emissions
- 8 hours of U.S. commercial energy emissions
- 1 day 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 2008, Mar. 2008, Table A2, p. 117-119, Table A7, p. 129-130 for consumption, Table A18, p. 147 for emissions, and Table G1, p. 215 for heat rates; EIA, Electric Power Annual 2006, September 2007, Table 2.2, page 19; EIA, International Energy Outlook 2008, June 2008, Table A10, p. 93; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 9 for carbon coefficients; and DOC, Statistical Abstract of the United States 2008, Jan. 2008, No. 2, p. 8 and No. 1084, p. 715.

1.5.4 Average Annual Carbon Dioxide Emissions for Various Functions

	Annual Unit Energy Consumption		Carbon Emissions (MMT CO2)	Carbon Emissions (lb CO2)
Stock Refrigerator	1,249	kWh - Electricity	0.80	1,800
Stock Electric Water Heater	2,549	kWh - Electricity	1.64	3,600
Stock Gas Water Heater	20	million Btu - Natural Gas	1.05	2,300
Stock Oil Water Heater	28	million Btu - Fuel Oil	2.07	4,500
Single-Family Home	107	million Btu	11.86	26,100
Mobile Home	76	million Btu	8.39	18,500
Multi-Family Unit in Large Building	41	million Btu	4.53	10,000
Multi-Family Unit in Small Building	78	million Btu	8.63	19,000
School Building	2,125	million Btu	269	593,300
Office Building	1,376	million Btu	174	384,200
Hospital, In-Patient	60,152	million Btu	7,617	16,794,600
Stock Vehicles				
Passenger Car	541	gallons - Gasoline	4.8	10,503
Van, Pickup Truck, or SUV	686	gallons - Gasoline	6.0	13,324
Heavy Truck	1,414	gallons - Diesel Fuel	12.8	28,334
Tractor Trailer Truck	11,697	gallons - Diesel Fuel	106.3	234,391

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for consumption and Table A18, p. 144 for emissions, and Table G1, p. 215 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 2008, June 2008, Table 2, p. 9 for carbon coefficients.

1.5.5 Cost of a Generic Quad Used in the Buildings Sector ($2006 Billion) (1)

	Residential	Commercial	**Buildings**
1980	9.88	9.56	**9.75**
1990	9.57	8.52	**9.11**
2000	9.06	7.70	**8.44**
2006	**10.04**	**9.59**	**9.83**
2010	9.90	9.56	**9.75**
2015	9.09	8.78	**8.94**
2020	9.17	8.85	**9.02**
2025	9.37	9.01	**9.19**
2030	9.76	9.36	**9.56**

Note(s): 1) See Table 1.5.1 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 2008, Mar. 2008, Table A2, p. 117-119 and Table A17, p. 143-144 for energy consumption and Table A3, p. 120-121 for energy prices(2006-2030). EIA, State Energy Data Report 2005, Feb. 2008, Tables 8-12 pages 22-24 and EIA, State Energy Prices and Expenditures 2005 Feb. 2008 Tables 2 and 3(1980-2005)

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

				Renewables				
	Natural Gas	Petroleum	Coal	Hydro.	Other	Total	Nuclear	Total
1980	40%	12%	30%	7%	4%	11%	7%	100%
1990	32%	8%	36%	7%	4%	11%	13%	100%
2000	33%	6%	38%	5%	3%	8%	15%	100%
2006	**31%**	**6%**	**39%**	**5%**	**3%**	**9%**	**15%**	**100%**
2010	32%	6%	38%	5%	4%	10%	15%	100%
2015	31%	6%	38%	5%	5%	10%	14%	100%
2020	29%	5%	39%	5%	6%	11%	15%	100%
2025	28%	5%	41%	5%	6%	11%	15%	100%
2030	26%	5%	43%	5%	6%	11%	15%	100%

Note(s): 1) See Table 1.5.1 for generic quad definition. 2) The total 2006 Buildings sector primary energy consumption was 38.77 quads.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A17, p. 143-144 for energy consumption and EIA, State Energy Data Report, Feb. 2008, table 8 and 9, pages 22-24

Embodied energy is defined as the energy used during the entire life cycle of a product including the energy used for manufacturing, transporting, and disposing of the product. For example, the embodied energy in dimensional lumber includes the energy used to grow, harvest and process the trees into boards, transport the lumber to its final destination, and ultimately dispose of the wood at the end of its useful life. Embodied energy, also called life cycle assessment (LCA), is a useful tool for evaluating the relative environmental impact of various building materials because it takes production, transportation and disposal into account, all things that can have a pronounced environmental impact but are not necessarily reflected in the price.

Due to the complexity of calculations and the wide range of production methods, transportation distances and other variables for some building products, exact figures for embodied energy vary from study to study. Fortunately, precise figures are not necessary. Builders, designers, purchasers and others can make informed decisions based on the embodied energy of a given product relative to its substitutes. It should be noted that when considering the embodied energy of an entire building, the energy embodied in the building materials is small relative to the energy it takes to operate that building over its lifetime. Looking at the embodied energy of a typical home, for example, only 15 percent of that energy is embodied in the materials used to make the home; the other 85 percent is in the operation of the home over its lifetime(1) . Thus, building for efficiency is the best way to lower the embodied energy of a building.

1) Life-Cycle Environmental Performance of Renewable Building Materials. B. Lippke et. al. June, 2004 Journal of Forest Products.

1.6.1 Embodied Energy of Windows in the U.S.

Window Type	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Aluminium	0.59	71.24
PVC-clad Wood	0.37	62.15
Wood	0.33	51.83
Vinyl (PVC)	0.49	82.31
Curtainwall Viewable Glazing	0.27	61.6
Curtainwall		
Opaque glazing (with insulated backpan)	0.18	32.16
Spandrel panel (with insulated backpan)	0.1	9.53

Note(s): 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material.
Assumptions: Assumes a Low rise building. Values are general estimations for the U.S. 60 year building lifetime. Low-e glass.
Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.2 Embodied Energy of Studded Exterior Walls in the U.S.

Exterior Wall Type	R-Value	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
2x6 Steel Stud Wall (3)			
16" OC with brick cladding	13.46	0.15	20.68
24" OC with brick cladding	14.96	0.15	19.48
16" OC with wood cladding (pine)	13.47	0.06	7.82
24" OC with wood cladding (pine)	14.97	0.06	6.61
16" OC with steel cladding (26 ga)	13.27	0.17	37.02
2x6 Wood Stud Wall (4)			
16" OC with brick cladding	15.73	0.16	18.88
16" OC with PVC cladding	15.60	0.10	9.63
24" OC with steel cladding	15.54	0.18	35.04
24" OC with stucco cladding	15.04	0.09	8.85
24" OC with wood cladding (pine)	15.74	0.07	5.83
Structural Insulated Panel (SIP) (5)			
with Brick cladding	23.93	0.20	20.73
with Steel cladding	23.74	0.22	37.07
with Stucco cladding	23.24	0.13	10.88
with PVC cladding	23.80	0.14	11.48
with Wood cladding	23.94	0.11	7.86

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material. 3) Includes cladding, 1" rigid insulation sheathing, batt insulation, vapor barrier, gypsum board, and latex paint. 4) Includes cladding, wood structural panel (WSP) sheathing, batt insulation, vapor barrier, gypsum board, and latex paint. 5) Includes cladding, vapor barrier, gypsum board, and latex paint.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.3 Embodied Energy of Concrete Exterior Walls in the U.S.

Exterior Wall Type	R-Value	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
8" Concrete Block			
with Brick cladding + rigid insulation + vapor barrier	21.80	0.22	32.04
+ Gypsum board + latex paint	22.36	0.24	33.08
with Stucco cladding + rigid insulation + vapor barrier + gypsum board + latex paint	21.67	0.16	23.24
6" Cast-In-Place Concrete (3)			
with Brick cladding	21.84	0.22	33.78
with Steel cladding	21.65	0.24	50.12
with Stucco cladding	21.15	0.14	23.93
with 1" rigid insulation + 2x6 steel stud wall (24" OC) + batt insulation	9.64	0.11	20.93
8" Concrete Tilt-Up			
with Steel cladding (3)	21.81	0.24	50.25
with Stucco cladding (3)	21.31	0.15	24.06
with 2x6 steel stud wall (24" OC) + batt insulation	9.80	0.11	21.05
Insulated Concrete Forms			
with Steel cladding + gypsum board + latex paint	20.93	0.28	57.78
with PVC cladding + gypsum board + latex paint	20.99	0.20	32.19
with Wood cladding + gypsum board + latex paint	21.13	0.17	28.57

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material. 3) Includes cladding, 4" rigid insulation, vapor barrier, gypsum board, and latex paint unless otherwise described.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.4 Embodied Energy of Wood-Based Roof Assemblies in the U.S.

	R-Value	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Glulam Joist with Plank Decking (3)			
with EPMD membrane	40.56	0.20	18.13
with PVC membrane	40.56	0.17	14.93
with Modified bitumen membrane	40.56	0.14	12.88
with 4-Ply built-up roofing	40.89	0.81	63.75
with Steel roofing	41.17	0.16	15.02
Wood I-Joist with WSP Decking (4)			
with PVC membrane	26.38	0.11	8.70
with 4-Ply built-up roofing	26.71	0.75	57.52
Solid Wood Joist with WSP Decking (4)			
with Modified bitumen membrane	26.38	0.10	6.77
Wood Chord / Steel Web Truss with WSP Decking (4)			
with Modified bitumen membrane	26.80	0.10	9.71
Wood Truss (Flat) with WSP Decking (4)			
with Modified bitumen membrane	25.60	0.09	7.10
Wood Truss (4:12 Pitch) with WSP Decking (4)			
with 30-yr Fibreglass Shingles	25.60	0.08	6.97
with Clay Tile	25.60	0.22	22.07

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material. 3) Includes membrane, 8" rigid insulation, vapor barrier, and latex paint. 4) Includes membrane, 9.5" batt insulation, vapor barrier, gypsum board, and latex paint. WSP = wood structural panel.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.5 Embodied Energy of Other Roof Assemblies in the U.S.

	R-Value	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Concrete Flat Plate Slab (3)			
with EPDM membrane	41.94	0.30	47.55
with PVC membrane	41.94	0.27	44.34
with Modified bitumen membrane	41.94	0.25	42.29
with 4-Ply built-up roofing	42.27	0.91	93.17
with Steel Roofing	42.55	0.26	44.44
Precast Double-T (3)			
with EPDM membrane	40.74	0.18	23.78
with PVC membrane	40.74	0.15	20.57
with Modified bitumen membrane	40.74	0.13	18.52
with 4-Ply built-up roofing	41.07	0.80	69.39
with Steel Roofing	41.35	0.15	20.66
Open-Web Steel Joist (4)			
with Steel decking and EPDM membrane	41.55	0.19	20.29
with Steel decking and modified Bitumen membrane	41.55	0.14	15.03
with Steel decking and 4-ply built-up roofing	41.88	0.81	65.90
with Wood decking and modified bitumen membrane	40.68	0.14	11.89
with Wood decking and 4-ply built-up roofing	41.01	0.80	62.77

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material. 3) Includes membrane, 8" rigid insulation, vapor barrier, and latex paint. 4) Includes membrane, 8" rigid insulation, vapor barrier, gypsum board, and latex paint.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.6 Embodied Energy of Interior Wall Assemblies in the U.S.,

Interior Wall Type (3)	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Wood stud (16" OC) + gypsum board	0.03	2.49
Wood stud (24" OC) + gypsum board	0.03	2.42
Wood stud (24" OC) + 2 gypsum boards (4)	0.05	4.08
Steel stud (24" OC) + 2 gypsum boards (4)	0.05	4.84
6" Concrete block + gypsum board	0.11	15.89
6" Concrete block	0.09	14.22
Clay brick (4") unpainted	0.11	13.37

Note(s): Assumptions: Values are general estimations for the U.S. 60 year building lifetime. Low rise building. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material. 3) All interior walls include latex paint on each side unless noted otherwise. 4) Rounding obscures difference in embodied energy figure: wood stud wall is 7% lower than steel stud wall.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.7 Embodied Energy of Floor Structures in the U.S.

Floor Structure with Interior Ceiling Finish of Gypsum Board, Latex Paint

	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Concrete flat plate and slab column system 25% flyash	0.15	31.98
Precast double-T concrete system	0.08	17.73
Glulam joist and plank decking	0.07	6.41
Wood chord and steel web truss system	0.06	6.49
Wood I-joist and OSB decking system	0.05	3.72
Open web steel joist with steel decking system and concrete topping	0.09	12.67
Wood truss and OSB decking system	0.06	4.35
Open web steel joist with 3/4" OSB flooring system	0.06	5.01

Floor Structure without Interior Ceiling Finish

Concrete flat plate and slab column system 25% flyash	0.14	30.94
Concrete hollow core slab	0.06	14.14
Open web steel joist with 3/4" OSB flooring system	0.05	3.96

Note(s): Assumptions: Values are general estimations for the U.S. 60 year building lifetime. Low rise building. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

1.6.8 Embodied Energy of Column and Beam Assemblies in the U.S.

Column Type	Beam Type	Embodied Energy (MMBtu SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Concrete	Concrete	0.13	20.17
Concrete	Steel I-beam	0.09	11.42
Hollow structural steel	Glulam	0.02	1.68
Hollow structural steel	Structural composite lumber	0.02	2.38
Glulam	Glulam	0.03	2.64
Glulam	Structural composite lumber	0.03	1.92
Steel I-beam	Steel I-beam	0.09	8.19
Steel I-beam	Structural composite lumber	0.02	1.64
Built-up softwood	Glulam	0.03	2.41
Built-up softwood	Structural composite lumber	0.02	1.7

Note(s): Assumptions: Values are general estimations for the U.S. 60 year building lifetime. Low rise building. Bay size: 30 by 30 feet. Column Height: 10 feet. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Weighted Resource Use: The weight of raw materials used in extraction, processing, transportation, construction and disposal of each material.

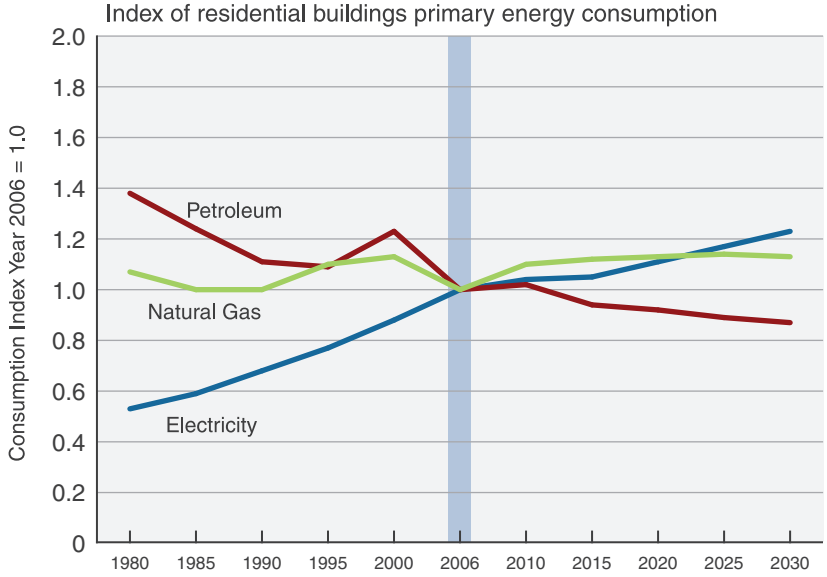
Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.2.3. 2007. Available at www.athenasmi.org/tools/ecoCalculator/index.html

PRIMARY ENERGY IN THE RESIDENTIAL BUILDINGS SECTOR

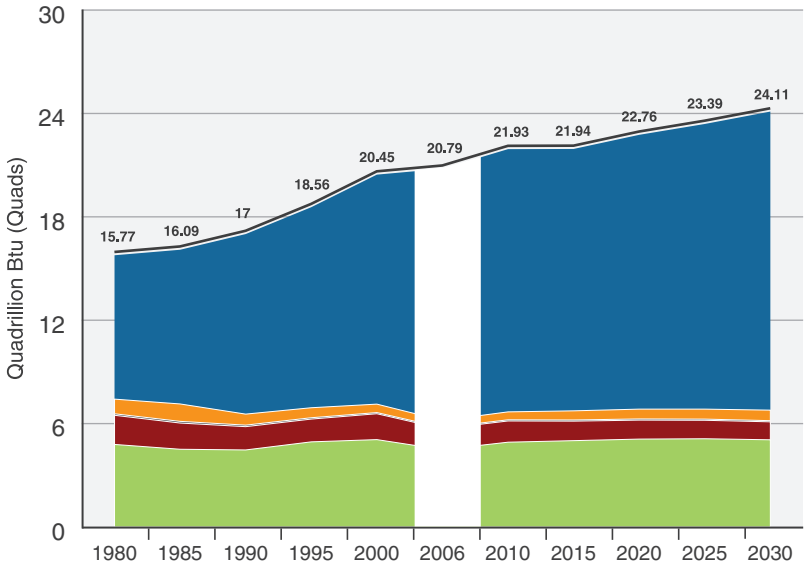
The Residential Sector Consumed 20% (20.79 Quads) of U.S. primary energy in 2006. Electricity mad up the overwhelming majority of consumption, representing 70% of all primary energy used in the Residential Sector. Electricity is also the fastest growing fuel, with a projected increase of 23% by 2030.

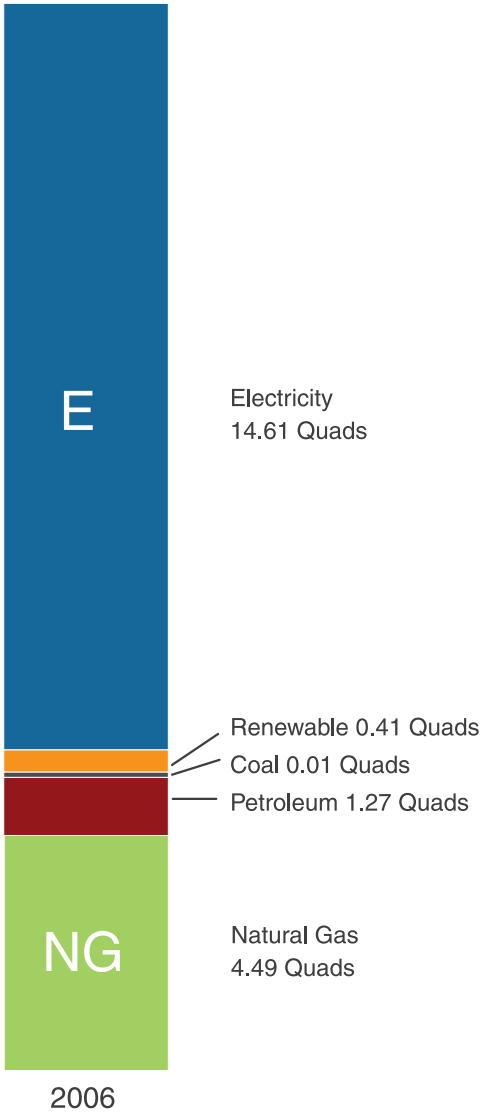
The index chart to the right shows the changes in fuels by indexing consumption of electricity, natural gas, and petroleum to 2006. For example, electricity consumption was about 50 percent below 2006 levels in 1980.

Index of residential buildings primary energy consumption



Residential primary energy consumption by year and fuel type





Residential Primary Energy Consumption, 1980–2030

Quadrillion Btu (Quads)

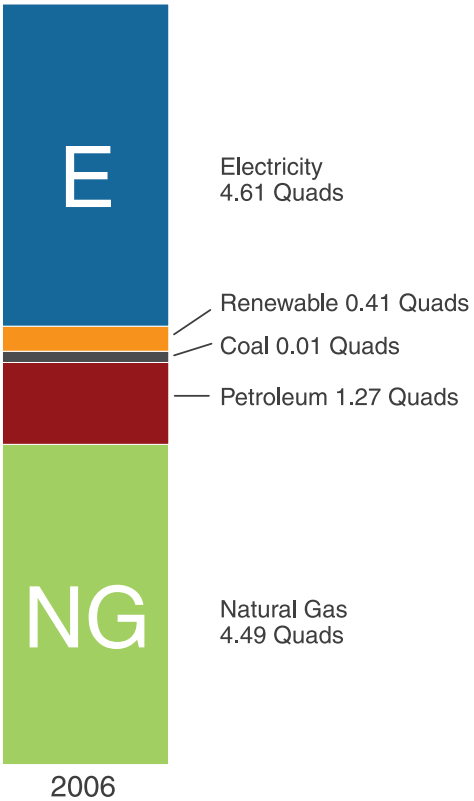
	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	8.35	8.95	10.45	11.64	13.32	14.61	15.25	15.20	15.92	16.55	17.33
Renewable	0.85	1.01	0.64	0.58	0.49	0.41	0.46	0.53	0.57	0.58	0.61
Coal	0.03	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Petroleum	1.75	1.58	1.41	1.38	1.56	1.27	1.29	1.19	1.16	1.13	1.10
Natural Gas	4.79	4.51	4.47	4.94	5.07	4.49	4.92	5.01	5.10	5.12	5.06

DELIVERED ENERGY IN THE RESIDENTIAL BUILDINGS SECTOR

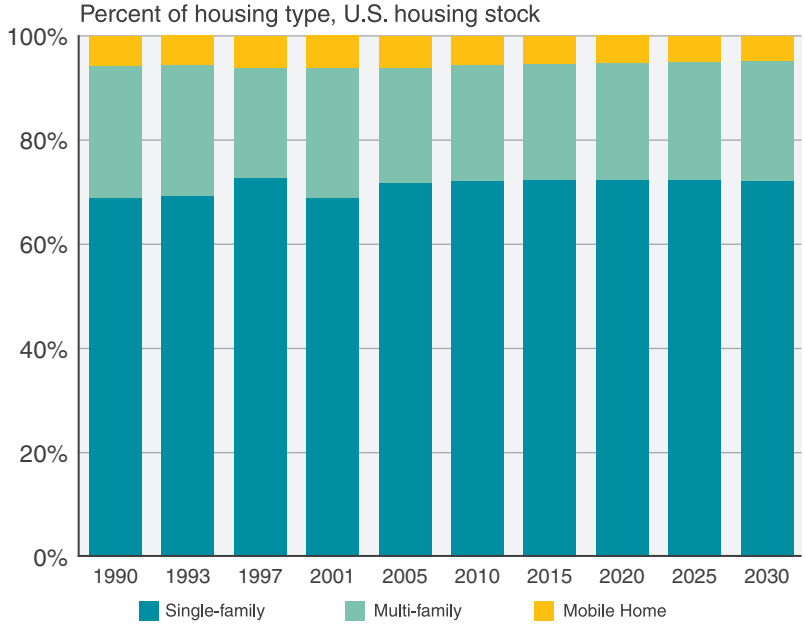
The Residential Sector consumed 10.8 Quads of delivered energy in 2006. Delivered energy does not include energy lost during production, transmission, and distribution to customers. In the case of electricity, delivered energy excludes that used by the electric generating and distribution companies.

The mix of housing types in the U.S. housing stock has remained fairly constant in the past, and that trend is likely to continueinto the future. In 2005, approximately 72% of all households were single-family residences, 22% were multi-family, and the remaining 6% were mobile homes.

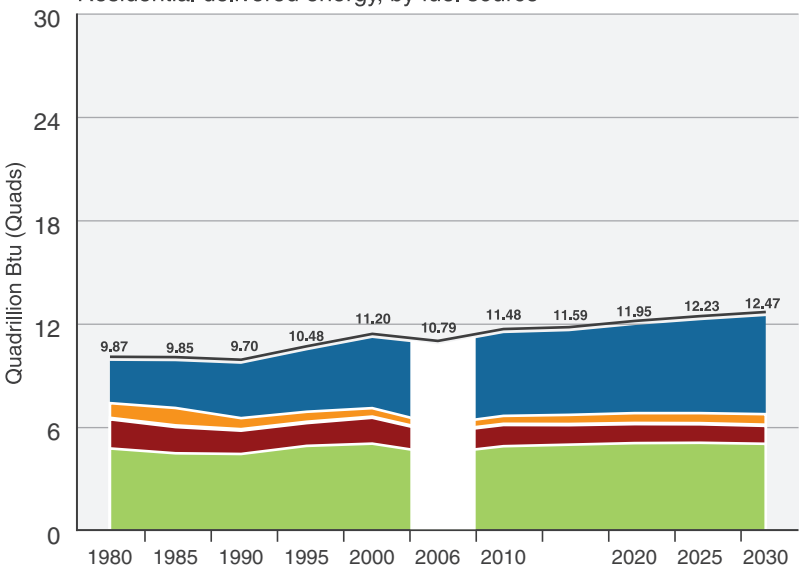
The growth in total Residential energy consumption is fueled by the growth in households and population. From 2006 to 2030, the U.S. population is expected to increase by 21% while the number of households will increase 25%.



Percent of housing type, U.S. housing stock



Residential delivered energy, by fuel source

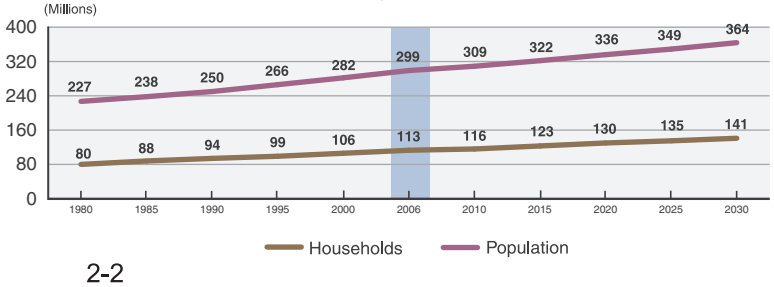


Residential delivered energy, by fuel source, 1980–2030

Quadrillion Btu (Quads)

	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	2.45	2.71	3.15	3.56	4.07	4.61	4.80	4.85	5.11	5.39	5.69
Renewable	0.85	1.01	0.64	0.58	0.49	0.41	0.46	0.53	0.57	0.58	0.61
Coal	0.03	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Petroleum	1.75	1.58	1.41	1.38	1.56	1.27	1.29	1.19	1.16	1.13	1.10
Natural Gas	4.79	4.51	4.47	4.94	5.07	4.49	4.92	5.01	5.10	5.12	5.06

U.S. household and population growth

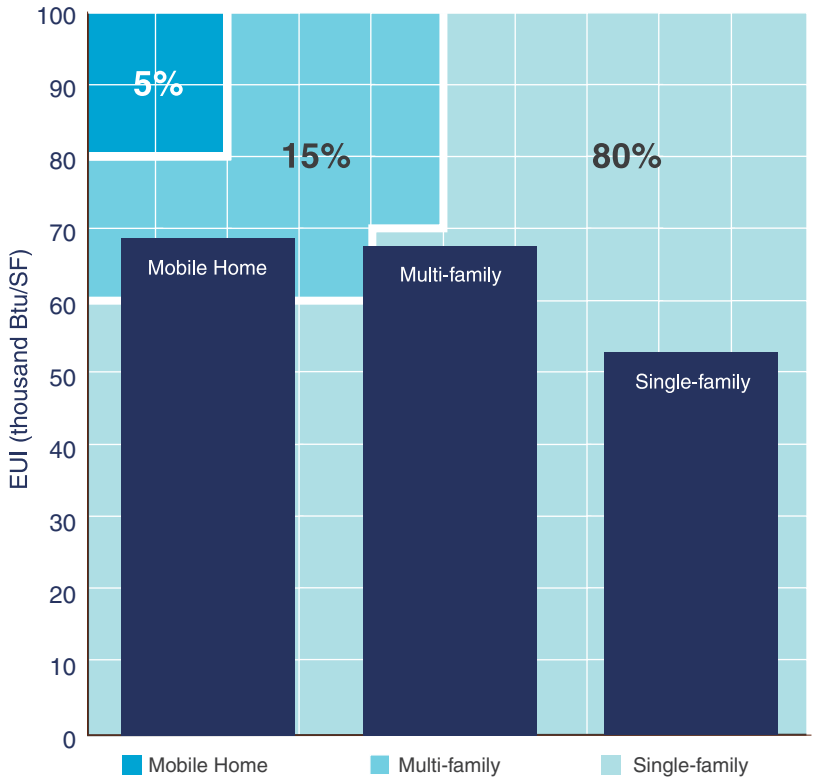


END-USE AND REGIONAL CONSUMPTION AND EXPENDITURES

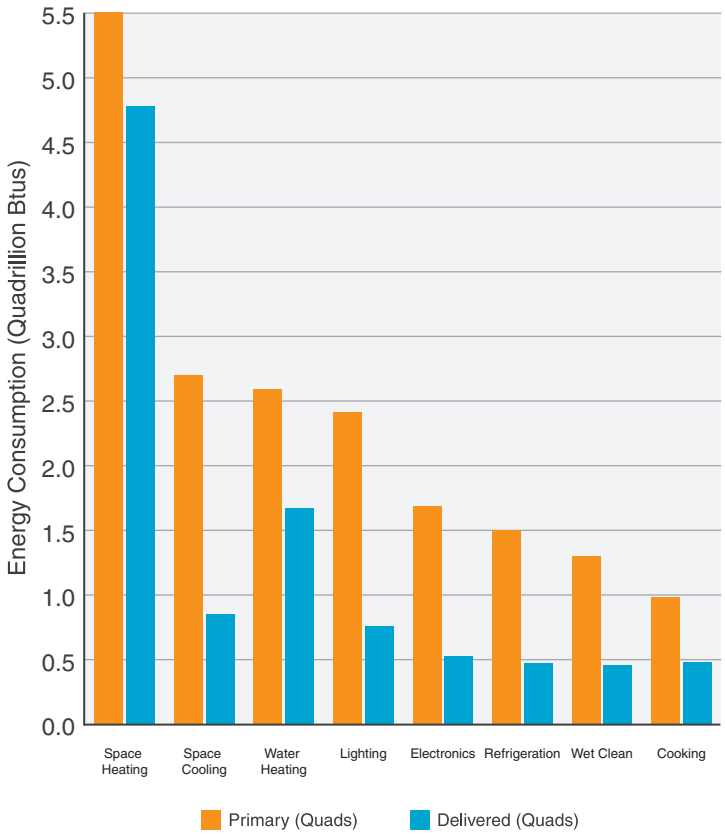
In 2005, household in single-family homes had an average EUI (End-Use Intensity) of 52.9 thousand Btu per square foot. Multi-family buildings and mobile homes have higher EUIs, but represent a much smaller portion of total U.S. energy consumption.

Heating is the largest use of energy in the Residential Sector for both primary and delivered energy, though it is a much smaller percentage of primary energy (44% compared to 26%). This difference is explained by the varying fuel mix for each end-use. End-uses that have high percentages of electricity or exclusively use electricity have a much larger share of primary energy compared to their shares of delivered.

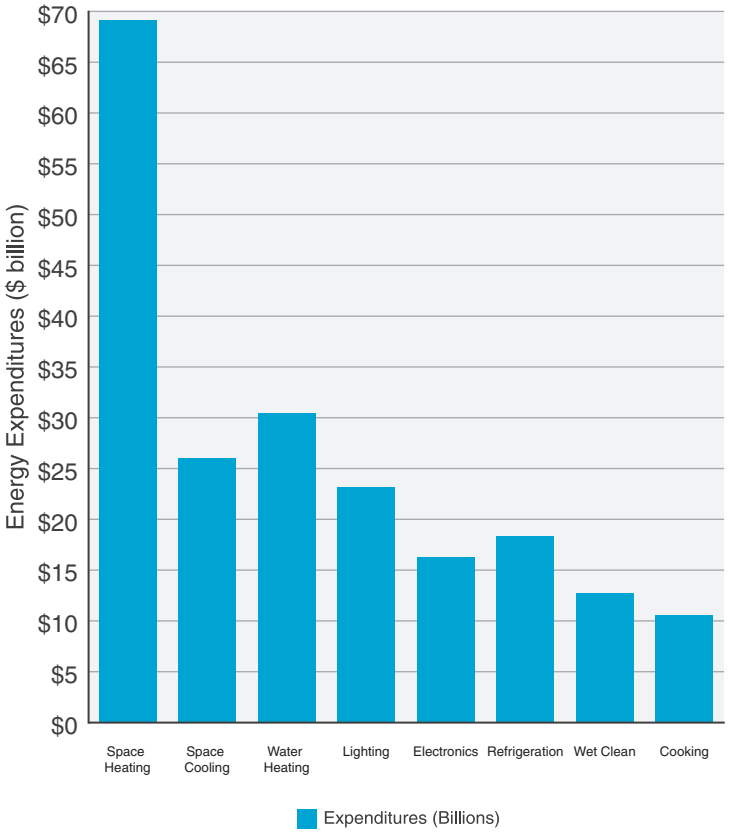
Percentage of total energy consumption, by housing type



Primary and delivered energy, by end-use

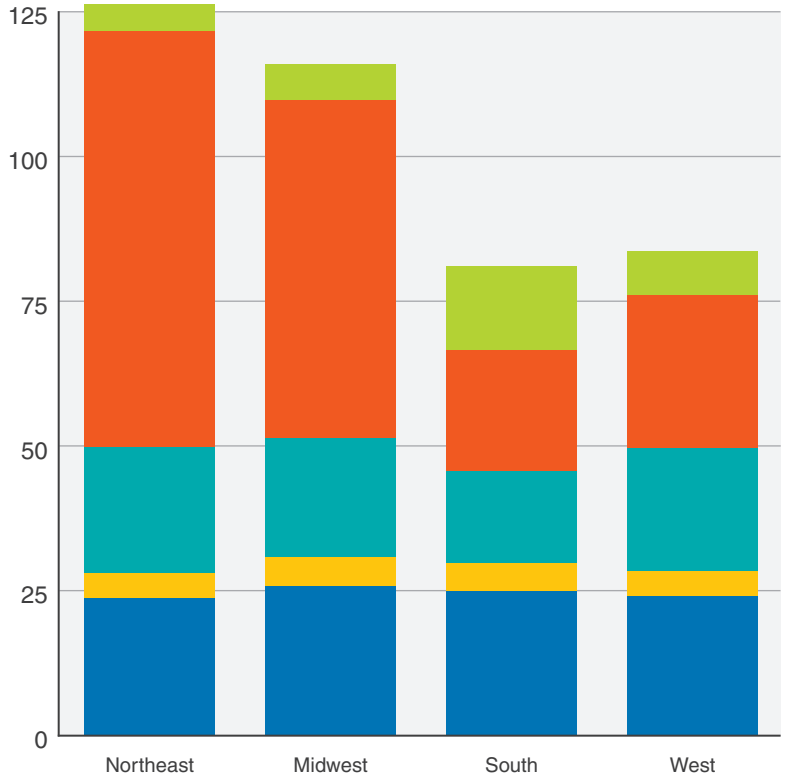


Expenditures for energy, by end-use



Energy consumption and expenditures vary significantly by region due to prices, fuel type, and climate. Though overall energy consumption varies greatly amongst regions, appliance, lighting, and plug loads remain relatively constant. Heating energy varies the most out of all the end uses. In the coldest regions, primary sources of energy, such as natural gas and fuel oil, tend to be used as heating fuels. In warmer regions, electricity, which is a secondary form of energy, tends to be the dominant heating fuel. The combination of fuel choice and climate is what causes the differences in regional heating energy use. These factors also contribute to the differences in water heating energy use between the Northeast and South.

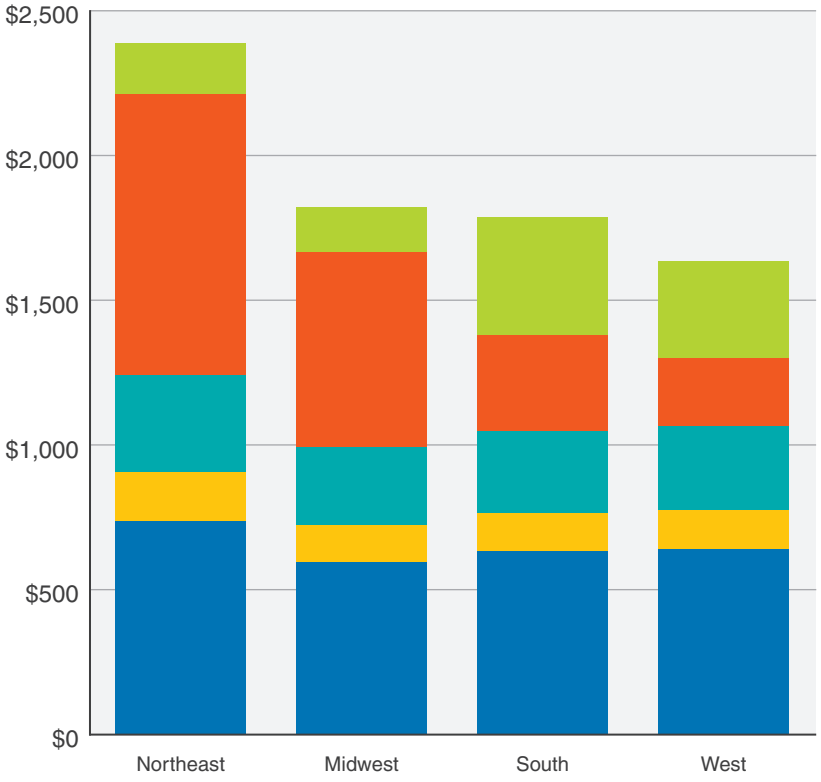
2005 Delivered energy consumption, by end use and census region (MMBtu per household)



Consumption
MMBtu per household

	Northeast	Midwest	South	West
Other Appliances & Lighting	23.0	25.9	25.0	24.1
Refrigerators	4.3	4.9	4.8	4.3
Water Heating	21.9	20.6	15.8	21.3
Space Heating	71.8	58.4	21.0	26.3
Space Cooling	4.5	6.2	14.5	7.6

2005 End-use energy expenditures, by census region (dollars per household)



Expenditures
Dollars per household

	Northeast	Midwest	South	West
Other Appliances & Lighting	739	596	635	642
Refrigerators	169	128	130	133
Water Heating	335	270	283	293
Space Heating	969	675	334	333
Space Cooling	176	154	406	233

Other Appliances & Lighting
Refrigerators
Space Heating
Space Cooling
Water Heating

2.1.1 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 2006-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%	0.49	2%	4.07	9.26	13.33	65%	20.49	100%	-
2006	**4.50**	**22%**	**1.25**	**6%**	**0.01**	**0%**	**0.43**	**2%**	**4.61**	**10.04 (3)**	**14.65**	**70%**	**20.83**	100%	-
2010	4.95	22%	1.31	6%	0.01	0%	0.46	2%	4.95	10.59	15.54	70%	22.27	100%	1.7%
2015	5.16	23%	1.33	6%	0.01	0%	0.45	2%	5.02	10.61	15.63	69%	22.59	100%	0.9%
2020	5.30	23%	1.33	6%	0.01	0%	0.45	2%	5.25	11.08	16.34	70%	23.43	100%	0.8%
2025	5.35	22%	1.31	5%	0.01	0%	0.44	2%	5.53	11.57	17.10	71%	24.21	100%	0.8%
2030	5.32	21%	1.29	5%	0.01	0%	0.44	2%	5.88	12.14	18.01	72%	25.08	100%	0.8%

Note(s): 1) Petroleum includes distillate oil, LPG, and kerosene. 2) Includes *site* -marketed and non-marketed renewable energy. 3) 2006 *site* -to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p.117-119 for 2006-2030 consumption and Table A17, p. 143-144 for non-marketed renewable energy.

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

	Natural Gas	Petroleum	Coal	Renewables Hydro.	Renewables Other	Renewables Total	Nuclear	Total
1980	41%	12%	28%	7%	6%	13%	6%	100%
1990	34%	9%	34%	6%	5%	11%	13%	100%
2000	35%	8%	35%	5%	4%	9%	14%	100%
2006	**33%**	**7%**	**36%**	**5%**	**4%**	**9%**	**15%**	**100%**
2010	34%	7%	35%	5%	5%	10%	14%	100%
2015	34%	7%	36%	5%	5%	10%	14%	100%
2020	32%	7%	37%	5%	6%	11%	14%	100%
2025	30%	6%	38%	4%	6%	11%	14%	100%
2030	29%	6%	40%	4%	6%	11%	14%	100%

Note(s): 1) See Table 1.5.1 for generic quad definition.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A17, p. 143-144 for energy consumption and EIA, State Energy Data Report, Feb. 2008, Table 8 and 9, pages 22-24.

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

	Wood	Solar Thermal	Solar PV	GSHP	Total	Growth Rate 2006-Year
1980	0.846	0.000	N.A.	0.000	0.846	-
1990	0.582	0.056	N.A.	0.006	0.644	-
2000	0.430	0.061	N.A.	0.009	0.500	-
2006	**0.409**	**0.013**	**0.000**	**0.003**	**0.426**	**-**
2010	0.440	0.018	0.001	0.004	0.463	2.1%
2015	0.418	0.025	0.001	0.006	0.450	0.6%
2020	0.404	0.032	0.002	0.008	0.446	0.3%
2025	0.390	0.039	0.003	0.011	0.443	0.2%
2030	0.378	0.045	0.007	0.014	0.444	0.2%

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

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A17, p. 143-144 for 2006-2030.

2.1.4 Residential *Delivered* and Primary Energy Consumption Intensities, by Year

	Number of Households (millions)	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 (million Btu/Hhold)
1980	79.6	N.A.	9.93	124.7	15.84	198.8
1990	94.9	N.A.	9.75	102.8	17.05	179.7
2000	105.7	N.A.	11.24	106.3	20.50	193.9
2006	**112.5**	**11%**	**10.77**	**95.8**	**20.83**	**185.2**
2010	116.0	15%	11.66	100.5	22.27	192.0
2015	122.7	22%	11.95	97.3	22.59	184.1
2020	129.2	28%	12.30	95.3	23.43	181.4
2025	135.0	33%	12.58	93.2	24.21	179.3
2030	140.6	38%	12.88	91.6	25.08	178.4

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

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123, and Table A17, p. 143-144 for 2005-2030, and Table A19, p. 146 for households; and DOC, Statistical Abstract of the United States 2008, Jan. 2008, Table No. 945, p. 626 for 1980-2004 households.

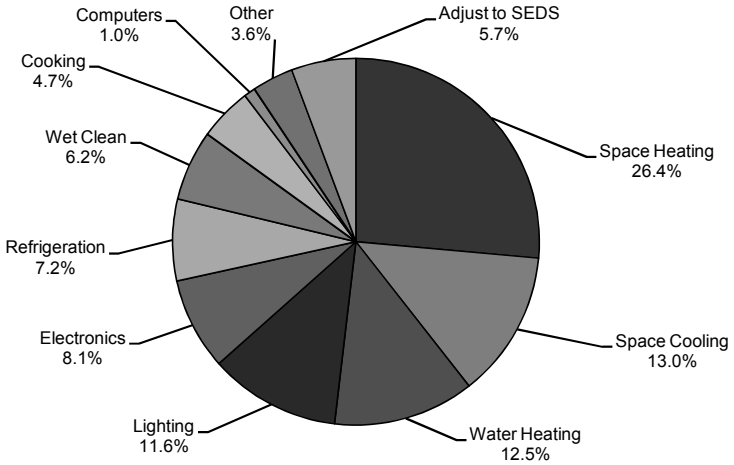
2.1.5 2006 Residential Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	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)	3.13	0.60	0.23	0.08	0.41	0.33	4.78	44.3%	1.05	5.51	26.4%
Space Cooling	0.00					0.85	0.85	7.9%	2.70	2.70	13.0%
Water Heating	1.08	0.10	0.06		0.01	0.42	1.67	15.5%	1.34	2.59	12.5%
Lighting						0.76	0.76	7.0%	2.41	2.41	11.6%
Electronics (5)						0.53	0.53	4.9%	1.69	1.69	8.1%
Refrigeration (6)						0.47	0.47	4.4%	1.50	1.50	7.2%
Wet Clean (7)	0.07					0.38	0.46	4.2%	1.22	1.30	6.2%
Cooking	0.22		0.03			0.23	0.48	4.4%	0.72	0.98	4.7%
Computers						0.07	0.07	0.6%	0.21	0.21	1.0%
Other (8)	0.00		0.15		0.00	0.19	0.34	3.2%	0.61	0.76	3.6%
Adjust to SEDS (9)						0.37	0.37	3.5%	1.19	1.19	5.7%
Total	**4.50**	**0.70**	**0.47**	**0.08**	**0.43**	**4.61**	**10.79**	100%	**14.65**	**20.83**	100%

Note(s): 1) Kerosene (0.07 quad) and coal (0.01 quad) are assumed attributable to space heating. 2) Comprised of wood space heating solar water heating (0.01 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 (0.17 quad). 5) Includes color television (1.05 quad) and other office equipment (0.64 quad). 6) Includes refrigerators (1.24 quad) and freezers (0.26 quad). 7) Includes clothes washers (0.11 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.81 quad), and dishwashers (0.30 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 1999, Jan., 1999, Tables A2, p.113-114; EIA, AEO 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123 and Table A17, p. 143-144; and BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A, for residential electric end-uses.

2006 Residential Primary Energy End Use



2.1.6 2010 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)	3.57	0.66	0.24	0.09	0.44	0.37	5.37	46.0%	1.15	6.16	27.6%
Space Cooling	0.00					0.79	0.79	6.8%	2.48	2.48	11.1%
Water Heating	1.08	0.09	0.05		0.02	0.38	1.63	13.9%	1.20	2.45	11.0%
Lighting						0.72	0.72	6.2%	2.26	2.26	10.1%
Refrigeration (5)						0.45	0.45	3.8%	1.41	1.41	6.3%
Wet Clean (6)	0.07					0.38	0.45	3.9%	1.19	1.27	5.7%
Electronics (7)						0.39	0.39	3.4%	1.23	1.23	5.5%
Cooking	0.22		0.03			0.11	0.36	3.1%	0.34	0.60	2.7%
Computers						0.10	0.10	0.8%	0.30	0.30	1.3%
Other (8)	0.00		0.16		0.00	1.26	1.42	12.2%	3.97	4.13	18.5%
Total	**4.95**	**0.75**	**0.48**	**0.09**	**0.46**	**4.95**	**11.68**	100%	**15.54**	**22.27**	100%

Note(s): 1) Kerosene (0.08 quad) and coal (0.01 quad) are assumed attributable to space heating. 2) Comprised of wood space heating (0.44 quad), solar water heating (0.02 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) = 3.14. 4) Includes furnace fans (0.19 quad). 5) Includes refrigerators (1.16 quad) and freezers (0.25 quad). 6) Includes clothes washers (0.10 quad), natural gas clothes dryers (0.07 quad), electric clothes dryers (0.80 quad), and dishwashers (0.29 quad). Does not include water heating energy. 7) Includes color television (1.23 quad). 8) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123 and Table A17, p. 143-144.

2.1.7 2020 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)	3.83	0.65	0.24	0.09	0.41	0.40	5.61	45.5%	1.23	6.45	27.5%
Space Cooling	0.00					0.91	0.91	7.4%	2.83	2.83	12.1%
Water Heating	1.15	0.08	0.05		0.03	0.42	1.73	14.0%	1.31	2.63	11.2%
Lighting						0.51	0.51	4.1%	1.58	1.58	6.8%
Refrigeration (5)						0.46	0.46	3.7%	1.43	1.43	6.1%
Electronics (6)						0.43	0.43	3.5%	1.33	1.33	5.7%
Wet Clean (7)	0.08					0.39	0.47	3.8%	1.22	1.30	5.6%
Cooking	0.25		0.03			0.12	0.41	3.3%	0.39	0.67	2.9%
Computers						0.12	0.12	1.0%	0.38	0.38	1.6%
Other (8)	0.00		0.20		0.00	1.49	1.70	13.7%	4.63	4.84	20.7%
Total	**5.30**	**0.73**	**0.52**	**0.09**	**0.45**	**5.25**	**12.35**	100%	**16.34**	**23.43**	100%

Note(s): 1) Kerosene (0.08 quad) and coal (0.01 quad) are assumed attributable to space heating. 2) Comprised of wood space heating (0.40 quad), solar water heating (0.03 quad), geothermal space heating (0.01 quad), and solar PV (less than 0.01 quad). 3) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.11. 4) Includes furnace fans (0.23 quad). 5) Includes refrigerators (1.14 quad) and freezers (0.29 quad). 6) Includes color television (1.33 quad). 7) Includes clothes washers (0.08 quad), natural gas clothes dryers (0.08 quad), electric clothes dryers (0.84 quad), and dishwashers (0.30 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.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123 and Table A17, p. 143-144.

2.1.8 2030 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)	3.88	0.59	0.23	0.09	0.39	0.41	5.59	43.2%	1.26	6.44	25.7%
Space Cooling	0.00					1.04	1.04	8.0%	3.19	3.19	12.7%
Water Heating	1.09	0.07	0.04		0.05	0.43	1.68	13.0%	1.31	2.56	10.2%
Electronics (5)						0.55	0.55	4.3%	1.69	1.69	6.8%
Refrigeration (6)						0.50	0.50	3.9%	1.54	1.54	6.1%
Lighting						0.49	0.49	3.8%	1.49	1.49	5.9%
Wet Clean (7)	0.08					0.43	0.51	4.0%	1.31	1.40	5.6%
Cooking	0.26		0.03			0.14	0.43	3.4%	0.43	0.72	2.9%
Computers						0.16	0.16	1.2%	0.48	0.48	1.9%
Other (8)	0.00		0.25		0.01	1.73	1.98	15.3%	5.30	5.56	22.2%
Total	**5.32**	**0.65**	**0.55**	**0.09**	**0.44**	**5.88**	**12.94**	100%	**18.01**	**25.08**	100%

Note(s): 1) Kerosene (0.08 quad) and coal (0.01 quad) are assumed attributable to space heating. 2) Comprised of wood space heating (0.38 quad), solar water heating (0.05 quad), geothermal space heating (0.01 quad), and solar PV (0.01 quad). 3) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.07. 4) Includes furnace fans (0.24 quad). 5) Includes color television (1.69 quad). 6) Includes refrigerators (1.20 quad) and freezers (0.34 quad). 7) Includes clothes washers (0.08 quad), natural gas clothes dryers (0.08 quad), electric clothes dryers (0.90 quad), and dishwashers (0.33 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.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Tables A2, p. 117-119, Table A4, p. 122-123 and Table A17, p. 143-144.

2.1.9 2005 Residential Delivered Energy Consumption Intensities, by Census Region

Region	Per Square Foot (thousand Btu)	Per Household (million Btu)	Per Household Members (million Btu)	Percent of Total Consumption
Northeast	51.6	120.5	47.0	23%
Midwest	46.9	113.5	46.0	28%
South	37.5	80.9	32.1	31%
West	43.5	77.6	28.1	18%
				100%

Source(s): EIA, A Look at Residential Energy Consumption in 2005, June and October 2008, Table US-1 part 1.

2.1.10 2005 Residential Delivered Energy Consumption Intensities, by Housing Type

Type	Per Square Foot (thousand Btu)	Per Household (million Btu)	Per Household Members (million Btu)	Percent of Total Consumption
Single-Family:	**52.9**	**106.6**	**42.6**	**80.5%**
Detached	39.8	108.3	39.7	73.9%
Attached	47.3	91.7	37.0	6.6%
Multi-Family:	**67.6**	**63.7**	**29.5**	**14.8%**
2 to 4 units	77.6	84.5	34.9	6.3%
5 or more units	61.7	53.8	26.4	8.5%
Mobile Homes	**68.7**	**72.7**	**29.4**	**4.7%**
				100%

Source(s): EIA, A Look at Residential Energy Consumption in 2005, June and October 2008, Table HC 1-1-2, Table US-1 part1, and Table US-4.

2.1.11 2005 Delivered Energy End-Uses for an Average Household, by Region (Million Btu per Household)

	Northeast	Midwest	South	West	National
Space Heating	71.8	58.4	21.0	26.3	40.5
Space Cooling	4.5	6.2	14.5	7.6	9.6
Water Heating	21.9	20.6	15.8	21.3	19.2
Refrigerator	4.3	4.9	4.8	4.3	4.6
Other Appliances & Lighting	23.0	25.9	25.0	24.1	24.7
Total (1)	**122.2**	**113.5**	**79.8**	**77.4**	**94.9**

Note(s): 1) Due to rounding, sums do not add up to totals.
Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008, Table US-14.

2.1.12 2005 Residential Delivered Energy Consumption Intensities, by Vintage

Year	Per Square Foot (thousand Btu)	Per Household (million Btu)	Per Household Member (million Btu)	Percent of Total Consumption
Prior to 1970	49.3	104.2	41.8	46%
1970 to 1979	44.5	82.9	33.3	15%
1980 to 1989	41.3	82.3	32.7	14%
1990 to 1999	38.6	96.5	34.4	16%
2000 to 2005	34.0	96.1	34.8	8%
Average	43.8	95.0	37.0	

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008, Table US-1 part 1.

2.1.13 1997 Residential *Delivered* Energy Consumption Intensities, by Ownership of Unit

Ownership	Per Square Foot (thousand Btu)	Per Household (million Btu)	Per Household Members (million 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.

2.1.14 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.

2.1.15 1997 Residential *Delivered* Energy Consumption Intensities, by Principal Building Type and Vintage

	Consumption (thousand Btu/SF)		Consumption (million Btu/Hhold)		Consumption (million 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.

2.1.16 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							660	62
Freezer							470	44
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	1,337/632		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) $0.096/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 dryers; EIA, Supplement to AEO 2008, June 2008, Table 21 for refrigerator and freezer; GAMA, Consumers' 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: FY2005 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.

2.1.17 Operating Characteristics of Natural Gas Appliances in the Residential Sector

	Average Capacity (thousand Btu/hr)	Appliance Usage		Annual Consumption (million 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, Consumers' 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.

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

	Site Consumption				*Primary Consumption*			U.S. Natural Gas Total
	Residential	Industry	Electric Gen.	Transportation	**Residential**	Industry	Transportation	(quads)
1980	**24%**	41%	19%	3%	**30%**	49%	3%	20.38
1990	**23%**	43%	17%	3%	**29%**	49%	3%	19.75
2000	**21%**	40%	22%	3%	**29%**	47%	3%	23.80
2006(1)	**20%**	**35%**	**29%**	**3%**	**31%**	**43%**	**3%**	**22.30**
2010	**21%**	35%	29%	3%	**31%**	43%	3%	23.93
2015	**21%**	35%	28%	3%	**31%**	42%	3%	24.35
2020	**22%**	35%	25%	3%	**31%**	41%	3%	24.01
2025	**23%**	36%	23%	3%	**31%**	41%	3%	23.66
2030	**23%**	36%	22%	3%	**31%**	41%	3%	23.39

Note(s): 1) Buildings accounted for 58% (or $97 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

2.1.19 Residential Buildings Share of U.S. Petroleum Consumption (Percent)

	Site Consumption				Primary Consumption			U.S. Petroleum Total
	Residential	Industry	Electric Gen.	Transportation	**Residential**	Industry	Transportation	(quads)
1980	**5%**	28%	8%	56%	**8%**	31%	56%	34.2
1990	**4%**	25%	4%	64%	**6%**	26%	64%	33.6
2000	**4%**	24%	3%	67%	**5%**	25%	67%	38.4
2006	**3%**	**25%**	**2%**	**69%**	**4%**	**25%**	**69%**	**40.1**
2010	**3%**	24%	1%	70%	**4%**	24%	70%	40.5
2015	**3%**	23%	1%	71%	**4%**	23%	71%	41.8
2020	**3%**	22%	1%	72%	**4%**	22%	72%	42.2
2025	**3%**	21%	1%	73%	**4%**	22%	73%	42.8
2030	**3%**	21%	1%	73%	**3%**	21%	73%	44.0

Note(s): 1) Buildings accounted for an estimated 7.3% (or $30 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

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

	Households (millions)	Percent Post-2000 Households (1)	Floorspace (billion SF)	U.S. Population (millions)	Average Household Size (2)
1980	80	N.A.	142	227	2.9
1990	94	N.A.	169	250	2.6
2000	106	N.A.	N.A.	282	2.7
2006	**113**	**11%**	**N.A.**	**299**	**2.7**
2010	116	15%	N.A.	309	2.7
2015	123	22%	N.A.	322	2.6
2020	129	28%	N.A.	336	2.6
2025	135	33%	N.A.	349	2.6
2030	141	38%	N.A.	364	2.6

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. 2008, Oct. 2007, No. 948, p. 626, 1980-2000 households, No. 2-3, p. 7-8 for population; EIA, Annual Energy Outlook 2008, Mar. 2008, 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.

2.2.2 Share of Households, by Housing Type and Type of Ownership, as of 2005 (Percent)

Housing Type	Owned	Rented	Total
Single-Family:	**61.5%**	**10.3%**	**71.8%**
Detached	57.7%	7.2%	65.0%
Attached	3.8%	3.1%	6.8%
Multi-Family:	**3.7%**	**18.3%**	**22.0%**
2 to 4 units	1.6%	5.3%	6.9%
5 or more units	2.1%	13.0%	15.0%
Mobile Homes	**5.1%**	**1.1%**	**6.2%**
Total	**70.4%**	**29.6%**	**100%**

Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008, Table HC3-1 and HC4-1.

2.2.3 Share of Households, by Census Region and Vintage, as of 2005 (Percent)

Region	Prior to 1970	1970 to 1979	1980 to 1989	1990 to 1999	2000 to 2005	Total
Northeast	11.8%	2.4%	2.1%	1.4%	0.8%	18.5%
Midwest	11.5%	3.6%	2.5%	3.7%	1.6%	23.0%
South	11.0%	6.4%	7.6%	7.5%	4.3%	36.8%
West	8.0%	4.5%	4.6%	3.1%	1.5%	21.7%
						100%

Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008, Table HC10-1.

2.2.4 Residential Floorspace (Heated Square Feet), as of 2005 (Percent of Total Households)

Floorspace	
Fewer than 500	6%
500 to 999	26%
1,000 to 1,499	24%
1,500 to 1,999	16%
2,000 to 2,499	9%
2,500 to 2,999	7%
3,000 or more	11%
Total	100%

Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008, Table HC1-3.

2.2.5 Housing Vintage, as of 2005

Vintage	
Before 1940	13%
1940 to 1949	7%
1950 to 1959	11%
1960 to 1969	11%
1970 to 1979	17%
1980 to 1989	17%
1990 to 1999	16%
2000 to 2005	8%
Total	100%

Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008, Table HC5-1.

2.2.6 Construction Statistics of New Homes Completed/Placed

	Single-Family		Multi-Family		Mobile Homes	Total
	Thousand Units	Average SF	Thousand Units	Average SF	Thousand Units	Thousand Units
1980	957	1,700	545	979	234	1,736
1985	1,072	1,760	631	922	283	1,986
1990	966	2,050	342	1,005	195	1,503
1995	1,066	2,050	247	1,080	319	1,632
2000	1,242	2,265	332	1,039	281	1,855
2005	1,636	2,414	296	1,143	123	2,055
2006	1,654	2,456	325	1,172	112	2,091

Source(s): DOC, 2007 Characteristics of New Housing, June 2008, 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.

2.2.7 2007 New Homes Completed/Placed, by Census Region (Thousand Units and Percent of Total Units) (1)

Region	Single-Family Units		Multi-Family Units		Mobile Homes Units		Total
Northeast	105	9%	40	14%	7	7%	192
Midwest	189	15%	34	12%	11	11%	267
South	632	52%	135	47%	59	62%	960
West	294	24%	76	27%	18	19%	463
Total	**1,219**	100%	**284**	100%	**95**	100%	**1,882**

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. 2008 for mobile home placements.

2.2.8 2007 Construction Method of Single-Family Homes, by Region (Thousand Units and Percent of Total Units)

Region	Stick Built Units		Modular Units		Panelized/Precut Units		Total
Northeast	91	8%	9	29%	5	23%	105
Midwest	173	15%	10	32%	5	23%	189
South	613	53%	8	26%	10	45%	631
West	288	25%	4	13%	2	9%	294
Total	**1,165**	100%	**31**	100%	**22**	100%	**1,219**

Source(s): DOC, Manufacturing, Mining and Construction Statistics, New Residential Construction: Type of Construction Method of New One-Family Houses Completed, Mar. 2008.

2.2.9 2007 HUD-Code (Mobile) Home Placements, by Census Region and Top Five States (Percent of National Total)

Region		Top Five States	
Northeast	7%	Texas	11%
Midwest	11%	Florida	7%
South	62%	Louisiana	7%
West	19%	California	6%
Total	100%	Arizona	3%

Source(s): DOC, Manufactured Housing Statistics, 2007 New Manufactured Homes Placed by Size of Home, by State, Apr. 2008.

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

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

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

2.2.11 Characteristics of a Typical Single-Family Home (1)

Year Built	mid 1970s		Building Equipment	Type	Fuel	Age (5)
Occupants	3		Space Heating	Central Warm-Air Furnace	Natural Gas	12
Floorspace			Water Heating	49 Gallons	Natural Gas	8
Heated Floorspace (SF)	1,934		Space Cooling	Central Air Conditioner		8
Cooled Floorspace (SF)	1,495					
Garage	2-Car					
Stories	1		Appliances	Type / Fuel / Number	Size	Age (5)
Foundation	Concrete Slab		Refrigerator	2-Door Top and Bottom	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)	222		Ceiling Fans	3		
Number (4)	15		Computer	2		
Type	Double-Pane		Printer			
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, 2005 Residential Energy Consumption Survey: Characteristics, April 2008, Tables HC 1.1.1, HC1.1.3, HC 2.1, HC 2.2, HC 2.3, HC 2.4, HC 2.5, HC 2.6.

2.3.1 Residential Energy Prices, by Year and Major Fuel Type ($2006 per Million Btu)

	Electricity	Natural Gas	Petroleum (1)	Avg.
1980	33.86	7.77	15.66	16.35
1990	32.78	8.04	12.49	17.32
2000	28.12	8.90	13.45	16.85
2006	**30.52**	**13.40**	**19.68**	**21.78**
2010	31.37	12.15	20.05	21.56
2015	30.04	11.20	17.90	20.19
2020	30.20	11.39	18.09	20.45
2025	30.33	11.94	18.95	21.04
2030	30.63	12.91	20.14	22.00

Note(s): 1) Residential petroleum products include distillate fuel, LPG, and kerosene.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, Tables 2-3, p. 24-25 for 1980-2005 and prices for note, Tables 8-9, p. 18-19 for 1980-2005 consumption; EIA, Annual Energy Outlook 2008 Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121, Table A12, p. 138, and Table A13, p. 139 for 2006-2030 consumption and prices; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.2 Residential Energy Prices, by Year and Fuel Type ($2006)

	Electricity (¢/kWh)	Natural Gas (¢/therm)	Distillate Oil ($/gal)	LPG ($/gal)
1980	11.55	77.68	1.46	2.10
1990	11.18	80.38	1.34	1.59
2000	9.59	89.00	1.45	1.61
2006	**10.41**	**133.99**	**1.98**	**2.49**
2010	10.70	121.52	2.16	2.39
2015	10.25	112.02	2.07	1.98
2020	10.30	113.94	2.08	1.98
2025	10.35	119.35	2.11	2.10
2030	10.45	129.12	2.18	2.26

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. Tables 2-3, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A3, p. 120-121 for 2006-2030 and Table G1, p. 215 for fuels' heat content; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.3 Residential Aggregate Energy Expenditures, by Year and Major Fuel Type ($2006 Billion) (1)

	Electricity	Natural Gas	Petroleum (2)	Total
1980	82.9	37.7	27.4	148.0
1990	103.3	36.3	17.6	157.2
2000	114.4	45.4	21.0	180.8
2006	**140.8**	**60.3**	**24.5**	**225.6**
2010	155.2	60.2	26.3	241.7
2015	150.9	57.8	23.9	232.6
2020	158.7	60.4	24.1	243.2
2025	167.7	63.8	24.9	256.3
2030	180.0	68.7	26.0	274.7

Note(s): 1) Expenditures exclude wood and coal. 2006 U.S. energy expenditures were 1.14 trillion. 2) Residential petroleum products include distillate fuel oil, LPG, and kerosene.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A3, p. 120-121 for 2006-2030; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.4 Cost of a Generic Quad Used in the Residential Sector ($2006 Billion) (1)

1980	9.88
1990	9.57
2000	9.06
2006	**10.04**
2010	9.90
2015	9.09
2020	9.17
2025	9.37
2030	9.76

Note(s): 1) See Table 1.5.1 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 2008, Mar. 2007, Table A2, p. 117-119 and Table A17, p. 143-144 for energy consumption and Table A3, p. 120-121 for energy prices(2006-2030). EIA, State Energy Data Report 2005, Feb. 2008, Tables 8-12 pages 22-24 and EIA, State Energy Prices and Expenditures 2005 Feb. 2008 Tables 2 and 3(1980-2005); EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

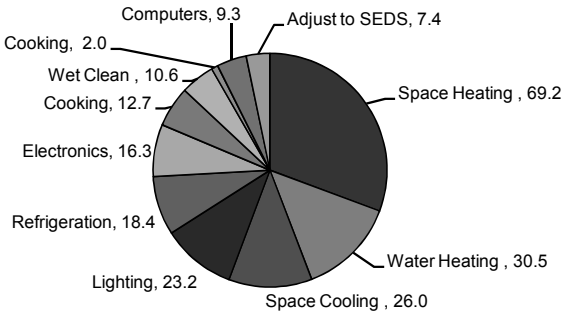
2.3.5 2006 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	41.9	10.8	5.3	1.1	17.1	0.01	10.1	69.2	30.7%
Water Heating (3)	14.5	1.9	1.3		3.2		12.9	30.5	13.5%
Space Cooling (4)	0.0						26.0	26.0	11.5%
Lighting							23.2	23.2	10.3%
Refrigeration (5)							18.4	18.4	8.2%
Electronics (6)							16.3	16.3	7.2%
Wet Clean (7)	1.0						11.7	12.7	5.6%
Cooking	2.9		0.7		0.7		7.0	10.6	4.7%
Computers							2.0	2.0	0.9%
Other (8)	-		3.5		3.5		5.8	9.3	4.1%
Adjust to SEDS (9)							7.4	7.4	3.3%
Total	**60.3**	**12.6**	**10.8**	**1.1**	**24.5**	**0.01**	**140.8**	**225.6**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($1.7 billion). 3) Includes residential recreational water heating ($1.3 billion). 4) Fan energy use included. 5) Includes refrigerators ($14.1 billion) and freezers ($4.0 billion). 6) Includes color televisions ($10.1 billion) and other electronics ($6.3 billion). 7) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($1.0 billion), electric clothes dryers ($7.7 billion), and dishwashers ($2.9 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 2008, Mar. 2008, Table A2, p. 117-119 and Table A4, p. 122-123 for energy, Table A3, p. 120-121 for prices; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24 for coal price; EIA, Annual Energy Review 2007, June 2008, 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.

2006 Residential Energy End-Use Expenditures Splits ($2006 Billion)



2.3.6 2010 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	43.4	11.3	6.0	1.3	18.6	0.0	11.5	73.6	30.4%
Water Heating	13.1	1.6	1.2		2.9		12.0	28.0	11.6%
Space Cooling (3)	0.0						24.8	24.8	10.3%
Lighting							22.5	22.5	9.3%
Refrigeration (4)							14.1	14.1	5.8%
Wet Clean (5)	0.9						11.9	12.8	5.3%
Electronics (6)							12.3	12.3	5.1%
Cooking	2.7		0.8		0.8		3.4	6.9	2.9%
Computers							3.0	3.0	1.2%
Other (7)	-		4.0		4.0		39.6	43.7	18.1%
Total	**60.2**	**13.0**	**12.1**	**1.3**	**26.3**	**0.0**	**155.2**	**241.7**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($2.0 billion). 3) Fan energy use included. 4) Includes refrigerators ($11.5 billion) and freezers ($2.5 billion). 5) Includes clothes washers ($1.0 billion), natural gas clothes dryers ($0.9 billion), electric clothes dryers ($8.0 billion), and dishwashers ($2.9 billion). 6) Includes color televisions ($12.3 billion). 7) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2007, Table A2, p. 117-119 and Table A4, p. 122-123 for energy, Table A3, p. 120-121 for prices; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24 for coal price; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.7 2020 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	43.6	9.2	5.7	1.1	16.0	0.0	12.0	71.7	29.5%
Water Heating	13.1	1.2	1.1		2.3		12.8	28.2	11.6%
Space Cooling (3)	0.0						27.4	27.4	11.3%
Lighting							15.4	15.4	6.3%
Refrigeration (4)							13.9	13.9	5.7%
Electronics (5)							12.9	12.9	5.3%
Wet Clean (6)	0.9						11.9	12.8	5.3%
Cooking	2.8		0.8		0.8		3.8	7.4	3.0%
Computers							3.7	3.7	1.5%
Other (7)	-		4.9		4.9		45.0	49.9	20.5%
Total	**60.4**	**10.4**	**12.6**	**1.1**	**24.1**	**0.0**	**158.7**	**243.2**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($2.2 billion). 3) Fan energy use included. 4) Includes refrigerators ($11.1 billion) and freezers ($2.8 billion). 5) Includes color televisions ($12.9 billion). 6) Includes clothes washers ($0.8 billion), natural gas clothes dryers ($0.9 billion), electric clothes dryers ($8.2 billion), and dishwashers ($2.9 billion). 7) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2007, Table A2, p. 117-119 and Table A4, p. 122-123 for energy, Table A3, p. 120-121 for prices; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24 for coal price; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators;

2.3.8 2030 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	50.2	9.5	5.8	1.3	16.7	0.0	12.6	79.4	28.9%
Space Cooling (3)	0.0						31.9	31.9	11.6%
Water Heating	14.1	1.1	1.1		2.2		13.1	29.4	10.7%
Electronics (4)							16.9	16.9	6.2%
Refrigeration (5)							15.4	15.4	5.6%
Lighting							14.9	14.9	5.4%
Wet Clean (6)	1.1						13.1	14.2	5.2%
Cooking	3.4		0.9		0.9		4.3	8.5	3.1%
Computers							4.8	4.8	1.8%
Other (7)	-		6.2		6.2		53.0	59.3	21.6%
Total	**68.7**	**10.6**	**14.0**	**1.3**	**26.0**	**0.0**	**180.0**	**274.7**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($2.4 billion). 3) Fan energy use included. 4) Includes color televisions ($16.9 billion). 5) Includes refrigerators ($12.0 billion) and freezers ($3.4 billion). 6) Includes clothes washers ($0.8 billion), natural gas clothes dryers ($1.1 billion), electric clothes dryers ($9.0 billion), and dishwashers ($3.3 billion). 7) Includes small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2007, Table A2, p. 117-119 and Table A4, p. 122-123 for energy, Table A3, p. 120-121 for prices; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24 for coal price; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.9 Average Annual Energy Expenditures per Household, by Year ($2006)

Year	Total Expenditure
1980	1,858
1990	1,669
2000	1,710
2006	**2,003**
2010	2,084
2015	1,895
2020	1,883
2025	1,899
2030	1,954

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 for consumption, Table A3, p. 120-121 for prices 2006-2030; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators; and DOC, Statistical Abstract of the United States Historical Data for 1980-2005 occupied units.

2.3.10 2005 Energy End-Use Expenditures for an Average Household, by Region ($2006)

	Northeast	Midwest	South	West	National
Space Heating	978	672	345	328	536
Air-Conditioning	186	163	425	244	290
Water Heating	347	274	292	296	298
Refrigerators	180	135	136	143	146
Other Appliances and Lighting	770	620	666	667	675
Total (1)	**2,379**	**1,840**	**1,835**	**1,542**	**1,873**

Note(s): 1) Due to rounding, end-uses do not sum to totals.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008, Table US-15; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.3.11 2005 Energy Expenditures per Household, by Housing Type and Square Footage ($2006)

	Per Household	Per Square Foot
Single-Family		
Detached	2,126	0.78
Attached	1,672	0.87
Multi-Family		
2 to 4 units	1,610	1.47
5 or more units	1,116	1.28
Mobile Home	**1,592**	**1.51**

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Table US-1 part1; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

2.3.12 2005 Energy Expenditures per Household, by Census Region ($2006)

Region	
Northeast	2,379
Midwest	1,840
South	1,835
West	1,542

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Tables US-1 part 1; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

2.3.13 2005 Household Energy Expenditures, by Vintage ($2006)

Year	Per Household	Per Square Foot	Per Household Member	Percent of Residential Sector Expenditures
Prior to 1970	1,909	0.87	765	43%
1970 to 1979	1,706	0.92	686	15%
1980 to 1989	1,755	0.88	697	16%
1990 to 1999	2,000	0.80	713	17%
2000 to 2005	2,024	0.71	733	9%
				Total 100%
Average	**1,873**	**0.81**	**1,770**	

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Tables US-1 part 1; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

2.3.14 2005 Households and Energy Expenditures, by Income Level

Household Income	Households (10^6)		Energy Expenditures by Household	Energy Expenditures by Household Member	Mean Individual Energy Burden (1)
Less than $9,999	9.9	9%	1,357	706	21%
$10,000 to $14,999	8.5	8%	1,419	685	11%
$15,000 to $19,999	8.4	8%	1,462	668	8%
$20,000 to $29,999	15.1	14%	1,580	645	6%
$30,000 to $39,999	13.6	12%	1,677	641	5%
$40,000 to $49,999	11.0	10%	1,821	685	4%
$50,000 to $74,999	19.8	18%	1,916	695	3%
$75,000 to $99,999	10.6	10%	2,220	773	3%
$100,000 or more	14.2	13%	2,528	828	3%
Total	**111.1**	100%			**6%**

Note(s): 1) See Tables 2.3.15 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 2005, Oct. 2008, Tables US-1 part 2; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

2.3.15 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.

2.3.16 1998 Cost Breakdown of a 2,150-Square-Foot, New Single-Family Home ($2006) (1)

	Cost	
Finished Lot	**64,626**	**24%**
Construction Cost		
Inspection/Fees	4,223	2%
Shell/Frame		
Framing	30,927	11%
Windows/Doors	10,272	4%
Exterior Finish	11,304	4%
Foundation	16,131	6%
Wall/Finish Trim	28,212	10%
Flooring	7,211	3%
Equipment		
Plumbing	8,837	3%
Electrical Wiring	5,638	2%
Lighting Fixtures	1,560	1%
HVAC	6,171	2%
Appliances	2,165	1%
Property Features	17,567	6%
Financing	**5,152**	**2%**
Overhead & General Expenses	**15,645**	**6%**
Marketing	**3,840**	**1%**
Sales Commission	**9,238**	**3%**
Profit	**25,163**	**9%**
Total	**273,882**	100%

Note(s): 1) Based on a NAHB Survey asking builders to provide a detailed breakdown of the cost of constructing a 2,150 SF 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 2007, June 2008, Appendix D, p. 377 for price inflators.

2.4.1 Carbon Dioxide Emissions for U.S. Residential Buildings, by Year (million metric tons) (1)

	Residential				U.S.			
	Site Fossil	Electricity	Total	Growth Rate 2006-Year	Total	Growth Rate 2006-Year	Res.% of Total U.S.	Res.% of Total Global
1980	385	525	909	-	4723	-	19%	5.0%
1990	342	620	962	-	5012	-	19%	4.5%
2000	380	802	1182	-	5847	-	20%	5.0%
2006	**326**	**866**	**1192**	**-**	**5890**	**-**	20%	**4.3%**
2010	355	904	1259	1.4%	6011	0.5%	21%	4.0%
2015	367	913	1281	0.8%	6226	0.6%	21%	3.7%
2020	374	949	1324	0.8%	6384	0.6%	21%	3.6%
2025	375	1004	1379	0.8%	6571	0.6%	21%	3.5%
2030	372	1079	1451	0.8%	6851	0.6%	21%	3.4%

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 2008 and differs from EIA, AEO 2008, Table A18. Buildings sector total varies by 0.7% for year 2006 from EIA, AEO 2008. 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 2008, June 2008, Table 2, p. 9 for carbon coefficients; EIA, AEO 2008, Mar. 2008, Table A2, p. 137-139 for 2006-2030 energy consumption and Table A18, p. 164 for 2006-2030 emissions; EIA, International Energy Outlook 2007, May 2007, Table A10, p. 93 for 2004-2030 global emissions; and EIA, International Energy Annual 2007, July 2008, Table H1, www.eia.doe.gov for 1980-2000 global emission.

2.4.2 2001 End-Use Carbon Dioxide Emissions Splits for an Average Household, by Region (Pounds of CO2)

	Northeast	Midwest	South	West	National
Space Heating	9,143	8,731	4,906	4,483	6,505
Space Cooling	1,467	2,063	4,742	2,170	3,197
Water Heating	2,952	2,634	3,140	2,538	2,922
Refrigerator	1,444	2,041	2,463	1,796	2,068
Other Appliances & Lighting	6,960	8,697	9,226	7,127	8,179
Total	**21,966**	**24,165**	**24,477**	**18,114**	**22,871**

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.

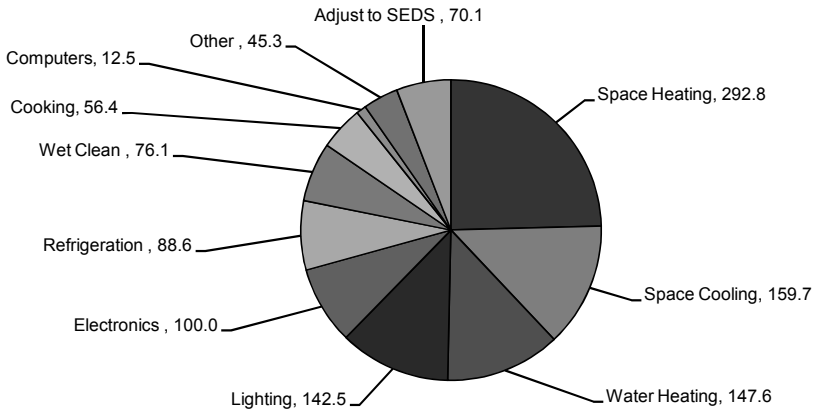
2.4.3 2006 Residential Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	166.0	43.9		14.4	5.4	63.7	0.8	62.3	292.8	24.6%
Space Cooling	0.0							159.7	159.7	13.4%
Water Heating	57.3	7.7		3.5		11.2		79.2	147.6	12.4%
Lighting								142.5	142.5	12.0%
Electronics (5)								100.0	100.0	8.4%
Refrigeration (6)								88.6	88.6	7.4%
Wet Clean (7)	3.9							72.2	76.1	6.4%
Cooking	11.6			2.0		2.0		42.8	56.4	4.7%
Computers								12.5	12.5	1.0%
Other (8)				9.6		9.6		35.8	45.3	3.8%
Adjust to SEDS (9)								70.1	70.1	5.9%
Total	**238.7**	**51.5**		**29.5**	**5.4**	**86.4**	**0.8**	**865.6**	**1,191.5**	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 2008 and differs from AEO 2008, Table A18. Buildings sector total varies by 0.7% from AEO 2008. 2) Includes kerosene space heating (5.4 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (10.1 MMT). 5) Includes color television (62.2 MMT) and other office equipment(11.9 MMT). 6) Includes refrigerators (73.1 MMT) and freezers (15.6 MMT). 7) Includes clothes washers (6.7 MMT), natural gas clothes dryers (3.9 MMT), electric clothes dryers (47.7 MMT), and dishwashers (17.9 MMT). Does not include water heating energy. 8) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. 9) Emissions related to a discrepancy between data sources. Energy attributable to the residential sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 124-125 for energy consumption, and Table A18, p. 144 for emissions; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 10 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; EIA, AEO 1999, Dec. 1998, Table A4, p. 118-119

2006 Residential Buildings Energy End-Use Carbon Dioxide Emissions Splits (Million Metric Tons)



2.4.4 2010 Residential Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	189.4	48.2		15.1	5.8	69.1	0.8	67.1	326.5	25.9%
Space Cooling	0.0							144.5	144.5	11.5%
Water Heating	57.4	6.9		3.1		10.0		70.1	137.4	10.9%
Lighting								131.4	131.4	10.4%
Refrigeration (5)								81.9	81.9	6.5%
Wet Clean (6)	3.9							69.4	73.3	5.8%
Electronics (7)								71.7	71.7	5.7%
Cooking	11.9			2.0		2.0		19.8	33.7	2.7%
Computers								17.4	17.4	1.4%
Other (8)				10.1		10.1		230.9	241.0	19.1%
Total	**262.6**	**55.1**		**30.3**	**5.8**	**91.2**	**0.8**	**904.1**	**1,258.8**	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. 2) Includes kerosene space heating (5.8 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (11.6 MMT). 5) Includes refrigerators (67.1 MMT) and freezers (14.8 MMT). 6) Includes clothes washers (6.0 MMT), natural gas clothes dryers (3.9 MMT), electric clothes dryers (46.5 MMT), and dishwashers (16.9 MMT). Does not include water heating energy. 7) Includes color television (71.7 MMT). 8) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 124-125 for energy consumption, and Table A18, p. 144 for emissions; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 10 for emission coefficients.

2.4.5 2020 Residential Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	203.1	47.3		14.9	6.1	68.3	0.8	71.7	344.0	26.0%
Space Cooling	0.0							164.2	164.2	12.4%
Water Heating	61.0	6.0		2.9		9.0		76.4	146.4	11.1%
Lighting								91.9	91.9	6.9%
Refrigeration (5)								83.0	83.0	6.3%
Electronics (6)								77.3	77.3	5.8%
Wet Clean (8)	4.2							71.0	75.2	5.7%
Cooking	13.1			2.1		2.1		22.6	37.8	2.9%
Computers								22.0	22.0	1.7%
Other (9)				12.9		12.9		269.3	282.1	21.3%
Total	**281.5**	**53.4**		**32.7**	**6.1**	**92.3**	**0.8**	**949.4**	**1,323.9**	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. 2) Includes kerosene space heating (5.7 MMT). 3) Excludes electric imports by utilities. 4) Includesresidential furnace fans (13.2 MMT). 5) Includes refrigerators (66.4 MMT) and freezers (16.6 MMT). 6) Includes color television (77.3 MMT). 8) Includes clothes washers (4.8 MMT), natural gas clothes dryers (4.2 MMT), electric clothes dryers (48.9 MMT), and dishwashers (17.3 MMT). 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.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 124-125 for energy consumption, and Table A18, p. 144 for emissions; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 10 for emission coefficients.

2.4.6 2030 Residential Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum							
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Space Heating (4)	206.1	42.8		14.5	6.1	63.4	0.7	75.4	345.6	23.8%
Space Cooling	0.0							191.0	191.0	13.2%
Water Heating	58.1	4.9		2.7		7.6		78.8	144.4	10.0%
Electronics (5)								101.5	101.5	7.0%
Refrigeration (6)								92.3	92.3	6.4%
Lighting								89.4	89.4	6.2%
Wet Clean (7)	4.4							78.7	83.1	5.7%
Cooking	13.9			2.2		2.2		25.5	41.5	2.9%
Computers								28.9	28.9	2.0%
Other (8)				15.5		15.5		317.8	333.3	23.0%
Total	**282.5**	**47.7**		**34.8**	**6.1**	**88.6**	**0.7**	**1,079.1**	**1,450.9**	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. 2) Includes kerosene space heating (5.7 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (14.6 MMT). 5) Includes color television 101.5 MMT). 6) Includes refrigerators (71.8 MMT) and freezers (20.5 MMT). 7) Includes clothes washers (5.0 MMT), natural gas clothes dryers (4.4 MMT), electric clothes dryers (54.2 MMT), and dishwashers (19.5 MMT). Does not include water heating energy. 8) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 124-125 for energy consumption, and Table A18, p. 144 for emissions; EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 10 for emission coefficients.

2.4.7 2006 Methane Emissions for U.S. Residential Buildings Energy Production, by Fuel Type (MMT CO2 Equivalent) (1)

Fuel Type	
Petroleum	1.0
Natural Gas	30.8
Coal	0.0
Wood	2.3
Electricity (2)	38.2
Total	**72.3**

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

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 2006, Nov. 2007, Table 15, p. 22 for energy production emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, April 2008, Table 3-16, p. 3-25 for stationary combustion emissions; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for energy consumption.

2.4.8 Characteristics of U.S. Construction Waste

- Two to seven tons of waste (a rough average of four 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.

2.4.9 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 2.2.7 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, Residential Construction Waste: From Disposal to Management, Oct. 1996, www.nahb.org.

2.5.1 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.

2.5.2 Value of New Building Construction, by Year ($2006 Billion)

	Residential	GDP
1980	154.4	6,013
1985	198.5	7,053
1990	194.1	8,286
1995	166.9	9,357
2000	258.0	11,437
2003	341.6	12,114
2004	411.8	12,437
2005	473.6	12,819
2006	462.3	13,187

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 2007 for 1995-2006; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

2.6.1 Value of Residential Building Improvements and Repairs, by Sector ($2006 Billion) (1)

	Improvements	Maintenance and Repairs	Total
1980	67.2	32.7	99.9
1985	76.5	60.7	137.2
1990	85.1	79.7	164.8
1995	98.6	59.5	158.1
2000	129.0	49.2	178.2
2003	145.4	48.3	193.7
2004	157.4	53.9	211.3
2005	166.7	55.6	222.3
2006	174.8	53.4	228.2

Note(s): 1) Improvements includes additions, alterations, reconstruction, and major replacements. Repairs include maintenance.
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, May 2008 for 1995-2006; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for GDP and price deflators.

2.6.2 2005 Professional and Do-It-Yourself Improvements, by Project ($2006)

	Professional Installation			Do-It-Yourself Installation		
Repair/Improvement	Homeowners (millions)	Total Expenditures ($billion)	Mean Expenditures ($)	Homeowners (thousands)	Total Expenditures ($billion)	Mean Expenditures ($)
Disaster Repairs	0.61	9.0	14,398	0.20	1.3	6,698
Kitchen Remodeled	1.13	13.4	11,550	1.05	5.7	5,411
Additions Built	1.27	30.4	23,212	1.38	9.3	6,767
Bathroom Remodeled or Added	1.13	8.8	7,527	1.34	3.8	2,852
Exterior Improvements	3.85	23.7	5,983	3.11	7.9	2,527
Siding Replaced or Added	0.82	5.3	6,322	0.39	1.0	2,583
Roof Replacement	2.67	14.5	5,281	0.81	1.9	2,366
HVAC Replacement	2.44	7.3	2,895	0.51	1.5	2,909
Windows/Doors Installed	2.53	7.8	2,995	1.72	2.6	1,501
Flooring/Paneling/Ceiling Replacement	4.65	12.7	2,661	3.48	4.2	1,221
Electric System Replacement	1.35	1.6	1,144	0.89	0.4	451
Plumbing Replacement	0.84	1.5	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 $39.1 billion higher in Table 2.6.1. 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.

2.6.3 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 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.

2.6.4 2007 National Professional Remodeling Cost and Amount Recouped in Resale Value ($Thousand)

Envelope	Job Cost	Resale Value	Cost Recouped
Siding Replacement - Vinyl	9.9	8.2	83%
Siding Replacement - Foam-backed vinyl	12.1	9.7	80%
Siding Replacement - Fiber-cement	13.2	11.6	88%
Window Replacement - Vinyl	10.4	8.3	79%
Window Replacement - Wood	11.4	9.2	81%
Roofing Replacement - Asphalt	18.0	12.2	67%
Roofing Replacement - Steel	33.2	21.8	66%
Remodel			
Minor Kitchen Remodel	21.2	17.6	83%
Major Kitchen Remodel	55.5	43.4	78%
Bathroom Remodel	15.8	12.4	78%
Attic Bedroom Remodel	46.7	35.8	77%
Basement Remodel	59.4	44.7	75%
Home Office Remodel	27.2	15.5	57%
Additions			
Deck Addition - Wood	10.3	8.8	85%
Deck Addition - Composite	15.0	11.7	78%
Bathroom Addition	37.2	24.6	66%
Garage Addition	53.9	37.5	70%
Sunroom Addition	69.8	41.2	59%
Family Room Addition	79.0	54.1	69%
Master Suite Addition	98.9	68.2	69%
Two-Story Addition	139.3	103.0	74%
Back-Up Power Generator	13.4	7.7	58%

Note(s): Job cost includes labor, material, subtrades, contractor overhead and profit. Resale value based on a survey of appraisers, sales agents, and brokers. The survey asked for the estimated increase in resale value of standardized remodeling projects. Definitions of remodeling projects are available at costvalue.remodelingmagazine.com

Source(s): Complete regional and city data from the Remodeling 2007 Cost vs. Value Report can be downloaded for free at costvalue.remodelingmagazine.com.

2.7.1 *Delivered* Energy Consumption Intensities of Public Multi-Family Buildings, by Fuel and Region (Thousand Btu/SF)

Region	Electricity	Natural Gas	Fuel Oil	Total
Northeast	27.7	45.9	39.9	71.5
Midwest	22.5	49.9	N.A.	70.3
South	53.5	27.9	N.A.	65.9
West	22.0	25.3	N.A.	46.2
National Average	**33.0**	**43.4**		**68.3**

Source(s): HUD, Benchmarking Utility Usage in Public Housing, December 2007, http://www.hud.gov/offices/pih/programs/ph/phecc/finbnchrpt.doc.

2.7.2 *Delivered* Energy Consumption Intensities of Public Multi-Family Buildings, by Fuel and Region (Million Btu/Household)

Region	Electricity	Natural Gas	Fuel Oil	Total
Northeast	21.2	34.9	36.2	54.7
Midwest	16.6	36.6	N.A.	51.8
South	39.4	20.0	N.A.	48.5
West	16.6	19.3	N.A.	34.8
National Average	**24.6**	**32.2**		**51.0**

Source(s): HUD, Benchmarking Utility Usage in Public Housing, December 2007, http://www.hud.gov/offices/pih/programs/ph/phecc/finbnchrpt.doc.

2.8.1 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.

2.8.2 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.

2.8.3 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.

2.8.4 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.

2.8.5 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.

2.9.1 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% to 200% 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 75%(1) 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.

Note(s): 1) For fiscal year 2009 only; normally 60%.

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; HHS, LIHEAP Report to Congress FY 2001, Feb. 2003, Table E-1, p. 105 and Figure 1, p. iii for LIHEAP recipient household; Department of Energy, What is the Weatherization Program, p. 2, February 2009; U.S Department of Health and Human Services, Low Income Home Energy Assistance Program Guidance, Policy, and Procedures, February 2009.

2.9.2 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.

2.9.3 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.

2.9.4 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 more than 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.

2.9.5 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 on 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.

2.9.6 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.

2.9.7 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.

2.9.8 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.

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

2.9.9 2005 Housing Unit Ownership, by Income Level and Weatherization Eligibility (in Millions)

	Single-Family		Multi-Family Unit		Mobile Home	
2005 Household Income	Own	Rent	Own	Rent	Own	Rent
Less than $15,000	6.1	2.4	0.3	7.1	1.6	N.A.
$15,000 to $30,000	11.0	3.0	0.4	5.8	2.2	0.3
$30,000 to $49,999	15.7	2.5	N.A	3.9	1.2	N.A.
All Households	67.9	10.9	1.8	20.1	5.6	0.3
Federally Eligible	**15.7**	**5.9**	**1.4**	**11.7**	**3.1**	**0.8**
Federally Ineligible	52.5	5.6	2.7	8.6	2.6	0.4
Below 100% Poverty Line	5.3	2.5	0.8	6.1	1.5	0.4

Source(s): EIA, 2005 Residential Energy Consumption Survey: Housing Characteristics Tables, June 2008, Table HC 3-3 and Table HC 4-3.

2.9.10 2005 Average Energy Expenditures per Household Member and per Square Foot, by Weatherization Eligibility ($2006)

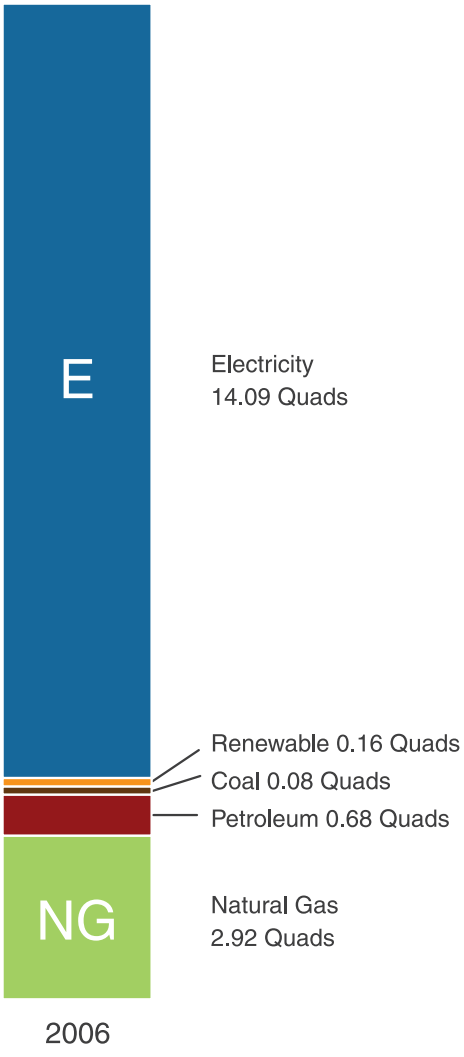
	Per Household Member	Members/ Hhold	Per Square Foot	Square Feet/ Hhold
Total U.S. Households	729	2.6	0.87	2,171
Federally Eligible	**604**	**2.7**	**1.01**	**1,598**
Federally Ineligible	800	2.5	0.81	2,475
Below 100% Poverty Line	564	2.7	1.09	1,400

Source(s): EIA, 2005 Residential Energy Consumption Survey: Household Energy Consumption and Expenditures Tables, Oct. 2008, Table US1 part2.

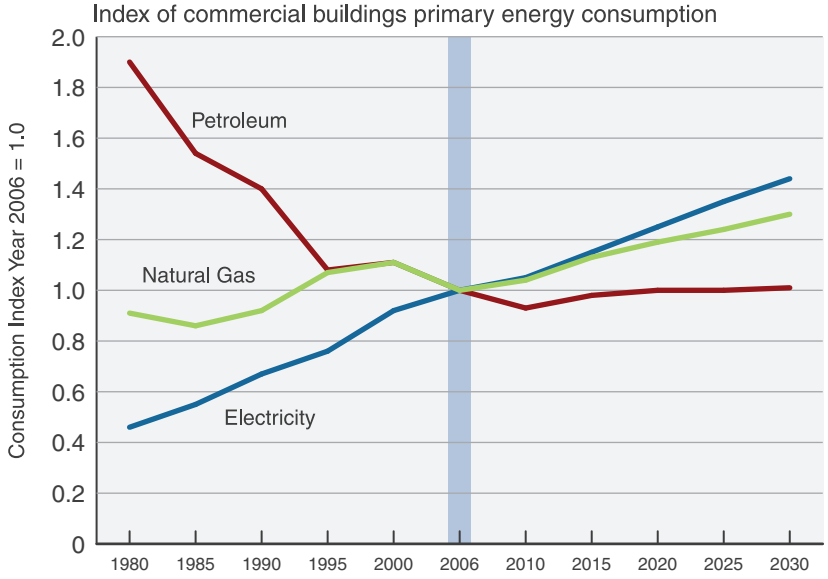
PRIMARY ENERGY IN THE COMMERCIAL BUILDINGS SECTOR

The Commercial Sector consumed 18% (17.93 Quads) of U.S. primary energy in 2006. Dominating this consumption was electricity, which represented 79% (14.09 Quads) of all primary energy used. Electricity is also expected to be the fastest growing fuel source, increasing 44% from 2006 to 2030.

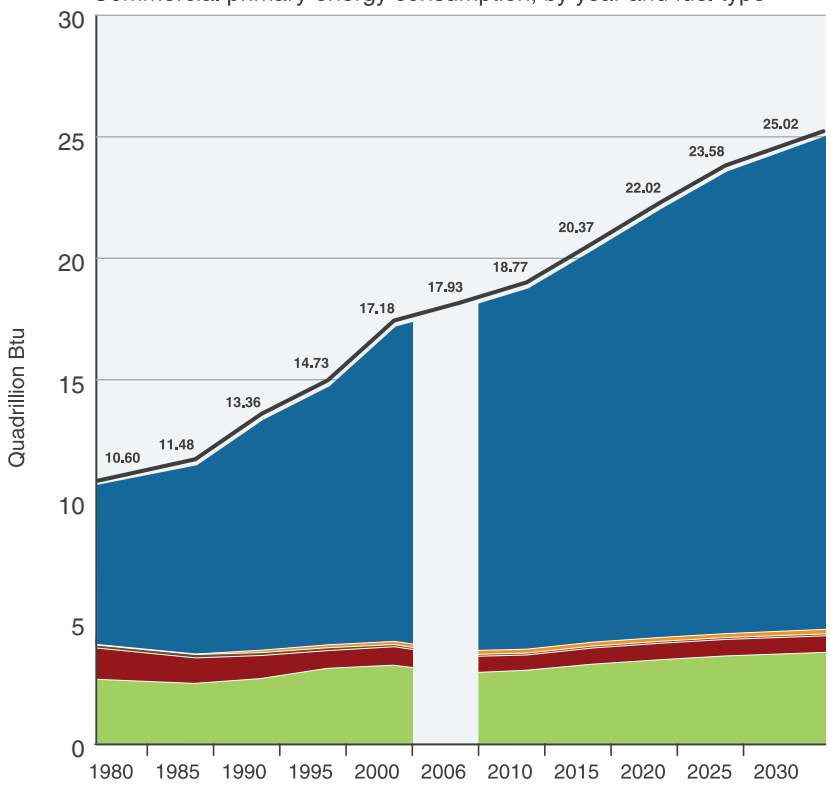
The index chart to the right shows the changes in fuels by indexing consumption of electricity, natural gas, and petroleum to 2006. For example, petroleum consumption in the 80's is almost twice that of today and is forecasted at the current level into the future.



Index of commercial buildings primary energy consumption



Commercial primary energy consumption, by year and fuel type



Consumption by fuel type, 1980–2030

Quadrillion Btu (Quads)

	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	6.51	7.77	9.48	10.64	12.96	14.09	14.85	16.17	17.63	19.02	20.30
Renewable	0.02	0.02	0.10	0.12	0.13	0.16	0.16	0.16	0.16	0.16	0.17
Coal	0.12	0.14	0.12	0.12	0.09	0.08	0.08	0.08	0.08	0.08	0.08
Petroleum	1.29	1.05	0.95	0.73	0.76	0.68	0.63	0.67	0.68	0.68	0.68
Natural Gas	2.67	2.50	2.70	3.12	3.25	2.92	3.04	3.29	3.47	3.63	3.78

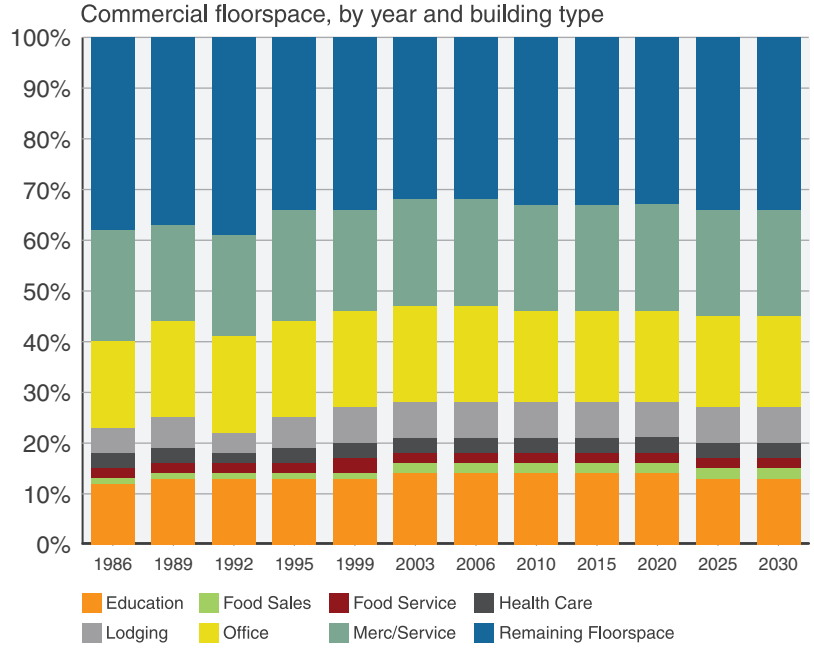
DELIVERED ENERGY IN THE COMMERCIAL BUILDINGS SECTOR

The Commercial Sector consumed 8.27 Quads of delivered energy in 2006. Delivered energy does not include energy lost during production, transmission, and distribution to customers. In the case of electricity, delivered energy excludes that used by the electric generating and distribution companies. Electricity still remains the dominant source of Commercial Sector delivered energy, at 53%.

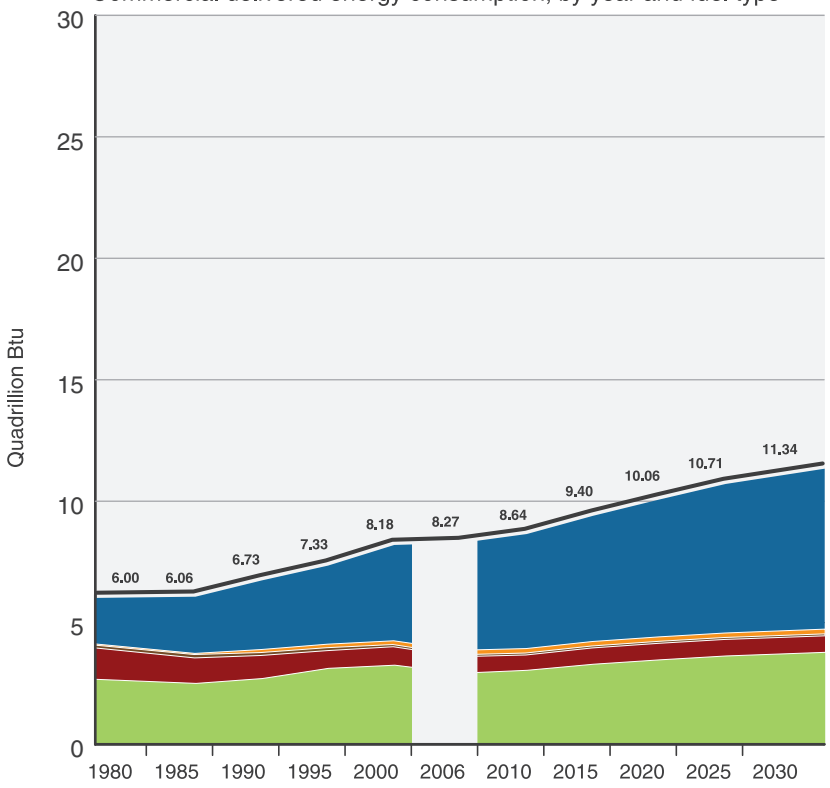
Commercial energy consumption is also dependent on building activity and floorspace. A breakdown of commercial floorspace is provided by building type.

Commercial floorspace is expected to increase by 26 billion square feet from 2006 to 2030; however, the building mix remains nearly unchanged.

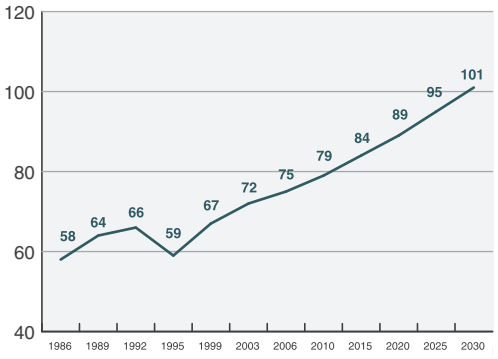
Commercial floorspace, by year and building type

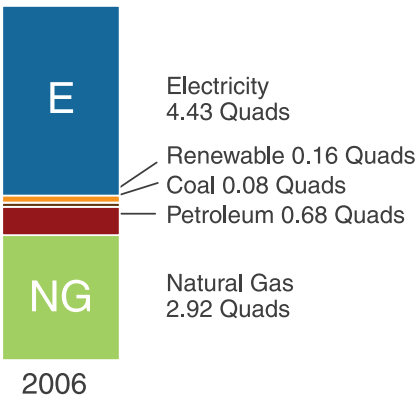


Commercial delivered energy consumption, by year and fuel type



Total floorspace
(Billion Square Feet)





Consumption by fuel type, 1980–2030
Quadrillion Btu (Quads)

	1980	1985	1990	1995	2000	2006	2010	2015	2020	2025	2030
Electricity	1.91	2.35	2.86	3.25	3.96	4.43	4.73	5.19	5.67	6.15	6.62
Renewable	0.02	0.02	0.10	0.12	0.13	0.16	0.16	0.16	0.16	0.16	0.17
Coal	0.12	0.14	0.12	0.12	0.09	0.08	0.08	0.08	0.08	0.08	0.08
Petroleum	1.29	1.05	0.95	0.73	0.76	0.68	0.63	0.67	0.68	0.68	0.68
Natural Gas	2.67	2.50	2.70	3.12	3.25	2.92	3.04	3.29	3.47	3.63	3.78

3.1.1 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 2006-Year
1980	2.67	25.2%	1.29	12.2%	0.12	1.1%	0.02	0.2%	1.91	4.60	6.51	61.4%	10.60	-
1990	2.70	20.2%	0.95	7.1%	0.12	0.9%	0.10	0.7%	2.86	6.62	9.48	71.0%	13.36	-
2000	3.25	18.9%	0.76	4.4%	0.09	0.5%	0.13	0.7%	3.96	9.00	12.96	75.4%	17.18	-
2006	**2.92**	**16.3%**	**0.68**	**3.8%**	**0.08**	**0.5%**	**0.16**	**0.9%**	**4.43**	**9.66**	**14.09**	**78.6%**	**17.93**	**-**
2010	3.04	16.2%	0.63	3.4%	0.08	0.4%	0.16	0.8%	4.73	10.12	14.85	79.1%	18.77	1.1%
2015	3.29	16.2%	0.67	3.3%	0.08	0.4%	0.16	0.8%	5.19	10.98	16.17	79.4%	20.37	1.4%
2020	3.47	15.8%	0.68	3.1%	0.08	0.4%	0.16	0.7%	5.67	11.96	17.63	80.1%	22.02	1.5%
2025	3.63	15.4%	0.68	2.9%	0.08	0.4%	0.16	0.7%	6.15	12.87	19.02	80.7%	23.58	1.5%
2030	3.78	15.1%	0.68	2.7%	0.08	0.3%	0.17	0.7%	6.62	13.68	20.30	81.2%	25.02	1.4%

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) 2006 *site* -to-source electricity conversion = 3.18.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 and Table A17, p. 143-144 for non-marketed renewable energy.

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

	Wood (2)	Solar Thermal (3)	Solar PV(3)	GHP	Total	Growth Rate 2006-Year
1980	0.021	N.A	N.A.	0.000	0.021	-
1990	0.094	N.A	N.A.	0.003	0.096	-
2000	0.119	N.A	N.A.	0.008	0.126	-
2006	**0.129**	**0.025**	**0.001**	**N.A.**	**0.155**	**-**
2010	0.129	0.025	0.003	N.A.	0.157	0.4%
2015	0.129	0.027	0.003	N.A.	0.159	0.3%
2020	0.129	0.027	0.005	N.A.	0.161	0.3%
2025	0.129	0.027	0.007	N.A.	0.164	0.3%
2030	0.129	0.028	0.010	N.A.	0.167	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.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A17, p. 143-144 for 2006-2030.

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

	Floorspace (million SF)	Percent Post-2000 Floorspace (1)	*Delivered* Energy Consumption Total (10^15 Btu)	*Delivered* Energy Consumption per SF (thousand Btu/SF)	Primary Energy Consumption Total (10^15 Btu)	Primary Energy Consumption per SF (thousand Btu/SF)
1980	50.9	N.A.	6.00	117.8	10.60	208.2
1990	64.3	N.A.	6.73	104.8	13.36	207.8
2000 (2)	68.5	N.A.	8.18	119.4	17.18	250.8
2006 (2)	**74.8**	**15%**	**8.27**	**110.6**	**17.93**	**239.7**
2010 (2)	78.8	24%	8.64	109.7	18.77	238.1
2015 (2)	83.9	33%	9.40	112.0	20.37	242.8
2020 (2)	89.3	41%	10.06	112.7	22.02	246.7
2025 (2)	94.8	49%	10.71	112.9	23.58	248.6
2030 (2)	100.8	56%	11.34	112.5	25.02	248.3

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 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; DOE for 1980 floorspace; EIA, Annual Energy Outlook 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 2008, Mar. 2008, Table A2, p. 117-119, Table A5, p. 124-125, and Table A17, p.143-144 for 2006-2030.

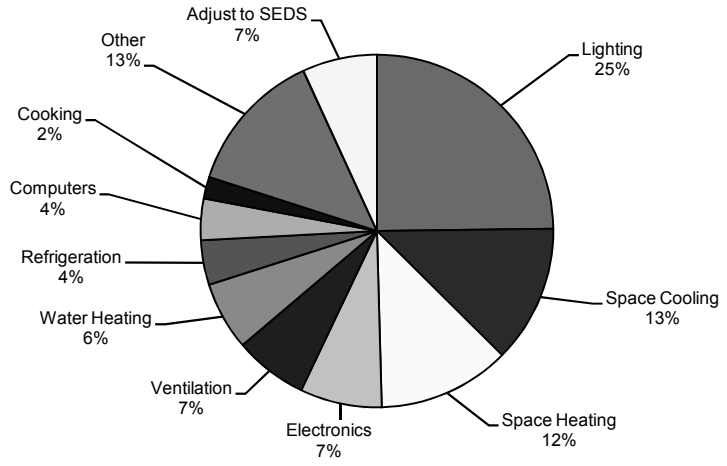
3.1.4 2006 Commercial Energy End-Use Splits, by Fuel Type (Quadrillion Btu)

	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						1.40	1.40	16.9%	4.45	4.45	24.8%
Space Cooling	0.02					0.71	0.73	8.8%	2.25	2.27	12.6%
Space Heating	1.18	0.24		0.10		0.21	1.73	20.9%	0.65	2.17	12.1%
Electronics						0.42	0.42	5.1%	1.34	1.34	7.5%
Ventilation						0.38	0.38	4.6%	1.21	1.21	6.7%
Water Heating	0.55	0.05			0.02	0.16	0.78	9.4%	0.50	1.13	6.3%
Refrigeration						0.23	0.23	2.8%	0.73	0.73	4.1%
Computers						0.21	0.21	2.6%	0.68	0.68	3.8%
Cooking	0.23					0.04	0.27	3.3%	0.12	0.35	2.0%
Other (5)	0.27	0.03	0.08	0.05	0.13	0.57	1.12	13.6%	1.81	2.36	13.2%
Adjust to SEDS (6)	0.67	0.22				0.11	1.00	12.1%	0.34	1.23	6.9%
Total	**2.92**	**0.53**	**0.08**	**0.15**	**0.16**	**4.43**	**8.27**	100%	**14.09**	**17.93**	100%

Note(s): 1) Includes (0.42 quad) distillate fuel oil and (0.11 quad) residual fuel oil. 2) Kerosene (0.02 quad) and coal (0.08 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.13 quad) biomass, (0.03 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; 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; EIA, Supplement to the AEO 2008, April 2008, Table 22.

2006 Commercial Primary Energy End-Use Splits



3.1.5 2010 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						1.12	1.12	13.0%	3.53	3.53	18.8%
Space Heating	1.29	0.23		0.10		0.14	1.76	20.4%	0.43	2.06	11.0%
Electronics						0.55	0.55	6.4%	1.73	1.73	9.2%
Space Cooling	0.02					0.50	0.52	6.0%	1.56	1.58	8.4%
Water Heating	0.54	0.04			0.03	0.15	0.76	8.8%	0.48	1.09	5.8%
Computers						0.25	0.25	2.9%	0.80	0.80	4.3%
Refrigeration						0.23	0.23	2.7%	0.73	0.73	3.9%
Ventilation						0.19	0.19	2.2%	0.60	0.60	3.2%
Cooking	0.24					0.04	0.28	3.3%	0.12	0.36	1.9%
Other (5)	0.22	0.02	0.09	0.05	0.13	0.76	1.26	14.6%	2.38	2.89	15.4%
Adjust to SEDS (6)	0.73	0.19				0.79	1.71	19.7%	2.49	3.40	18.1%
Total	**3.04**	**0.48**	**0.09**	**0.15**	**0.16**	**4.73**	**8.64**	100%	**14.85**	**18.77**	100%

Note(s): 1) Includes (0.38 quad) distillate fuel oil and (0.10 quad) residual fuel oil. 2) Kerosene (0.02 quad) and coal (0.08 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.13 quad) biomass, (0.03 quad) solar water heating, and (less than 0.01 quad) solar PV. 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.14. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.1.6 2020 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						1.22	1.22	12.1%	3.79	3.79	17.2%
Electronics						0.79	0.79	7.9%	2.46	2.46	11.2%
Space Heating	1.40	0.25		0.10		0.14	1.90	18.8%	0.45	2.20	10.0%
Space Cooling	0.02					0.55	0.57	5.6%	1.70	1.72	7.8%
Water Heating	0.65	0.05			0.03	0.16	0.89	8.8%	0.50	1.23	5.6%
Computers						0.30	0.30	3.0%	0.93	0.93	4.2%
Refrigeration						0.25	0.25	2.5%	0.79	0.79	3.6%
Ventilation						0.21	0.21	2.1%	0.65	0.65	3.0%
Cooking	0.29					0.04	0.33	3.3%	0.12	0.41	1.8%
Other (5)	0.28	0.02	0.09	0.05	0.13	1.13	1.70	16.9%	3.51	4.09	18.6%
Adjust to SEDS (6)	0.83	0.20				0.88	1.90	18.9%	2.74	3.76	17.1%
Total	**3.47**	**0.52**	**0.09**	**0.15**	**0.16**	**5.67**	**10.06**	100%	**17.63**	**22.02**	100%

Note(s): 1) Includes (0.41 quad) distillate fuel oil and (0.10 quad) residual fuel oil. 2) Kerosene (0.02 quad) and coal (0.08 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.16 quad) biomass, (0.03 quad) solar water heating, and (less than 0.01 quad) solar PV. 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.11. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.1.7 2030 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						1.34	1.34	11.9%	4.12	4.12	16.5%
Electronics						0.92	0.92	8.1%	2.81	2.81	11.2%
Space Heating	1.42	0.25		0.10		0.15	1.92	16.9%	0.45	2.22	8.9%
Space Cooling	0.02					0.61	0.63	5.6%	1.88	1.90	7.6%
Water Heating	0.73	0.05			0.03	0.16	0.97	8.6%	0.50	1.31	5.2%
Computers						0.35	0.35	3.1%	1.08	1.08	4.3%
Refrigeration						0.28	0.28	2.5%	0.86	0.86	3.4%
Ventilation						0.23	0.23	2.0%	0.71	0.71	2.8%
Cooking	0.33					0.04	0.36	3.2%	0.11	0.43	1.7%
Other (5)	0.41	0.02	0.09	0.05	0.14	1.57	2.28	20.1%	4.80	5.52	22.1%
Adjust to SEDS (6)	0.89	0.19				0.97	2.05	18.1%	2.99	4.06	16.2%
Total	**3.78**	**0.52**	**0.09**	**0.15**	**0.17**	**6.62**	**11.34**	100%	**20.30**	**25.02**	100%

Note(s): 1) Includes (0.41 quad) distillate fuel oil and (0.10 quad) residual fuel oil. 2) Kerosene (0.02 quad) and coal (0.08 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.17 quad) biomass, (0.03 quad) solar water heating, and (0.01 quad) solar PV. 4) *Site* -to-source electricity conversion (due to generation and transmission losses) = 3.07. 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 2008, Mar. 2008, Tables A2, p. 117-119, Table A5, p. 124-125, and Table A17, p. 143-144; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.1.8 Commercial *Delivered* Energy Consumption Intensities, by Vintage

Year Constructed	Consumption per Square Foot (thousand Btu/SF)	
Prior to 1960	84.4	23%
1960 to 1969	91.5	12%
1970 to 1979	97.0	18%
1980 to 1989	100.0	19%
1990 to 1999	90.3	19%
2000 to 2003	81.6	8%
Average	91.0	

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

3.1.9 2003 Commercial *Delivered* Energy Consumption Intensities, by Principal Building Type and Vintage (1)

	Consumption (thousand Btu/SF)				Consumption (thousand Btu/SF)		
Building Type	Pre-1959	1960-1989	1990-2003	Building Type	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 3.1.3 for primary versus delivered energy consumption.

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Oct. 2006, Table C12a.

3.1.10 2003 Commercial Primary Energy Consumption Intensities, by Principal Building Type

Building Type	Consumption (thousand Btu/SF)	Percent of Total Consumption	Building Type	Consumption (thousand 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.

3.1.11 2003 Commercial *Delivered* Energy Consumption Intensities, by Ownership of Unit (1)

Ownership	Consumption (thousand 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.

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

Component	Loads (quads) and Percent of Total Loads			
	Heating		Cooling	
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.

3.1.13 2003 Commercial Buildings Delivered Energy End-Use Intensities, by Building Activity (Thousand Btu per SF) (1)

	Education	Food Sales	Food Service	Health Care	Inpatient	Outpatient	Lodging
Space Heating	39.4	28.9	43.1	70.4	91.8	38.1	22.2
Cooling	8.0	9.8	17.4	14.1	18.6	7.2	4.9
Ventilation	8.4	5.9	14.8	13.3	20.0	3.3	2.7
Water Heating	5.8	2.9	40.4	30.2	48.4	2.5	31.4
Lighting	11.5	36.7	25.4	33.1	40.1	22.6	24.3
Cooking	0.8	8.6	63.5	3.5	5.6	N.A.	3.2
Refrigeration	1.6	94.8	42.1	2.6	2.0	3.5	2.3
Office Equipment	0.4	1.6	1.0	1.2	1.1	1.3	N.A.
Computers	3.4	1.9	1.4	3.4	3.9	2.6	1.3
Other	4.0	9.1	9.5	16.1	18.1	13.2	7.0
Total	83.1	199.7	258.3	187.7	249.2	94.6	100.0

	Mercantile	Service	Retail (No Mall)	Enclosed and Strip Malls	Office	Public Assembly	Public Order and Safety
Space Heating	24.0	35.9	24.8	23.6	32.8	49.7	49.9
Cooling	9.9	3.8	5.9	12.4	8.9	9.6	8.9
Ventilation	6.0	6.0	3.7	7.5	5.2	15.9	9.5
Water Heating	5.1	1.0	1.1	7.7	2.0	1.0	14.0
Lighting	27.5	15.6	25.7	28.6	23.1	7.0	16.5
Cooking	2.3	N.A.	0.6	3.4	0.3	0.8	1.3
Refrigeration	4.4	2.1	5.0	4.0	2.9	2.2	2.9
Office Equipment	0.7	0.3	0.6	0.8	2.6	N.A.	0.6
Computers	1.1	1.0	1.0	1.1	6.1	N.A.	1.6
Other	10.3	11.4	5.6	13.2	9.0	6.5	10.6
Total	91.3	77.0	73.9	102.2	92.9	93.9	115.8

	Religious Worship	Warehouse and Storage	Other	Vacant
Space Heating	26.2	19.3	79.4	14.4
Cooling	2.9	1.3	10.5	0.6
Ventilation	1.4	2.0	6.1	0.4
Water Heating	0.8	0.6	2.1	0.1
Lighting	4.4	13.1	34.1	1.7
Cooking	0.8	N.A.	N.A.	N.A.
Refrigeration	1.7	3.5	6.0	N.A.
Office Equipment	0.1	0.2	N.A.	N.A.
Computers	0.3	0.6	3.0	N.A.
Other	4.9	4.8	18.9	3.1
Total	43.5	45.2	164.4	20.9

Note(s): 1) Due to rounding, end-uses do not sum to total.

Source(s): EIA, 2003 Commercial Building Energy Consumption Survey, Energy End-Uses, Oct 2008, Table E.2A.

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

	Site Consumption				Primary Consumption			U.S. Natural Gas Total
	Commercial	Industry	Electric Gen.	Transportation	**Commercial**	Industry	Transportation	(quads)
1980	**13%**	41%	19%	3%	**18%**	49%	3%	20.38
1990	**14%**	43%	17%	3%	**19%**	49%	3%	19.75
2000	**14%**	40%	22%	3%	**21%**	47%	3%	23.80
2006(1)	**13%**	**35%**	**29%**	**3%**	**23%**	**43%**	**3%**	**22.30**
2010	**13%**	35%	29%	3%	**23%**	43%	3%	23.93
2015	**14%**	35%	28%	3%	**24%**	42%	3%	24.35
2020	**14%**	35%	25%	3%	**24%**	41%	3%	24.01
2025	**15%**	36%	23%	3%	**25%**	41%	3%	23.66
2030	**16%**	36%	22%	3%	**25%**	41%	3%	23.39

Note(s): 1) Buildings accounted for 58% (or $97 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

3.1.15 Commercial 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	**4%**	28%	8%	56%	**6%**	31%	56%	34.2
1990	**3%**	25%	4%	64%	**4%**	26%	64%	33.6
2000	**2%**	24%	3%	67%	**3%**	25%	67%	38.4
2006	**2%**	**25%**	**2%**	**69%**	**2%**	**25%**	**69%**	**40.1**
2010	**2%**	24%	1%	70%	**2%**	24%	70%	40.5
2015	**2%**	23%	1%	71%	**2%**	23%	71%	41.8
2020	**2%**	22%	1%	72%	**2%**	22%	72%	42.2
2025	**2%**	21%	1%	73%	**2%**	22%	73%	42.8
2030	**2%**	21%	1%	73%	**2%**	21%	73%	44.0

Note(s): 1) Buildings accounted for an estimated 7.3% (or $30 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, Table A3, p. 120-121 for 2006 expenditures.

3.2.1 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)
2006 (4)	**74.8**	**15%**	N.A.
2010 (4)	78.8	24%	N.A.
2015 (4)	83.9	33%	N.A.
2020 (4)	89.3	41%	N.A.
2025 (4)	94.8	49%	N.A.
2030 (4)	100.8	56%	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 = 67.3 billion square feet.

Source(s): EIA, Annual Energy Outlook 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 2008, Mar. 2008, Table A5, p. 124-142 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.

3.2.2 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 3.1.13. Total CBECS 2003 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.

3.2.3 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.

3.2.4 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.

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

Square Foot Range	Number of Buildings (thousands)	
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.

3.2.6 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.

3.2.7 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 2008, June 2008, Table 12, p. 32; EIA, Model Documentation Report: Commercial Sector Demand Module of the National Energy Modeling System, Apr. 2008, p. 30-35; and PNNL, Memorandum: New Construction in the Annual Energy Outlook 2003, Apr. 24, 2003 for Note 2.

3.2.8 2003 Average Commercial Building Floorspace, by Principal Building Type and Vintage

	Average Floorspace/Building (thousand 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.

3.3.1 Commercial Energy Prices, by Year and Major Fuel Type ($2006 per Million Btu)

	Electricity	Natural Gas	Petroleum (2)	Average
1980	34.62	7.16	12.17	17.19
1990	30.27	6.71	8.49	17.32
2000	25.07	7.64	9.43	16.46
2006	**27.75**	**11.50**	**14.75**	**20.75**
2010	27.89	10.59	15.48	20.69
2015	25.52	9.68	13.29	18.93
2020	25.64	9.91	13.64	19.25
2025	25.71	10.47	14.24	19.67
2030	26.17	11.43	15.22	20.47

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.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, Tables 2-3, p. 24-25 for 1980-2005 and prices for note, Tables 8-9, p. 18-19 for 1980-2005 consumption; EIA, Annual Energy Outlook 2008 Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121, Table A12, p. 138, and Table A13, p. 139 for 2006-2030 consumption and prices; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

3.3.2 Commercial Energy Prices, by Year and Fuel Type ($2006)

	Electricity (¢/kWh)	Natural Gas (¢/therm)	Distillate Oil ($/gal)	Residual Oil ($/gal)
1980	11.81	71.63	1.33	1.93
1990	10.33	67.12	0.73	1.18
2000	8.55	76.39	0.78	1.21
2006	**9.47**	**115.03**	**1.29**	**2.02**
2010	9.52	105.95	1.51	2.11
2015	8.71	96.75	1.19	1.79
2020	8.75	99.06	1.19	1.84
2025	8.77	104.67	1.29	1.92
2030	8.93	114.32	1.38	2.08

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. Tables 2-3, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A3, p. 120-121 for 2006-2030 and Table G1, p. 215 for fuels' heat content; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

3.3.3 Buildings Aggregate Energy Expenditures, by Year and Major Fuel Type ($2006 Billion) (1)

	Electricity	Natural Gas	Petroleum (2)	Total
1980	66.0	19.1	15.7	100.7
1990	86.6	18.1	8.1	112.8
2000	99.2	24.9	7.1	131.2
2006	**123.1**	**33.6**	**10.0**	**166.7**
2010	131.9	32.3	9.8	173.9
2015	132.6	31.9	8.9	173.3
2020	145.3	34.4	9.2	188.9
2025	158.1	38.0	9.7	205.8
2030	173.3	43.2	10.4	226.9

Note(s): 1) Expenditures exclude wood and coal. 2006 U.S. energy expenditures were 1.14 trillion. 2) Commercial petroleum products include distillate fuel oil, LPG, kerosene, motor gasoline, and residual fuel.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 24-25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A3, p. 120-121 for 2006-2030; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

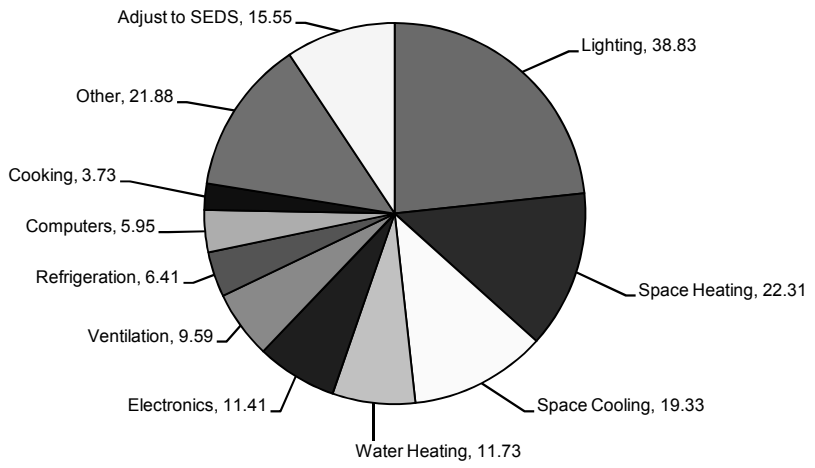
3.3.4 2006 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural Gas	Petroleum					Coal (3)	Electricity	Total	Percent
		Distil.	Resid.	LPG	Oth(2)	Total				
Lighting								38.8	38.8	23.3%
Space Heating	13.6	1.8	1.0		0.3	3.1	0.1	5.5	22.3	13.4%
Space Cooling	0.2							19.1	19.3	11.6%
Electronics								11.7	11.7	7.0%
Water Heating	6.3	0.7				0.7		4.4	11.4	6.8%
Ventilation								9.6	9.6	5.7%
Refrigeration								6.4	6.4	3.8%
Computers								6.0	6.0	3.6%
Cooking	2.6							1.1	3.7	2.2%
Other (4)	3.1	0.3		1.6	1.0	3.0		15.8	21.9	13.1%
Adjust to SEDS (5)	7.7	3.2				3.2		4.6	15.6	9.3%
Total	**33.6**	**6.0**	**1.0**	**1.6**	**1.3**	**9.9**	**0.1**	**123.0**	**166.7**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.3 billion) and motor gasoline other uses ($1.0 billion). 3) Coal average price is from AEO 2008, all users price. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, and Table A5, p. 124-125 for energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 25 for coal price; EIA, Annual Energy Review 2007, June 2008, 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; and BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p. 63.; EIA, Supplement to the AEO 2008, April 2008, Table 22.

2006 Commercial Energy End-Use Expenditures ($2006 Billion)



3.3.5 2010 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural Gas	Petroleum					Coal (3)	Electricity	Total	Percent
		Distil.	Resid.	LPG	Oth(2)	Total				
Lighting								31.3	31.3	18.0%
Space Heating	13.7	2.0	1.0		0.3	3.3	0.2	3.8	21.0	12.0%
Electronics								15.4	15.4	8.8%
Space Cooling	0.2							13.9	14.1	8.1%
Water Heating	5.7	0.7				0.7		4.3	10.6	6.1%
Computers								7.1	7.1	4.1%
Refrigeration								6.5	6.5	3.7%
Ventilation								5.3	5.3	3.0%
Cooking	2.6							1.1	3.7	2.1%
Other (4)	2.3	0.3		1.8	1.1	3.1		21.1	26.5	15.2%
Adjust to SEDS (5)	7.7	2.8				2.8		22.1	32.6	18.7%
Total	**32.3**	**5.8**	**1.0**	**1.8**	**1.3**	**9.8**	**0.2**	**131.9**	**174.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.3 billion) and motor gasoline other uses ($1.1 billion). 3) Coal average price is from AEO 2008, all users price. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, and Table A5, p. 124-125 for energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.3.6 2020 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural Gas	Petroleum					Coal (3)	Electricity	Total	Percent
		Distil.	Resid.	LPG	Oth(2)	Total				
Lighting								31.2	31.2	16.5%
Space Heating	13.9	2.0	0.8		0.2	3.0	0.1	3.7	20.7	11.0%
Electronics								20.3	20.3	10.7%
Space Cooling	0.2							14.0	14.2	7.5%
Water Heating	6.5	0.6				0.6		4.1	11.2	5.9%
Computers								7.7	7.7	4.1%
Refrigeration								6.5	6.5	3.4%
Ventilation								5.4	5.4	2.8%
Cooking	2.9							1.0	3.8	2.0%
Other (4)	2.8	0.3		1.7	1.0	3.0		28.9	34.7	18.3%
Adjust to SEDS (5)	8.2	2.6				2.6		22.6	33.4	17.7%
Total	**34.4**	**5.5**	**0.8**	**1.7**	**1.3**	**9.2**	**0.1**	**145.3**	**189.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.2 billion) and motor gasoline other uses ($1.0 billion). 3) Coal average price is from AEO 2008, all users price. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, and Table A5, p. 124-125 for energy consumption; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.3.7 2030 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2006 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								35.2	35.2	15.5%
Electronics								24.0	24.0	10.6%
Space Heating	16.2	2.3	0.9		0.3	3.5	0.1	3.9	23.7	10.4%
Space Cooling	0.2							16.0	16.2	7.2%
Water Heating	8.4	0.8				0.8		4.2	13.4	5.9%
Computers								9.2	9.2	4.1%
Refrigeration								7.3	7.3	3.2%
Ventilation								6.1	6.1	2.7%
Cooking	3.7							0.9	4.7	2.0%
Other (4)	4.6	0.3		1.9	1.1	3.3		41.0	48.9	21.5%
Adjust to SEDS (5)	10.1	2.9				2.9		25.5	38.5	16.9%
Total	**43.2**	**6.2**	**0.9**	**1.9**	**1.4**	**10.4**	**0.1**	**173.3**	**227.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.3 billion) and motor gasoline other uses ($1.1 billion). 3) Coal average price is from AEO 2008, all users price. 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 2008, Mar. 2008, Table A2, p. 117-119, Table A3, p. 120-121 for prices, and Table A5, p. 124-125 for energy consumption; EIA, National Energy Modeling System for AEO 2008, March 2008; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators; EIA, Supplement to the AEO 2008, April 2008, Table 22.

3.3.8 Average Annual Energy Expenditures per Square Foot of Commercial Floorspace, by Year ($2006)

Year	($/SF)
1980(1)	1.96
1990	1.83
2000	1.91
2006	**2.30**
2010	2.28
2015	2.13
2020	2.18
2025	2.24
2030	2.32

Note(s): 1) End of year 1979.

Source(s): EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, p. 25 for 1980-2005; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 and Table A5, p. 124-125 for consumption, Table A3, p. 120-121 for prices for 2006-2030; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators; EIA, AEO 1994, Jan. 1994, Table A5, p. 62 for 1990 floorspace; and PNNL for 1980 floorspace.

3.3.9 2003 Energy Expenditures per Square Foot of Commercial Floorspace and per Building, by Building Type ($2006) (1)

	Per Square Foot	Per Building (thousand)		Per Square Foot	Per Building (thousand)
Food Service	4.54	25.3	Mercantile	2.08	35.5
Food Sales	4.36	24.2	Education	1.34	34.1
Health Care	2.57	63.3	Service	1.29	8.4
Public Order and Safety	1.93	29.8	Warehouse and Storage	0.74	12.6
Office	1.87	27.7	Religious Worship	0.71	7.2
Public Assembly	1.61	22.9	Vacant	0.32	4.5
Lodging	1.60	57.3	Other	2.78	61.0

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 2007, June 2008, Appendix D, p. 377 for price deflators.

3.3.10 2003 Energy Expenditures per Square Foot of Commercial Floorspace, by Vintage ($2006)

Vintage	($/SF)
Prior to 1960	1.35
1960 to 1969	1.58
1970 to 1979	1.75
1980 to 1989	1.94
1990 to 1999	1.75
2000 to 2003	1.60
Average	**1.65**

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Table C4; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

3.3.11 Energy Service Company (ESCO) Industry Activity ($Million Nominal) (1)

	Estimated Revenue ($Million Nominal) (1)	
	Low	High
1990	143	342
1991	218	425
1992	331	544
1993	505	703
1994	722	890
1995	1,105	1,159
1996	1,294	1,396
1997	1,394	1,506
1998	1,551	1,667
1999	1,764	1,925
2000 (2)	1,876	2,186
2001	-	-
2002	-	-
2003	-	-
2004 (3)	2,447	2,507
2005	2,949	3,004
2006	3,579	3,627

2006 Revenue Sources

Market Segment	Share
MUSH (4)	58%
Federal	22%
Commercial	9%
Industrial	6%
Residential	3%
Public Housing	2%

Note(s): 1) Estimates based on surveys of major ESCOs and input from industry experts. 2) Includes municipal and state governments, universities and colleges, K-12 schools, and hospitals.

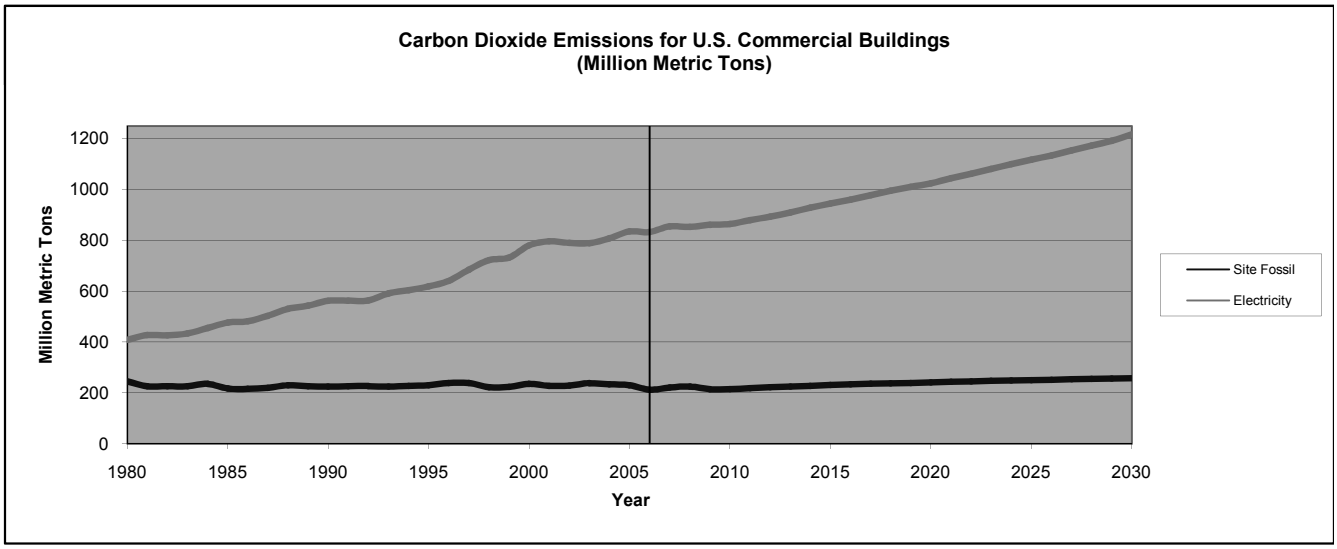
Source(s): LBNL, Market Trends in the U.S. ESCO Industry: Results from the NAESCO Database Project, LBNL-49601, May 2002 for 1990-2000; and LBNL, A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006, LBNL-62679, May 2007 for 2004-2006.

3.4.1 Carbon Dioxide Emissions for U.S. Commercial Buildings, by Year (Million Metric Tons) (1)

	Commercial				U.S.			
	Site Fossil	Electricity	Total	Growth Rate 2006-Year	Total	Growth Rate 2006-Year	Com.% of Total U.S.	Com.% of Total Global
1980	245	409	653	-	4723	-	14%	3.6%
1990	225	563	788	-	5012	-	16%	3.7%
2000	235	780	1015	-	5847	-	17%	4.3%
2006 (2)	**212**	**832**	**1045**	**-**	**5890**	**-**	**18%**	**3.7%**
2010	215	864	1079	0.8%	6011	0.5%	18%	3.5%
2015	231	945	1176	1.3%	6226	0.6%	19%	3.5%
2020	241	1024	1265	1.4%	6384	0.6%	20%	3.4%
2025	250	1117	1367	1.4%	6571	0.6%	21%	3.4%
2030	258	1216	1474	1.4%	6851	0.6%	22%	3.4%

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 2008 and differs from EIA, AEO 2008, Table A18. Buildings sector total varies by 0.7% from EIA, AEO 2008.

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 2008, April 2008, Table 2, p. 10 for carbon coefficients; EIA, AEO 2008, Mar. 2008, Table A2, p. 137-139 for 2005-2030 energy consumption and Table A18, p. 164 for 2005-2030 emissions; EIA, International Energy Outlook 2008, July 2008, 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.



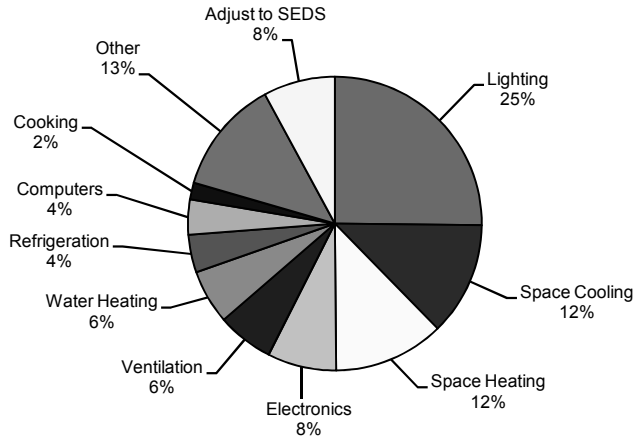
3.4.2 2006 Commercial Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Lighting								263.1	263.1	25.2%
Space Cooling	1.1							129.2	130.3	12.5%
Space Heating	62.7	9.2	8.9		1.2	19.4	8.1	37.3	127.4	12.2%
Electronics								79.3	79.3	7.6%
Ventilation								64.9	64.9	6.2%
Water Heating	29.1	3.5				3.5		29.8	62.4	6.0%
Refrigeration								43.4	43.4	4.2%
Computers								40.3	40.3	3.9%
Cooking	12.2							7.4	19.6	1.9%
Other (4)	14.2	1.9		5.1	3.5	10.4		107.0	131.6	12.6%
Adjust to SEDS (5)	35.6	16.1				16.1		30.8	82.5	7.9%
Total	**154.9**	**30.6**	**8.9**	**5.1**	**4.7**	**49.3**	**8.1**	**832.4**	**1,044.7**	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 2008 and differs from EIA, AEO 2008, Table A18. Buildings sector total varies by 0.7% from EIA, AEO 2008. 2) Includes kerosene space heating (1.2 MMT) and motor gasoline other uses (3.5 MMT). 3) Excludes electric imports by utilities. 4) Includes commercial 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 buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Mar. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 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.

2006 Commercial Building Energy End-Use Carbon Dioxide Emissions Splits



3.4.3 2010 Commercial Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Lighting								205.4	205.4	19.0%
Space Heating	68.7	9.7	7.7		1.3	18.6	7.9	25.2	120.4	11.2%
Electronics								100.6	100.6	9.3%
Space Cooling	1.1							90.8	91.8	8.5%
Water Heating	28.6	3.2				3.2		28.0	59.8	5.5%
Computers								46.5	46.5	4.3%
Refrigeration								42.7	42.7	4.0%
Ventilation								34.6	34.6	3.2%
Cooking	13.0							6.9	19.9	1.8%
Other (4)	11.6	1.3		5.7	3.5	10.5		138.5	160.6	14.9%
Adjust to SEDS (5)	38.6	13.7				13.7		144.7	197.0	18.2%
Total	**161.6**	**27.8**	**7.7**	**5.7**	**4.8**	**46.0**	**7.9**	**863.9**	**1,079.3**	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. 2) Includes kerosene space heating (1.3 MMT) and motor gasoline other uses (3.5 MMT). 3) Excludes electric imports by utilities. 4) Includes commercial 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 buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients.

3.4.4 2020 Commercial Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity (3)	Total	Percent
Lighting								220.0	220.0	17.4%
Electronics								143.1	143.1	11.3%
Space Heating	74.3	10.9	8.1		1.3	20.3	7.9	25.9	128.4	10.1%
Space Cooling	1.1							98.9	100.0	7.9%
Water Heating	34.6	3.6				3.6		29.0	67.1	5.3%
Computers								54.2	54.2	4.3%
Refrigeration								45.6	45.6	3.6%
Ventilation								37.7	37.7	3.0%
Cooking	15.5							6.7	22.2	1.8%
Other (4)	14.8	1.4		5.8	3.7	11.0		203.9	229.7	18.2%
Adjust to SEDS (5)	43.8	14.4				14.4		159.3	217.5	17.2%
Total	**184.0**	**30.3**	**8.1**	**5.8**	**4.9**	**49.2**	**7.9**	**1,024.3**	**1,265.4**	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. 2) Includes kerosene space heating (1.2 MMT) and motor gasoline other uses (3.7 MMT). 3) Excludes electric imports by utilities. 4) Includes commercial 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 buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients;

3.4.5 2030 Commercial Buildings Energy End-Use Carbon Dioxide Emissions Splits, by Fuel Type (Million Metric Tons) (1)

	Natural Gas	Petroleum					Coal	Electricity (3)	Total	Percent
		Distil.	Resid.	LPG	Oth(2)	Total				
Lighting								246.9	246.9	16.7%
Electronics								168.2	168.2	11.4%
Space Heating	75.1	11.0	8.1		1.3	20.5	7.9	27.2	130.7	8.9%
Space Cooling	1.1							112.4	113.4	7.7%
Water Heating	38.8	3.7				3.7		29.7	72.2	4.9%
Computers								64.8	64.8	4.4%
Refrigeration								51.4	51.4	3.5%
Ventilation								42.4	42.4	2.9%
Cooking	17.3							6.6	23.8	1.6%
Other (4)	21.5	1.6		5.9	3.8	11.3		287.8	320.6	21.7%
Adjust to SEDS (5)	47.0	13.9				13.9		179.0	239.9	16.3%
Total	**200.7**	**30.3**	**8.1**	**5.9**	**5.1**	**49.4**	**7.9**	**1,216.3**	**1,474.3**	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. 2) Includes kerosene space heating (1.3 MMT) and motor gasoline other uses (3.8 MMT). 3) Excludes electric imports by utilities. 4) Includes commercial 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 buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, Table A4, p. 122-123 and Table A5, p. 134-135 for energy consumption, and Table A18, p. 143-144 for emissions; EIA, National Energy Modeling System for AEO 2008, Feb. 2008; EIA, Assumptions to the AEO 2008, April 2008, Table 2, p. 10 for emission coefficients.

3.4.6 2006 Methane Emissions for U.S. Commercial Buildings Energy Production, by Fuel Type (MMT CO2 Equivalent) (1)

Fuel Type	
Petroleum	0.5
Natural Gas	20.0
Coal	0.2
Wood	0.4
Electricity (2)	36.7
Total	**57.9**

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

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 2006, Nov. 2007, Table 15, p. 22 for energy production emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006, April 2008, Table 3-16, p. 3-25 for stationary combustion emissions; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for energy consumption.

3.5.1 Value of New Commercial Building Construction, by Year ($2006 Billion)

1980	148.7
1985	210.4
1990	211.7
1995	192.0
2000	300.8
2003	277.7
2004	288.0
2005	294.7
2006	307.1

Note(s): 1) In 2006, new building construction accounted for 5.9% of the $13.2 trillion U.S. GDP.

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, May 2008 for 1995-2006; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price deflators.

3.5.2 Value of Building Improvements and Repairs, by Sector ($2006 Billion) (1)

	Improvements	Maintenance and Repairs	Total
1980	N.A.	N.A.	N.A.
1985	82.6	47.8	130.4 (2)
1990	82.8	49.8	132.6 (3)
1995	105.8	34.9	140.6
2000	142.6	44.0	186.6
2003	131.7	40.6	172.3
2004	136.6	42.1	178.7
2005	139.8	43.1	182.9
2006	145.6	44.9	190.5

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

Source(s): 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, May 2008 for 1995-2006; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for GDP and price deflators.

3.6.1 2006 Energy Consumption per Square Foot of Office Floorspace by Vintage (Thousand Btu/SF) (1)

Vintage	Energy Intensity
1997-2006	90.9
1987-1996	79.3
1977-1986	78.6
1967-1976	76.8
1957-1966	N.A.
Pre-1957	80.7

Buildings providing consumption data: 415

Note(s): 1) Commercial office buildings sampled include the following: Class A, B, C.
Source(s): BOMA International, Experience Exchange Report 2007, August 2007.

3.6.2 Energy Expenditures per Square Foot of Office Floorspace by Building Age ($2006) (1)

Age (years)	2006	2004
0-9	1.99	1.73
10-19	2.18	1.89
20-29	2.23	1.84
30-39	2.52	2.18
40-49	2.78	2.76
50+	2.36	1.96
All Buildings	**2.26**	**1.83**

Note(s): 1) Energy includes electric, gas, fuel oil, purchased steam, purchased chilled water, and water/sewage expenditures.
Source(s): BOMA International, The Experience Exchange Report 2007, August 2007; BOMA International, The Experience Exchange Report 2005; August 2005.

3.6.3 Energy Consumption and Expenditures per Square Foot of Office Floorspace, by Function and Class (1)

	2006		2004	
	Energy Intensity (thousand Btu/SF)	Energy Expenditures ($/SF)	Energy Intensity (thousand Btu/SF)	Energy Expenditures ($/SF)
Medical Offices	90.8	2.39	N.A.	2.19
Financial Offices	N.A.	2.91	N.A.	3.09
Corporate Facilities(2)	96.8	2.56	89.4	2.53
Class A	81.9	2.28	78.8	1.94
Class B	74.9	2.15	N.A.	1.89
Class C	N.A.	2.28	N.A.	1.71
All Buildings	**81.1**	**2.26**	**77.8**	**1.95**

Note(s): 1) Categories are not mutually exclusive. 2) Coporate Facilities are any building that the owner occupies atleast 75% of the rentable space.
Source(s): BOMA International, The Experience Exchange Report 2007, August 2007; BOMA International, The Experience Exchange Report 2005; August 2005.

3.6.4 2006 Energy Expenditures per Square Foot of Office Floorspace for Selected Cities by Location ($2006/SF) (1)

	Urban	Suburban
New York, NY	3.99	N.A.
Los Angeles, CA	2.14	2.36
Chicago, IL	1.51	N.A.
Houston, TX	2.64	2.35
Phoenix, AZ	1.88	1.80
Philadelphia, PA	2.40	2.73
San Antonio, CA	1.87	1.96
San Diego, CA	2.75	2.81
Dallas, TX	2.37	2.31
San Jose, CA	2.78	2.01
San Francisco, CA	2.68	1.43
Miami, FL	2.93	2.93
Washington, DC	2.79	N.A.
Seatle, WA	1.18	1.92
Boston, MA	3.31	3.57
National Average (2)	**2.32**	**2.18**

Note(s): 1) Energy includes electric, gas, fuel oil, purchased steam, purchased chilled water, and water/sewage expenditures. 2) Averages based on 831 urban respondents and 1788 suburban respondents across 94 US cities.

Source(s): BOMA International, The Experience Exchange Report 2007, August 2007.

3.6.5 Top 10 Office Building Owners Globally as of Year End, 2006 (Million SF)

Owner	Square Footaged Owned
Brookfield Properties Corp.	76.0
Tishman Speyer	53.9
LasSalle Investment Management	49.0
Hines	46.0
TIAA-CREF	44.2
Boston Properties	43.3
HRPT Properties Trust	42.0
Wells Real Estate Funds	39.2
CB Richards Ellis Investors LLC	38.4
Mack-Cali Realty Corp.	33.9
Total for Top 10:	**465.9**

Source(s): National Real Estate Investor, The Best of The Best: National Real Estate Investor Presents its Annual Rankings of the Leading Commercial Real Estate Companies, July 2007, p. 10.

3.6.6 Top 10 Property Managers Globally as of Year End, 2006 (Million SF)

Managing Company	Square Footaged Owned
CB Richard Ellis	1,700
Jones Lang LaSalle	1,000
Colliers International	829
Cushman & Wakefield	445
ProLogis	422
Lincoln Property Co.	221
Simon Property Group	211
Grubb & Ellis Co.	211
NAI Global	200
ING Clarion	193

Source(s): National Real Estate Investor, The Best of The Best: National Real Estate Investor Presents its Annual Rankings of the Leading Commercial Real Estate Companies, July 2007, p. 24.

3.6.7 Advanced Energy Design Guide for Small Office Buildings (1)

Shell	
Percent Glass (WWR)	20-40%
Window U-Factor	0.33-0.56
SHGC	0.31-0.49
Wall R-Value	7.6-15.2
Roof R-Value	
Attic	30-60
Insulation Above Deck	15-30
Wall Material	Mass (HC > 7 Btu/ft^2)
Lighting	
Average Power Density (Watts/SF)	0.9
System and Plant	
System and Plant	
Packaged Single-Zone	
Packaged Single-Zone w/ Economizer	Cooling Capacity > 54 kBtu
Heating Plant:	
Gas Furnace	80% Combustion Efficiency
Cooling Plant:	
Air conditioner (135-240 thousand Btu*hr.)	10.8 EER/11.2 IPLV - 11.0 EER/11.5 IPLV
Service Hot Water:	
Gas Water Heater	90% Thermal Efficiency

Note(s): 1) Guide provides approximate parameters for constructing a building which is 30% more efficient than ASHRAE 90.1-1999. Ranges are because of climate zone dependencies.

Source(s): ASHRAE, Advanced Energy Design Guide for Small Office Buildings, 2004.

3.6.8 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.

3.6.9 Energy Benchmarks for Newly Constructed Large Office Buildings, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.4	13.6	0.3	1.8
Houston	2A	5.3	12.1	0.4	1.8
Phoenix	2B	4.4	10.8	0.4	2.2
Atlanta	3A	4.9	9.4	0.5	1.7
Los Angeles	3B	1.3	6.7	0.4	1.5
Las Vegas	3B	3.2	11.3	0.4	2.1
San Francisco	3C	6.0	3.6	0.5	1.5
Baltimore	4A	8.6	9.9	0.5	1.8
Albuquerque	4B	5.0	8.9	0.5	2.2
Seattle	4C	8.6	3.2	0.5	1.7
Chicago	5A	11.7	6.5	0.5	1.9
Boulder	5B	7.8	5.1	0.5	2.1
Minneapolis	6A	15.7	6.3	0.6	2.0
Helena	6B	12.5	6.3	0.6	2.1
Duluth	7	18.7	4.8	0.6	2.1
Fairbanks	8	32.3	4.1	0.7	2.2

Note(s): The benchmark building had 498,584 square feet and 12 floors plus a basement. Benchmark lighting energy = 9.9 thousand Btu/SF and internal loads = 12.7 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.6.10 Energy Benchmarks for Newly Constructed Medium Office Buildings, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.7	10.6	0.5	1.9
Houston	2A	7.6	8.7	0.6	1.9
Phoenix	2B	7.3	7.6	0.5	2.2
Atlanta	3A	10.7	6.2	0.6	1.8
Los Angeles	3B	4.1	3.8	0.6	1.5
Las Vegas	3B	7.6	5.6	0.6	2.1
San Francisco	3C	11.5	1.7	0.7	1.5
Baltimore	4A	17.1	6.1	0.7	2.0
Albuquerque	4B	11.6	4.2	0.7	2.2
Seattle	4C	17.0	1.6	0.7	1.7
Chicago	5A	21.6	3.9	0.7	2.0
Boulder	5B	16.1	3.1	0.7	2.0
Minneapolis	6A	27.8	3.6	0.8	2.1
Helena	6B	24.1	2.4	0.8	2.0
Duluth	7	32.4	2.1	0.8	2.1
Fairbanks	8	52.7	1.7	0.9	2.2

Note(s): Benchmark lighting energy = 10.5 thousand Btu/SF and internal loads = 14.3 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.7.1 2006 Top Retail Companies, by Sales

Chain	2006 Revenues ($billion)	% Change over 2005 Revenues	# Stores 2006	% Change over 2005 Stores
Wal-Mart Stores, Inc.	345.0	11.7%	6,779	12.3%
The Home Depot	90.8	11.4%	2,147	5.1%
The Kroger Co.	66.1	9.2%	3,659	-1.8%
Target Corp.	59.5	13.1%	1,488	6.5%
Costco	59.0	13.7%	458	5.8%
Sears Holdings	53.0	7.9%	3,791	-1.4%
Walgreen Co.	47.4	12.3%	5,461	9.5%
Lowe's	46.9	8.5%	1,385	12.2%
CVS Caremark Corp.	43.8	18.4%	6,202	13.4%
Safeway	40.2	4.6%	1,761	-0.8%

Source(s): Chain Store Age, 2007 Top 100 U.S. Retailers, August 2007.
Full report available at http://www.chainstoreage.com/industrydata/pdf/top100retailers/csa_2007_Top_100_Charts.pdf

3.7.2 2006 Top Chain Restaurants, by Sales

Chain	2006 Sales ($billion)	% Change over 2005 Sales	Franchised Stores	Company-owned Stores	Total Stores
McDonald's	27.1	5.7%	11,670	2,104	13,774
Burger King (1)	8.5	0.4%	6,656	878	7,534
Wendy's (2)	7.8	1.1%	4,638	1,310	5,948
Subway (2)	7.7	7.5%	20,755	-	20,755
Taco Bell (2)	6.3	2.8%	4,341	1,267	5,608
Starbucks (3)	5.5	21.1%	-	5,728	5,728
KFC (2)	5.3	1.2%	4,371	1,023	5,394
Pizza Hut (2)	5.2	-2.3%	6,079	1,453	7,532
Dunkin' Donuts	4.3	11.9%	5,239	-	5,239
Sonic Drive-In	3.3	10.7%	2,565	623	3,188

Note(s): 1) Includes U.S. and Canadian Units. 2) Estimates. 3) U.S. only sales, estimate.
Source(s): QSR Magazine, The QSR 50 - 2007, Available at http://www.qsrmagazine.com/reports/qsr50/2007/charts/qsr50-1.phtml.

3.7.3 2006 Top Supermarkets, by Sales

Supermarket	2006 All Commodity Volume (millions)	No. of Stores (> $2 million in sales)	Square Feet Selling Area (thousands)
Wal-Mart Stores, Inc.	126.7	2401	149,366
Kroger Co.	59.8	2459	103,493
Supervalu, Inc.	34.0	1718	70,068
Safeway, Inc.	33.7	1526	55,707
Ahold USA (Stop and Shop, Giant)	24.2	786	33,995
Publix Super Markets, Inc.	20.2	901	33,505
Delhaize America, Inc. (Food Lion)	17.3	1560	46,504
H.E. Butt Grocery Co. (HEB)	11.2	276	13,474
Winn-Dixie Stores, Inc.	8.5	522	24,180
Meijer, Inc.	7.3	176	10,397

Note(s): All commodity volume in this example represents the annualized range of the estimated retail sales volume of all items sold at a retail site that pass through the retailer's cash registers. TDLinx ACV is an estimate based on best available data—a directional measure to be used as an indicator of store and account size, not an actual retail sales report". (Progressive Grocer)
Source(s): TDLinx. Progressive Grocer Super 50. March 2007. www.progressivegrocer.com.

3.7.4 Advanced Energy Design Guide for Small Retail Buildings (1)

Shell	
Percent Glass	40%
Window (U-Factor	0.38-0.69
SHGC	0.40-0.44
Wall R-Value	7.6-15.2 c.i.
Roof R-Value	
Attic	30-60
Insulation Above Deck	15-25 c.i.
Wall Material	Mass (HC > 7 Btu/ft^2)
Lighting	
Average Power Density (W/ft.^2)	1.3
System and Plant	
System and Distribution Type	
Packaged Single-Zone	
Packaged Single-Zone w/ Economizer	Cooling Capacity > 54 kBtuh
Heating Plant	
Gas Furnace(>225 kBtuh)	80% Combustion Efficiency
Cooling Plant	
Air conditioner (>135-240 kBtuh)	10.0 EER/10.4 IPLV - 11.0 EER/11.5 IPLV
Service Hot Water	
Gas Water Heater	90% Thermal Efficiency

Note(s): 1) Guide provides approximate parameters for constructing a building which is 30% more efficient than ASHRAE 90.1-1999. Ranges are because of climate zone dependencies.

Source(s): ASHRAE, Advanced Energy Design Guide for Small Retail Buildings, 2004.

3.7.5 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.

3.7.6 Energy Benchmarks for Newly Constructed Retail Buildings, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.0	15.1	0.0	3.8
Houston	2A	3.9	10.4	0.0	2.9
Phoenix	2B	3.6	9.8	0.0	3.6
Atlanta	3A	5.4	5.3	0.0	1.7
Los Angeles	3B	1.5	2.1	0.0	2.0
Las Vegas	3B	5.0	5.0	0.0	2.5
San Francisco	3C	5.3	0.5	0.0	0.5
Baltimore	4A	10.3	4.1	0.0	1.6
Albuquerque	4B	8.6	2.8	0.0	1.9
Seattle	4C	9.5	0.7	0.0	0.9
Chicago	5A	14.6	2.8	0.0	1.5
Boulder	5B	13.0	1.6	0.0	1.5
Minneapolis	6A	21.6	2.4	0.0	1.7
Helena	6B	20.3	1.0	0.0	1.4
Duluth	7	30.1	0.7	0.0	1.4
Fairbanks	8	57.4	0.2	0.0	1.9

Note(s): Benchmark lighting energy = 21.1 thousand Btu/SF and internal loads = 7.6 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.7.7 Energy Benchmarks for Newly Constructed Supermarkets, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	2.1	12.3	0.3	10.2
Houston	2A	21.0	9.5	0.4	12.6
Phoenix	2B	20.8	9.3	0.4	13.1
Atlanta	3A	37.9	4.7	0.4	12.8
Los Angeles	3B	23.5	1.0	0.4	10.4
Las Vegas	3B	32.4	5.5	0.4	12.8
San Francisco	3C	47.3	0.3	0.4	10.6
Baltimore	4A	59.3	3.7	0.4	13.4
Albuquerque	4B	48.5	2.4	0.4	14.3
Seattle	4C	64.3	0.4	0.5	11.6
Chicago	5A	77.9	2.3	0.5	14.4
Boulder	5B	62.6	1.4	0.5	18.2
Minneapolis	6A	93.2	2.3	0.5	18.4
Helena	6B	85.2	0.9	0.5	19.6
Duluth	7	115.4	0.8	0.5	19.0
Fairbanks	8	172.4	0.4	0.6	21.9

Note(s): Benchmark lighting energy = 21.1 thousand Btu/SF and internal loads = 20.5 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.7.8 Number of Stores and Average Sales in the Grocery Industry as of 2007

Store Type	Number of Stores (1,000s)	US Annual Sales ($Billions)
Supermarket	35.0	535.4
Convenience	145.9	306.6
Grocery (<$2million)	13.7	18.2
Wholesale Clubs	1.2	101.5
Military Convenience Stores	0.4	2.2
Total	**196.2**	**963.9**

Source: Energy Savings Potential and R&D Opportunities for Commercial Refrigeration (2009)

3.8.1 Medical Offices, Utilities Cost Per Square Foot ($2006)

Expense	Downtown	Suburban	All
Electricity	2.09	1.85	1.93
Natural Gas	0.34	0.37	0.36
Water/Sewer	0.21	0.21	0.21
Overall Utilities (1)	**2.57**	**2.31**	**2.39**

Note(s): 1) Does not equal sum of the other categories. Can also include purchased steam, purchased chilled water, and fuel oil.
Source(s): BOMA International, The Experience Exchange Report 2007, August 2007.

3.8.2 Inpatient Medical Facilities Square Footage, *Delivered* Energy, Energy Intensity, Selected Years

	Total Square Footage (billion)	Energy Use (quadrillion Btus)	Energy Intensity (thousand Btus/SF)
1999	1.865	0.43	229.0
2003	1.905	0.48	249.3
2006	**1.999**	**0.41**	**205.1**
2010	2.131	0.44	206.2
2015	2.314	0.50	215.0
2020	2.508	0.55	219.1
2025	2.718	0.60	220.9
2030	2.949	0.65	219.8

Source(s): EIA, The Commercial Energy Consumption Survey 2003, Table A2. Census Region, Number of Buildings and Floorspace for All Buildings (Including Malls); EIA, The Commercial Energy Consumption Survey 1999, Table B3. Page 11 Census Region, Number of Buildings and Floorspace; EIA, The Supplement to the Annual Energy Outlook 2008, Table 22, June 2008.

3.8.3 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.

3.8.4 Energy Benchmarks for Newly Constructed Hospitals, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	14.4	39.1	0.5	9.9
Houston	2A	16.8	34.2	0.6	10.2
Phoenix	2B	15.7	23.3	0.5	10.9
Atlanta	3A	17.6	26.5	0.7	10.2
Los Angeles	3B	14.6	18.5	0.7	10.0
Las Vegas	3B	15.4	18.1	0.6	10.8
San Francisco	3C	18.8	11.5	0.8	10.4
Baltimore	4A	20.4	24.0	0.8	10.1
Albuquerque	4B	14.9	11.8	0.8	10.9
Seattle	4C	19.4	9.3	0.8	9.9
Chicago	5A	22.6	15.5	0.8	10.4
Boulder	5B	17.7	9.9	0.8	11.1
Minneapolis	6A	24.9	14.3	0.9	10.4
Helena	6B	21.3	8.0	0.9	10.9
Duluth	7	26.7	9.0	1.0	10.3
Fairbanks	8	35.3	5.6	1.1	10.3

Note(s): Benchmark lighting energy = 15.8 thousand Btu/SF and internal loads = 29.7 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.8.5 Energy Benchmarks for Newly Constructed Outpatient Buildings, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.0	23.9	1.5	10.4
Houston	2A	0.5	19.4	1.7	8.7
Phoenix	2B	0.1	17.6	1.6	14.2
Atlanta	3A	0.6	15.6	1.9	7.6
Los Angeles	3B	0.0	7.1	1.9	18.6
Las Vegas	3B	0.1	13.6	1.7	13.8
San Francisco	3C	0.2	2.8	2.0	12.6
Baltimore	4A	1.7	13.7	2.0	6.7
Albuquerque	4B	0.7	8.8	2.0	14.5
Seattle	4C	0.8	2.8	2.1	11.5
Chicago	5A	2.3	8.6	2.2	10.5
Boulder	5B	1.3	6.5	2.2	13.4
Minneapolis	6A	4.5	8.1	2.3	10.4
Helena	6B	3.3	4.8	2.3	11.2
Duluth	7	5.1	5.4	2.5	9.3
Fairbanks	8	13.9	4.2	2.7	7.7

Note(s): Benchmark lighting energy = 10.4 thousand Btu/SF and internal loads = 59.9 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.9.1 2003 Delivered Energy End-Use Intensities and Consumption of Educational Facilities, by Building Activity (1

	(10^12 Btu)		(thousand Btu/SF)
Space Heating	389	47%	39.4
Cooling	79	10%	8.0
Ventilation	83	10%	8.4
Water Heating	57	7%	5.8
Lighting	113	14%	11.5
Cooking	8	1%	0.8
Refrigeration	16	2%	1.6
Office Equipment	4	0%	0.4
Computers	32	4%	4.0
Other	39	5%	3.4
Total	**820**	100%	**83.1**

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, 2003 Commercial Building Energy Consumption and Expenditures End-Uses, Sept. 2008, Table E1A and E2A.

3.9.2 2003-2004 Number of Public K-12 Schools in the United States and Students per School

Number of Schools (2004-2005)	
Regular (1)	86,487
Special	1,635
Vocational	326
Alternative	4,847
Total (2)	**93,295**

Average Number of Students per School (2003-2004) (3)	
Elementary	438
Middle	616
High	758
Other	266

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.

3.9.3 National Enrollment and Expenditures for Public K-12 Facilities ($2006)

	Enrollment (millions)	Expenditures ($billion)	Expenditures per Pupil
1986	39.42	254.0	6,444
1990	40.54	301.9	7,446
1995	44.11	330.2	7,484
2000	46.86	389.5	8,313
2003	48.18	433.7	9,000
2005	48.56	454.0	9,405
2010	49.27	507.8	10,419
2015	50.74	597.6	11,779

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 2007, June 2008, Appendix D, p. 377 for price inflators.

3.9.4 Total Expenditures for K-12 School Plant Operations and Maintenance, by Function ($2006 Billion)

	1990		1995		2000		2004	
Salaries and Benefits	16.4	54%	17.2	53%	20.1	51%	22.1	51%
Purchased Services	8.2	27%	9.7	30%	11.2	28%	9.4	22%
Supplies	5.4	18%	5.3	16%	8.0	20%	0.4	1%
Other	0.5	2%	0.3	1%	0.3	1%	11.6	27%
Total	**30.4**	100%	**32.5**	100%	**39.6**	100%	**43.5**	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 2007, Mar. 2008, Table 169, p. 250-251; EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 377 for price inflators.

3.9.5 New Construction and Renovations Expenditures for Public K-12 Schools ($2006 Billion)

	New Schools	Additions	Modernizations	Total
1996	6.11	4.13	3.36	13.60
1997	7.46	4.36	3.31	15.13
1998	9.53	6.21	4.90	20.64
1999	7.11	6.04	5.95	19.09
2000	13.42	4.75	6.96	25.13
2001	12.74	4.81	12.92	30.47
2002	13.04	6.35	7.83	27.22
2003	19.10	5.79	6.47	31.36
2004	14.08	5.93	10.94	30.95
2005	12.67	6.34	4.66	23.67
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 2007, June 2008, Appendix D, p. 377.

3.9.6 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.

3.9.7 Advanced Energy Design Guide for Typical Educational Facilities (1)

Shell		
Percent Glass		35% Maximum
Window U-Factor		0.33-0.56
Wall R-Value		5.7-15.2
Roof R-Value		
Attic		30.0-60.0 (2)
Insulation Above Deck		25.0
Wall Material		Mass: Heat Capacity > 7 Btu/SF*F
Lighting		
Average Power Density(Watts/ft.^2)		
With Daylighting		0.9
Without Daylighting		1.1
System and Plant		
System and Plant		
1 Central System		
Packaged Multi-Zone w/ Economizer		Comply with ASHRAE 90.1
Heating Plant:	Gas Boiler	80-85 Combustion Efficiency
Cooling Plant:	Hermetic Centrifugal Chiller	Comply with ASHRAE 90.1
Service Hot Water:	Gas Boiler	80-85 Combustion Efficiency

Note(s): 1) Guide provides approximate parameters for constructing a building which is 30% more efficient than ASHRAE 90.1-1999. Ranges are because of climate zone dependencies.

Source(s): ASHRAE, Advanced Energy Design Guide for K-12 School Buildings, 2004.

3.9.8 Typical School Building (1)

	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.

Source(s): LBNL, Commercial Heating and Cooling Loads Component Analysis, June 1998, Table 15, p. 36; and D&R for hours of occupancy.

3.9.9 Energy Benchmarks for Newly Constructed Primary Schools, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	1.1	21.5	0.9	3.0
Houston	2A	9.6	18.5	1.2	3.0
Phoenix	2B	9.4	16.3	1.1	3.6
Atlanta	3A	13.7	12.6	1.5	2.7
Los Angeles	3B	6.0	8.6	1.4	2.5
Las Vegas	3B	10.2	11.6	1.2	3.4
San Francisco	3C	22.7	5.5	1.6	3.2
Baltimore	4A	24.1	10.9	1.7	2.9
Albuquerque	4B	16.7	7.8	1.6	3.6
Seattle	4C	19.6	3.4	1.7	2.3
Chicago	5A	33.9	7.5	1.8	3.1
Boulder	5B	24.9	5.7	1.8	3.4
Minneapolis	6A	49.0	6.5	2.0	3.3
Helena	6B	39.9	4.2	2.0	3.3
Duluth	7	59.7	3.6	2.2	2.9
Fairbanks	8	100.8	2.3	2.5	2.7

Note(s): Benchmark lighting energy = 16.6 thousand Btu/SF and internal loads = 20.7 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.9.10 Energy Benchmarks for Newly Constructed Secondary Schools, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.7	28.9	0.8	8.2
Houston	2A	10.2	23.4	1.1	8.5
Phoenix	2B	7.9	24.8	1.0	9.1
Atlanta	3A	18.0	14.1	1.4	8.4
Los Angeles	3B	4.1	7.1	1.3	7.2
Las Vegas	3B	10.0	17.7	1.2	8.7
San Francisco	3C	19.3	4.2	1.5	10.8
Baltimore	4A	33.7	12.4	1.6	8.7
Albuquerque	4B	19.7	9.8	1.6	9.9
Seattle	4C	29.9	2.7	1.7	7.3
Chicago	5A	49.2	8.3	1.8	8.9
Boulder	5B	31.5	6.9	1.8	9.6
Minneapolis	6A	67.5	7.0	1.9	9.3
Helena	6B	53.5	4.8	2.0	9.6
Duluth	7	82.5	3.5	2.2	9.2
Fairbanks	8	135.8	2.5	2.5	9.0

Note(s): Benchmark lighting energy = 16.7 thousand Btu/SF and internal loads = 13.4 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.10.1 2003 Floorspace and Energy Consumption for Hotels and Motels/Inns (1)

	Hotels	Motels/Inns
Average Electricity Consumption (thousand Btus/SF):	61.3	40.5
Average Natural Gas Consumption (thousand Btus/SF):	50.7	42.2
Average Fuel Oil Consumption (thousand Btus/SF) (2):	5.4	36.6
Total Energy Consumption (quads)	**0.21**	**0.08**
Average Energy Consumption (thousand Btu/SF):	**110.0**	**74.9**
Total Floorspace (billion SF):	**1.90**	**1.05**

Note(s): 1) Averages for fuel souces include only the floorspace that use a given fuel. 2) For Hotels, fuel oil was often used in buildings that used natural gas as well.

Source(s): EIA, Commercial Buildings Energy Consumption Survey 2003 Public Use Data Files, December 2006, Tables 2, 15, and 16.

3.10.2 Lodging Industy, Sales and Occupancy Rates

Year	Properties	Guestrooms (thousand)	Sales ($2007 billion)	Avg. Occupancy Rate	Avg. Room Rate
2001	41,393	4,200	133.40	60.3%	88.27
2002	47,040	4,398	114.71	59.1%	83.54
2003	47,584	4,416	115.29	61.1%	82.52
2004	47,598	4,412	120.98	61.3%	86.23
2005	47,590	4,402	126.50	63.1%	90.88
2006	47,135	4,389	133.40	63.3%	97.78
2007	48,062	4,476	139.40	63.1%	103.87

Source(s): The American Lodging Association, 2002 Lodging Industy Profile, p. 2-3; The American Lodging Association, 2003 Lodging Industy Profile, p. 2-3, 2002; The American Lodging Association, 2004 Lodging Industy Profile, p. 2-4, 2004; The American Lodging Association, 2005 Lodging Industy Profile, p. 2, 4, 2005; The American Lodging Association, 2006 Lodging Industy Profile, p. 2, 4, 2006; The American Lodging Association, 2007 Lodging Industy Profile, p. 2, 4, 2007; The American Lodging Association, 2008 Profile p. 2, 4, 2008.

3.10.3 Lodging Industry Profile (Thousands)

	2004		2005		2006		2007	
Location	Properties	Rooms	Properties	Rooms	Properties	Rooms	Properties	Rooms
Suburban	15.8	1,564	15.9	1,570	15.9	1,577	16.3	1,610
Highway	6.7	446	6.8	452	6.8	452	6.9	463
Urban	4.6	706	4.6	700	4.5	691	4.5	699
Airport	1.9	274	1.9	275	2.0	275	2.0	283
Resort	4.1	595	3.8	573	3.6	567	3.6	571
Small Metro	14.5	826	14.6	832	14.4	827	14.7	850
Number of Rooms								
Under 75	27.5	1,164	27.4	1,160	26.9	1,147	27.2	1,159
75 - 149	14.3	1,524	14.4	1,532	14.5	1,542	15.1	1,595
150 - 299	4.2	847	4.2	837	4.1	824	4.2	833
300 - 500	1.1	398	1.1	397	1.1	399	1.1	405
Over 500	0.5	479	0.5	477	0.5	478	0.5	484

Source(s): The American Lodging Association, 2002 Lodging Industy Profile, p. 2-3, 2002; The American Lodging Association, 2005 Lodging Industy Profile, p. 2, 4, 2005; The American Lodging Association, 2006 Lodging Industy Profile, p. 2, 4, 2006; The American Lodging Association, 2007 Lodging Industy Profile, p. 2, 4, 2007; The American Lodging Association, 2008 Profile p. 2, 4, 2008.

3.10.4 Energy Benchmarks for Newly Constructed Hotels, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.2	50.2	30.1	5.8
Houston	2A	6.4	38.0	37.8	5.9
Phoenix	2B	3.6	34.1	33.4	6.9
Atlanta	3A	11.0	24.2	45.3	5.9
Los Angeles	3B	1.1	17.6	43.8	5.5
Las Vegas	3B	5.8	30.1	38.7	6.7
San Francisco	3C	6.5	7.6	50.2	5.7
Baltimore	4A	20.8	19.8	51.2	6.1
Albuquerque	4B	12.0	19.0	50.1	7.1
Seattle	4C	16.2	8.0	54.2	6.1
Chicago	5A	30.9	15.0	56.3	6.1
Boulder	5B	20.0	12.3	56.1	7.0
Minneapolis	6A	42.7	13.9	60.8	6.2
Helena	6B	33.0	9.6	61.6	6.8
Duluth	7	52.9	7.9	68.2	6.4
Fairbanks	8	89.2	5.9	77.1	6.7

Note(s): Benchmark lighting energy = 11.7 thousand Btu/SF and internal loads = 34.5 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

3.10.5 Energy Benchmarks for Newly Constructed Motels, by Selected City and End-Use (thousand Btu per square foot)

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.3	21.4	6.4	5.7
Houston	2A	5.0	16.2	8.1	5.5
Phoenix	2B	3.5	16.7	7.1	5.9
Atlanta	3A	8.9	11.3	9.7	5.3
Los Angeles	3B	2.5	8.1	9.4	5.0
Las Vegas	3B	5.8	12.5	8.3	5.6
San Francisco	3C	8.3	5.0	10.8	4.6
Baltimore	4A	15.9	9.0	11.0	4.9
Albuquerque	4B	10.6	8.2	10.8	5.6
Seattle	4C	14.7	4.4	11.7	4.5
Chicago	5A	22.2	7.4	12.2	4.9
Boulder	5B	15.9	6.4	12.1	5.5
Minneapolis	6A	28.5	6.9	13.2	5.0
Helena	6B	23.8	4.9	13.3	5.2
Duluth	7	35.8	4.4	14.8	4.7
Fairbanks	8	56.9	3.3	16.8	4.7

Note(s): Benchmark lighting energy = 14.6 thousand Btu/SF and internal loads = 22.0 thousand Btu/SF.
Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html, May 2009.

4.1.1 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.

4.1.2 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* Energy Consumption =	0.30
Natural Gas	33.2%	15.6%	USPS	10.0%	Total Primary Energy Consumption =	0.65
Fuel Oil	9.4%	4.4%	DOE	5.3%		
Coal	4.3%	2.0%	VA	8.5%		
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. 2006, Table A-5, p. 152 for fuel types and Table A-3, p. 150 for agency consumption.

4.1.3 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. 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. 2005, Table 6-A, p. A-10 for 2003; DOE/FEMP, Annual Report to Congress on FEMP, Feb. 2006, Table 6-A, p. A-10 for 2004; DOE/FEMP, Annual Report to Congress on FEMP, Sept. 2006, Table 2, p. 13 for 1985 and 2005; and DOE/FEMP for remaining data.

4.1.4 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. 2006, Table 5, p. 21, and p. 20 for note 1.

4.2.1 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, Feb. 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 .

4.3.1 FY 2005 Federal Buildings' Energy Prices and Expenditures, by Fuel Type ($2006)

Fuel Type	Average Fuel Prices ($/million Btu)	Total Expenditures ($million) (2)
Electricity	21.51 (1)	2,977.3
Natural Gas	8.53	849.2
Fuel Oil	9.63	272.1
Coal	3.10	40.1
Purchased Steam	10.85	134.1
LPG/Propane	12.43	37.9
Other	14.63	79.5
Average	14.19	**Total** **4,390.1**

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. EIA, Annual Energy Review 2007, June 2008, p. 377 for price deflators.

4.3.2 Annual Energy Expenditures per Gross Square Foot of Federal Floorspace Stock, by Year ($2006)

FY 1985	2.24
FY 2000	1.25
FY 2002	1.36
FY 2003	1.35
FY 2004	1.43
FY 2005	1.48

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. 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. 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. 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. 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.

4.3.3 Direct Appropriations on Federal Buildings Energy Conservation Retrofits and Capital Equipment ($2006 Million)

FY 1985	432.37	|	FY 1991	156.73	|	FY 1997	242.26	|	FY 2003	187.99
FY 1986	317.66	|	FY 1992	194.66	|	FY 1998	315.27	|	FY 2004	185.21
FY 1987	91.51	|	FY 1993	158.37	|	FY 1999	242.69	|	FY 2005	299.08
FY 1988	100.78	|	FY 1994	295.49	|	FY 2000	139.60			
FY 1989	77.26	|	FY 1995	362.20	|	FY 2001	147.87			
FY 1990	84.57	|	FY 1996	220.85	|	FY 2002	134.84			

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

5.1.1 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.

5.1.2 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.

5.1.3 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.

5.1.4 "Green Roofs" Completed by Year (Thousands of SF)

North America

	Extensive	Intensive	Mixed	**Total**
2004	916.8	405.8	4.924	1,327
2005	1,785	488.1	198.7	2,472
2006	1,957	1033	73.79	3,064
2007	-	-	-	2,408

United States

	Extensive	Intensive	Mixed	**Total**
2004	777.1	405.8	3.924	1,187
2005	1,570	476.4	102.9	2,150
2006	-	-	-	-

Note(s): 1) Extensive: soil depth of less than 6 inches. 2)Intensive: soil depth greater than 6 inches. 3) Mixed: at least 25% break up between extensive and intensive. 4)This data is best used as a gauge of activity in this market rather than actual amount of green roofs.
Source(s): Green Roof Industry Survey, Green Roof Infrastructure Monitor, (Reporting Years 2006, 2007, and 2008)

5.1.5 Properties of Cool Roofing Materials (1)

Asphalt Shingles	Solar Reflectance (2)	Infrared Emittance (3)
Shasta White	0.26	0.91
Generic White	0.25	0.91
Generic Grey	0.22	0.91
Light Brown	0.19	0.91
Medium Brown	0.12	0.91
Generic Black	0.05	0.91
White Coatings		
White Coating (1 coat, 8 mil)	0.80	0.91
White Coating (2 coats, 20 mil)	0.85	0.91
Aluminum Coatings		
Aluminum	0.61	0.25
Fibered on Black	0.40	0.56
Membranes		
Gray EPDM (4)	0.23	0.87
White EPDM (4)	0.69	0.87
T-EPDM (4)	0.81	0.92
Light Gravel on Built-Up Roof	0.34	0.90
Metal Roof		
New, Bare Galvanized Steel	0.61	0.04
Tiles		
Red Clay	0.33	0.90
White Concrete	0.73	0.90
Fiber Cement, Pewter Gray	0.25	0.90

Note(s): 1) A good cool-roofing material has high solar reflectance and high infrared emittance. 2) Solar Relectance is the percentage of incident solar radiation that is reflected by the material. 3) A number between 0 and 1 that describes the ability of a material to shed heat. The lower the value, the more heat the material retains. 4) Ethylene propylene diene monomer rubber material.
Source(s): Lawernce Berkley National Laboratory, Cool Roofing Materials Database, http://eetd.lbl.gov/coolroofs/.

5.1.6 ENERGY STAR Cool Roofing Product Shipments (Billion SF) and Penetration Rate

	Commercial Roofing	Residential Roofing	Total	ENERGY STAR Penetration
1999	0.0	0.1	0.1	0%
2000	0.0	0.1	0.1	0%
2001	0.0	0.1	0.1	0%
2002	4.4	0.0	4.5	24%
2003	1.0	0.1	1.0	5%
2004	1.2	0.3	1.4	7%
2005	3.5	0.2	3.7	19%
2006	4.1	0.5	4.5	23%

Note(s): N/A: Year is before date of ENERGY STAR specification. 1) Billion square feet.
Source(s): LBNL, Climate Change Action Plan spreadsheet (updated 2007).

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

	Aluminum (2)	Wood (3)	Vinyl	Other	**Total (4)**
New Construction					
1990	5.9	9.4	1.2	0.1	16.6
1995	4.7	11.6	4.8	0.3	21.4
2000	3.7	12.8	9.0	0.4	25.8
2005	6.5	9.2	17.4	1.0	34.1
2007	4.4	6.2	13.2	1.0	24.8
Remodeling/Replacement					
1990	3.6	7.6	7.1	0.1	18.4
1995	3.9	9.4	9.6	0.2	23.1
2000	4.0	10.2	14.8	0.2	29.2
2005	2.4	10.0	23.2	0.9	36.4
2007	1.9	8.9	22.5	1.0	34.3
Total Construction					
1990	9.5	17.0	8.3	0.2	35.0
1995	8.6	21.0	14.4	0.5	44.5
2000	7.7	23.0	23.8	0.6	55.0
2005	8.9	19.2	40.6	1.9	70.5
2007	6.3	15.1	35.7	2.0	59.1

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, Industry Statistical Review and Forecast 1992, 1993 for Note 2; AAMA/NWWDA, 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, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, p. 41 for 2005.; AAMA/WDMA. U.S. Industry Statistical Review and Forecast Mar. 2008, p. 6 for 2007.

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

	Windows				Doors				Total			
Type	1990	2000	2005	2007	1990	2000	2005	2007	1990	2000	2005	2007
Aluminum	9.9	8.0	6.6	NA	1.9	4.3	4.4	3.8	11.8	12.3	11.0	NA
Wood	0.5	2.3	2.0	NA	0.4	1.4	1.7	1.3	0.9	3.7	3.7	NA
Other (1)	0.1	0.3	0.2	NA	0.1	0.1	0.1	0.1	0.2	0.4	0.3	NA
Total (2)	**10.5**	**10.6**	**8.8**	**NA**	**2.4**	**5.8**	**6.4**	**5.2**	**12.9**	**16.4**	**15.2**	**NA**

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, 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; AAMA/WDMA, Study of U.S. Market for Windows, Doors, and Skylights, Apr. 2006, p. 101, Exhibit G.2 for 2005; AAMA/WDMA, Study of U.S. Market for Windows, Doors, and Skylights, Mar. 2008, p. 98

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

	Northeast		Midwest		South		West		Total	
Type	1995	2007	1995	2007	1995	2007	1995	2007	1995	2007
New Construction										
Commercial Windows (2)	4	33	16	32	21	56	13	37	54	159
Curtain Wall	3	17	6	15	16	31	8	23	33	86
Store Front	7	20	11	21	14	46	11	29	43	116
Total (3)	**14**	**71**	**33**	**68**	**51**	**133**	**32**	**90**	**130**	**361**
Remodeling/Replacement										
Commercial Windows (2)	18	29	25	27	46	34	27	19	116	109
Curtain Wall	4	3	6	3	8	5	10	4	28	15
Store Front	12	9	18	9	24	20	22	13	76	51
Total (3) Green Roof Industry	**34**	**40**	**49**	**38**	**78**	**60**	**59**	**36**	**220**	**174**
Total										
Commercial Windows (2)	22	62	41	59	67	90	40	56	170	268
Curtain Wall	7	20	12	18	24	36	18	27	61	101
Store Front	19	29	29	30	38	66	33	42	119	167
Total (3)	**48**	**111**	**82**	**106**	**129**	**193**	**91**	**126**	**350**	**536**

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, U.S. Industry Statistical Review and Forecast, Mar. 2008, p. 17 for 2007.

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

Sector	1985	1990	1995	2000	2005	2007
Residential	73%	86%	89%	92%	94%	95%
Nonresidential	63%	80%	84%	86%	88%	89%

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; AAMA/WDMA, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, for 2005; AAMA/WDMA, U.S. Industry Statistical Review and Forecast, Mar. 2008, p. 12

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

Type	1980	1990	1995	2001	2003	2005	2007
Single Lite	8.6	4.9	5.5	3.9	4.7	4.2	2.7
Two Lite, Sealed, IG (1)	0.0	12.0	37.8	50.9	55.9	63.8	55.0
Other	16.6	18.7	1.3	1.5	2.2	2.5	1.4
Total	**25.2**	**35.6**	**44.5**	**56.3**	**62.8**	**70.5**	**59.1**

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, 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, Study of U.S. Market For Windows, Doors, and Skylights, Apr. 2006, Exhibit D.8 Conventional Window Glass Usage, p. 50.; AAMA/WDMA, Study of U.S. Market For Windows, Doors, and Skylights, Mar. 2008, Exhibit D.8 Conventional Window Glass Usage, p. 49

5.2.6 2005 Residential Prime Window Stock (million households) (1)

Census Division	Single-Pane	Double-Pane			Total Housholds(2)
		Without Low-e	With Low-e	Total	
New England	2.1	2.8	0.4	3.2	5.3
Middle Atlantic	4.7	9.4	0.9	10.3	15.0
East North Central	5.6	9.7	2.0	11.7	17.3
West North Central	2.9	3.9	0.9	4.8	7.7
South Atlantic	12.3	7.9	1.1	9.0	21.3
East South Central	3.4	3.1	0.3	3.4	6.8
West South Central	8.0	3.8	0.3	4.1	12.1
Mountain	2.8	3.6	0.9	4.5	7.3
Pacific	8.9	6.4	1.1	7.5	16.4
National	**50.7**	50.6	7.9	**58.5**	**109.2**
Selected States					
New York	2.2	4.2	0.6	4.8	7.0
Florida	5.4	1.3	N.A.	1.3	6.7
Texas	5.1	2.5	N.A.	2.5	7.6
California	7.6	3.7	0.7	4.4	12.0

Note(s): 1) Preliminary data. 2) This is the total households using single- and double-pane glass. An additional 1.3 million households use o ther forms of windows, such as triple-pane windows.

Source(s): EIA, The 2005 Residential Energy Consumption Survey, Tables HC 11.5, HC 12.5, HC 13.5, HC 14.5, and HC 15.5, June 2008.

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

Type	Existing U.S. Stock (% of buildings)	Glass Area Usage (million SF)				
		1995	2001	2003	2005	2007
Single-Pane	53%	56	57	48	56	60
Insulating Glass (2)	47%	294	415	373	407	476
Total	100%	**350**	**472**	**421**	**463**	**536**
Clear	65%	36%	49%	43%	44%	38%
Tinted	28%	40%	24%	17%	15%	11%
Reflective	7%	7%	8%	6%	4%	3%
Low-e	(3)	17%	19%	34%	37%	48%
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/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; 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.; AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, Mar. 2008, Exhibit D.31 and Exhibit D.32, p. 72 for 2007.

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

	U-Factor	Solar Heat Gain Coeffcient	Visual Transmittence
Sinlge-Glazed Clear	0.84-1.16	0.64-0.76	0.65-0.75
Single-Glazed with Bronze Tint	0.84-1.16	0.54-0.65	0.49-0.56
Double-Glazed Clear	0.44-0.76	0.56-0.68	0.59-0.68
Double-Glazed with grey/Bronze Tint	0.44-0.76	0.47-0.56	0.44-0.51
Double-Glazed with High Performance Tint	0.44-0.76	0.39-0.47	0.50-0.57
Double-Glazed with High-Solar Gain Low-e Glass, Argon/Krypton Gas	0.29-0.61	0.53-0.64	0.54-0.62
Double-Glazed with Moderate-Solar Gain Low-e Glass, Argon/Krypton Gas	0.27-0.60	0.44-0.53	0.556-0.65
Double-Glazed with Low-Solar Gain Low-e (1) Glass, Argon/Krypton Gas	0.26-0.59	0.30-0.37	0.51-0.59
Triple-Glazed (2) with High-Solar Gain Low-e Glass, Argon/Krypton Gas (3)	0.15	0.51	0.65
Triple-Glazed (2) with Low-Solar Gain Low-e (1) Glass, Argon/Krypton Gas (3)	0.14	0.33	0.56

Note(s): 1) Spectrally selective, 2) Includes double glazing with suspended film, 3) Center of glass properties, does not include frame or installation properties

Source(s): The Effcient Windows Collaberative http://www.efficientwindows.org/index.cfm.

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

Equipment Type	1990 (1,000s)	2000 (1,000s)	2005 (1,000s)	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, 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.

5.3.2 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% or More	36%
71% to 80%	10%	Total	100%
80% to 86%	19%		
More Than 86%	12%		
Total	100%		

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

Oil-Fired

AFUE Range	1985
Below 75%	10%
75% to 80%	56%
More Than 80%	35%
Total	100%

Average shipped in 1985 (2):	79% AFUE
Average shipped in 1995:	81% AFUE
Best Available in 1981:	85% AFUE
Best Available in 2007:	95% 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 Consumer's 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

5.3.3 Residential Boiler Efficiencies (1)
Green Roof Industry Survey, Green Roof Infrastructure Monitor, (Reporting Years 2006, 2007, and 2008)

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 Consumer's Directory of Certified Efficiency Ratings for Heating and Water Heating Equipment, May 2007.

5.3.4 Residential Air Conditioner and Heat Pump Cooling Efficiencies

Equipment Type	Efficiency Parameter	2005 Stock Efficiency	2007 U.S. Average New Efficiency	2007 Best-Available New Efficiency
Air Conditioners	SEER	10.2	13.0	21.0
Heat Pump - Cooling				
Air-Source	SEER	10.0	13.0	17.0
Ground-Source	EER	13.8	16.0	30.0
Heat Pump - Heating				
Air-Source	HSPF	6.8	7.7	10.6
Ground-Source	COP	3.4	3.4	5.0

Source(s): EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Buildings Technologies Reference Case, Second Edition (Revised), Sept. 2007, p. 26-31.

5.3.5 Commercial Equipment Efficiencies

Equipment Type	Efficiency Parameter	2003 Stock Efficiency	2007 U.S. Average New Efficiency	2007 Best-Available New Efficiency
Chiller				
Screw	COP	2.3	2.7	2.9
Scroll	COP	2.6	3.0	N.A.
Reciprocating	COP	2.3	2.7	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	1.7	N.A.
Rooftop A/C	EER	9.2	10.1	12.0
Rooftop Heat Pump	EER (cooling)	9.3	10.3	11.7
	COP (heating)	3.1	3.2	3.4
Boilers				
Gas-Fired	Thermal Efficiency	76	80	96
Oil-Fired	Thermal Efficiency	79	83	89
Electric	Thermal Efficiency	98	98	98
Gas-Fired Furnace	AFUE	76	80	82
Water Heater				
Gas-Fired	Thermal Efficiency	77	80	94
Electric Resistance	Thermal Efficiency	97	98	98
Gas-Fired Instantaneous	Thermal Efficiency	76	84	89

Source(s): EIA/Navigant Consulting, EIA - Technology Forecast Updates - Residential and Commercial Buildings Technologies Reference Case, Second Edition (Revised), Sept. 2007, p. 43-80.

5.3.6 2007 Air-Conditioner/Heat Pump Manufacturer Market Shares (Percent of Products Produced)

Total Units Shipped: 16,619,296 (1)

Company	Market Share (%)
LG Electronics	17%
UTC/Carrier	13%
Whirlpool	9%
Goodman (Amana)	7%
American Standard (Trane)	6%
Fedders	6%
Electrolux (Frigidaire)	6%
Lennox	6%
Rheem	6%
York	4%
Nordyne	4%
Haier	4%
Others	12%
Total (2)	100%

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. 2008, p. 38.

5.3.7 2007 Gas Furnace Manufacturer Market Shares (Percent of Products Produced)

Total Units Shipped: 2,782,006

Company	Market Share (%)
UTC/Carrier	30%
Goodman (Amana)	15%
Lennox	14%
American Standard (Trane)	13%
Rheem	12%
York	9%
Nordyne	6%
Others	1%
Total	100%

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2008, p. 38.

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

Equipment Type	Typical Service Lifetime Range	Average Lifetime	2005 Average Stock Age	Units to be Replaced During 2009 (1,000s)
Central Air Conditioners	**8 - 14**	**11**	**8**	**5,354**
Heat Pumps	**9 - 15**	**12**	**8**	**1,260**
Furnaces				**2,750**
Electric	10 - 20	15	11	N.A.
Gas-Fired	12 - 17	15	11	2,601
Oil-Fired	15 - 19	17	N.A.	149
Steam or Hot-Water Boilers (gas and oil)	**20 - 40**	**N.A.**	**17**	**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. 2009, p. 38 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.

5.3.9 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.

5.3.10 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	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note(s): 1) Other includes wood and kerosene.
Source(s): EIA, Residential Energy Consumption Survey 2001 , June 2004, Table HC 5.4.

5.3.11 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.

5.3.12 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 total more than 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.

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

Heating Equipment	
Packaged Heating Units	25%
Boilers	21%
Individual Space Heaters	2%
Furnaces	20%
Heat Pumps	5%
District Heat	7%
Unit Heater	18%
PTHP & WLHP (1)	2%
	100%

Cooling Equipment	
Packaged Air Conditioning Units	54%
Room Air Conditioning	5%
PTAC (2)	3%
Centrifugal Chillers	14%
Reciprocating Chillers	12%
Rotary Screw Chillers	3%
Absorption Chillers	2%
Heat Pumps	7%
	100%

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

5.3.14 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.

5.3.15 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.

5.3.16 Estimated U.S. Emissions of Halocarbons, 1987-2001 (MMT CO2 Equivalent)

Gas	1987	1990	1992	1995	1998	2000	2001
Chlorofluorocarbons							
CFC-11	391	246	207	167	115	105	105
CFC-12	1166	1194	853	549	223	182	226
CFC-113	498	158	103	52	0	0	0
CFC-114	N.A.	46	29	16	1	N.A.	N.A.
CFC-115	N.A.	30	27	22	19	N.A.	N.A.
Bromofluorocarbons							
Halon-1211	N.A.	1	1	1	1	N.A.	N.A.
Halon-1301	N.A.	12	12	12	13	N.A.	N.A.
Hydrochlorofluorocarbons							
HCFC-22	116	136	135	123	128	134	137
HCFC-123	N.A.	0	0	0	0	N.A.	N.A.
HCFC-124	0	0	0	3	4	N.A.	N.A.
HCFC-141b	N.A.	0	0	14	19	4	4
HCFC-142b	N.A.	0	2	18	22	26	26
Hydrofluorocarbons							
HFC-23	48	36	36	28	41	31	22
HFC-125	N.A.	0	1	2	4	5	6
HFC-134a	N.A.	1	1	19	35	44	41
Total	**2219**	**1861**	**1408**	**1024**	**624**	**532**	**566**

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.

5.4.1 2005 Water Heater Stock for Residential Buildings, By Fuel Type (Million Households)

	Households	Percent
Electric	43.1	39.2%
Natural Gas	58.7	53.4%
Fuel Oil	4.0	3.6%
Propane/LPG	4.0	3.6%
Other	0.2	0.2%
Total(1)	**110.0**	**100.0%**

Note(s): According to RECS, 1.1 million households did not use hot water. The total only reflects those household that used hot water.
Souce(s): EIA, Residential Energy Consumption Survey 2005, Table HC 2.8, June 2008.

5.4.2 2005 Water Heater Stock for Residential Buildings, By Storage Type (Percent of Households)

	Used by One Unit		Used by Multiple Units		Total	
Small (30 gallons or less)	17.1	17%	1.4	14%	18.5	17%
Medium (31 to 49 gallons)	52.4	53%	2.4	24%	54.8	50%
Large (50 gallons or more)	27.1	27%	2.8	27%	29.9	27%
Tankless water heater	1.1	1%	0.2	2%	1.3	1%
No Separate Water Heater	1.9	2%	3.4	33%	5.3	5%
Total(1)	**99.6**	100%	**10.2**	100%	**109.8**	100%

Note(s): According to RECS, 1.1 million households did not use hot water. The total only reflects those household that used hot water.
Souce(s): EIA, Residential Energy Consumption Survey 2005, Table HC 2.8, June 2008.

5.4.3 2006 Water Heater Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
Rheem Manufacturing	37%
A.O. Smith/State Industries	23%
American Water Heater	14%
Bradford-White	14%
Others	12%
Total	100%

Total Units Shipped: 9,446,076

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2007, p. 63.

5.4.4 2003 Water Heater Stock for Commercial Buildings, By Fuel Type (Percent of Total Buildings)

Type	
Electric	41%
Natural Gas	31%
Fuel Oil	2%
Propane/LPG	1%
District Heat	3%

Souce(s): EIA, 2003 Commercial Buildings Energy Consumption Survey: Buildings Characteristics, June 2006, Table B31, p. 175.

5.4.5 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
Commerc	Green Roof Industry Survey, Green Roof Infrastructure Monitor, (Reporting Years 2006, 2007, and 2008)			
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.

5.5.1 Market Share of Major HVAC Equipment Manufacturers ($2006 Million)

	Total Market Size
Air-Handling Units	962
Cooling Towers	497
Pumps	310
Central System Terminal Boxes	179
Classroom Unit Ventilator	149
Fan Coil Units	114

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 2007, June 2008, Appendix D, p. 377 for price deflators.

5.5.2 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.

5.5.3 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.

5.5.4 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.

Green Roof Industry Survey, Green Roof Infrastructure Monitor, (Reporting Years 2006, 2007, and 2008)

5.5.5 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.

5.5.6 1999 Energy Efficient Motors, Replacements and Sales, by Horsepower Class

	Existing		Replacements	
Horsepower Range	Units in Use (thousands)	Horsepower (10^6)	% Retired	Energy Efficient 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.

5.5.7 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.

5.6.1 Selected Flourescent and Incandescent Lamp Sales (Thousands)

Commercial Trends	2001	2002	2003	2004	2005
T12 Rapid-Start Fluorescent (Mainly 4')	213	206	182	176	163
T8 Medium Bi-Pin Fluorescent (Mainly 4')	164	164	172	196	216
Total (mainly) 4'	**377**	**370**	**354**	**372**	**378**
2' U-Shaped T12	10	9	9	7	9
2' U-Shaped T8	8	7	7	9	9
Total 2' U lamp	**18**	**16**	**16**	**16**	**17**
8' Slimline T12 (Mainly 8')	43	41	37	36	34
8' Slimline T8 (Mainly 8')	4	5	5	6	5
Total Slimline (Mainly 8')	**48**	**47**	**42**	**42**	**39**
8' HO T12 (Mainly 8')	24	24	24	25	25
8' HO T8 (Mainly 8')	1	1	0	1	0
Total HO (Mainly 8')	**25**	**25**	**25**	**25**	**26**
Residential Trends					
Incandescent A-line	1,568	1,526	1,542	1,470	1,410
Screw-Based Compact Fluorescent- Census	69	52	66	93	102
Total Medium Screw-Based Market	**1,637**	**1,577**	**1,608**	**1,563**	**1,512**
Commerical and Residential Trends					
PAR Incandescent	9	7	5	5	15
R Incandescent	89	96	103	112	125
PAR 38 Halogen	41	46	46	50	46
PAR30 and PAR20 Halogen	33	27	31	36	40
Total Reflector Lamps	**172**	**176**	**185**	**203**	**226**

Note(s): 2001-2005 growth rate for A-line Incandescent was -2.62% while Screw-based Compact Fluorescent had a growth rate of 10.17% over the sa

Source(s): National Electrical Manufactors Association, Special Bulletin for the Lamp Section (2-LL), June 2006, page 1.

5.6.2 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.

5.6.3 Shipments of Fluorescent Lamp Ballasts

Year	Standard Magnetic Type (1) Quantity (million)	Standard Magnetic Type (1) Value ($million)	Electronic Type Quantity (million)	Electronic Type Value ($million)	Total Quantity (million)	Total 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%
2002	40.7	263.3	53.8	573.1	94.5	836.4	57%
2004 Green	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.

5.6.4 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.

5.6.5 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.

5.6.6 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.

5.6.7 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.

5.6.8 2003 Lighting Consumption and Energy Intensities, by Commercial Building Type

Building Type	Percent of Total Lighted Floorspace	Total Annual Lighting Energy (billion KWh)		Annual Lighting End-Use Intensity (kWh/SF)
Education	14%	33.1	6.5%	3.4
Food Sales	2%	13.5	2.6%	10.8
Food Service	2%	12.3	2.4%	7.4
Health Care	5%	30.8	6.0%	9.7
Inpatient	3%	22.3	4.3%	11.8
Outpatient	2%	8.2	1.6%	6.6
Lodging	7%	36.3	7.1%	7.1
Mercantile	16%	90.3	17.6%	8.1
Retail (Other Than Mall)	6%	32.5	6.3%	7.5
Enclosed and Strip Malls	10%	57.7	11.3%	8.4
Office	18%	82.4	16.0%	6.8
Public Assembly	6%	7.9	1.5%	2.1
Public Order and Safety	2%	5.3	1.0%	4.8
Religious Worship	5%	5.0	1.0%	1.3
Service	6%	18.5	3.6%	4.6
Warehouse and Storage	13%	38.7	7.5%	3.8
Other	2%	17.3	3.4%	10.0
Vacant	1%	1.2	0.2%	0.5
Total (1)		**513.2**	**100%**	

Source(s): EIA, 2003 Commericial Buildings Energy Consumption Survey Characteristics and End-Uses, Oct. 2006 and Sept. 2008, Table A1 and Table E1A.

5.6.9 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.

5.7.1 Refrigeration System Shipments, by Type (Including Exports)

Appliance Type	1990 (thousands)	2000 (thousands)	2006 (thousands)	2006 Value of Shipments ($million)
Refrigerator-Freezers (1)	7,317	9,462	11,966	5,419
Freezers (chest and upright)	1,328	2,007	2,199	N.A.
Refrigerated Display Cases	359	347	181	N.A.
Unit Coolers	178	207	221	158
Ice-Making Machines	171	385	386	678
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.

5.7.2 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.

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

	1982		1990		1996		2001		2005	
Appliance Type	Households		Households		Households		Households		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.

5.7.4 2008 Refrigerator Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
GE	27%
Electrolux (Frigidaire)	23%
Whirlpool	33%
Maytag (Admiral)	(1)
Haier	6%
W.C. Wood	1%
Others	10%
Total	100%

Total Units Shipped: 9,310,000

Note(s): 1) Included in Whirpool shipments

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 35.

5.7.5 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.
1995	20.0	649	555
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.

5.7.6 2008 Room Air Conditioner Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
LG Electronics (Goldstar)	32%
Fedders	12%
Electrolux (Frigidaire)	13%
Whirlpool	13%
Haier	8%
Samsung	5%
Sharp	4%
Friedrich	4%
UTC/Carrier	3%
Matsushita	2%
Others	4%
Total	100%

Total Units Shipped: 9,085,500

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 34.

5.7.7 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.
1995	10,099	9.03	12.0
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.

5.7.8 2008 Clothes Washer Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
Whirlpool	64%
Maytag	(1)
GE	16%
Electrolux (Frigidaire)	6%
LG Electronics	6%
Others	8%
Total	100%

Total Units Shipped: 8,292,000

Note(s): 1) Included in Whirpool shipments

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 35.

5.7.9 2008 Clothes Dryer Manufacturer Market Shares (Percent of Products Produced)

Company	Electric Market Share (%)	Gas Market Share (%)
Whirlpool	70%	74%
Maytag	(1)	(1)
GE	16%	10%
Electrolux (Frigidaire)	8%	5%
Others	6%	11%
Total	100%	100%

Total Electric Units Shipped: 5,620,000

Total Gas Units Shipped: 1,353,000

Note(s): 1) Included in Whirpool shipments

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 35.

5.7.10 2008 Range Manufacturer Market Shares (Percent of Products Produced)

Company	Electric Market Share (%)	Gas Market Share (%)
GE	47%	37%
Whirlpool	29%	25%
Electrolux (Frigidaire)	8%	23%
Maytag	(1)	(1)
Others	16%	15%
Total	100%	100%

Total Electric Units Shipped: 5,106,000

Total Gas Units Shipped: 2,842,400

Note(s): 1) Included in Whirpool shipments

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 35.

5.7.11 2008 Microwave Oven Manufacturer Market Shares (Percent of Products Produced)

Company	Market Share (%)
LG Electronics (Goldstar)	33%
Sharp	15%
Samsung	15%
Daewoo	7%
Matsushita	10%
Whirlpool	3%
Sanyo	9%
Others	8%
Total	100%

Total Units Shipped: 11,340,000

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2009, p. 35.

5.7.12 2007 Copier Machine Manufacturer Market Shares (Percent of Products Produced)

	Copier Market Share (%)
Canon	31%
Konica Minolta	21%
Ricoh	16%
Xerox	10%
Sharp	4%
Kyocera Mita	4%
Others	14%
Total	100%

Total Copier Units Shipped: 247,763

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2008, p. 41.

5.7.13 2007 Personal Computer Manufacturer Market Shares (Percent of Products Produced)

Company	Desktop Computer Market Share (%)	Portable Computer Market Share (%)
Dell	32%	25%
Hewlett-Packard	24%	26%
Gateway	5%	4%
Apple	4%	9%
Acer America	3%	N/A
IBM	1%	N/A
Micron	0%	N/A
Toshiba	N/A	12%
Levono (IBM)	N/A	6%
Sony	N/A	5%
Fujitsu Siemens	N/A	1%
Others	30%	13%
Total	100%	100%

Total Desktop Computer Units Shipped: 34,211,601

Total Portable Computer Units Shipped: 30,023,844

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2008, p. 41.

5.7.14 2007 Printer Manufacturer Market Shares (Percent of Products Produced)

Company	Ink Jet Printer Market Share (%)	Laser Printer Market Share (%)	Dot Matrix Market Share (%)
Hewlett-Packard	58%	56%	N/A
Canon	16%	N/A	N/A
Epson	11%	N/A	27%
Lexmark	15%	10%	11%
Dell	0%	11%	N/A
Samsung	N/A	6%	N/A
Brother	N/A	4%	N/A
Oki Data	N/A	3%	46%
Konica Minolta	N/A	1%	N/A
Panasonic	N/A	N/A	6%
TallyGenicom	N/A	N/A	5%
Others	0%	9%	6%
Total	100%	100%	100%

Total Ink Jet Units Shipped:	6,392,177
Total Laser Units Shipped:	3,356,556
Total Dot Matrix Units Shipped:	231,547

Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2008, p. 41.

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

Appliance Type	Typical Service Lifetime Range (years)	Average Lifetime (years)	2005 Average Stock Age (years)	Units to be Replaced During 2010 (1,000s)
Refrigerators (1)	10 - 16	12	8	8,774
Freezers	8 - 16	11	11	2,420
Room Air Conditioners	7 - 13	9	7	5,575
Microwave Ovens	7 - 10	9	N.A.	13,446
Ranges (2)				
Electric	12 - 19	16	N.A.	4,171
Gas	14 - 22	17	N.A.	2,755
Clothes Washers	7 - 14	11	N.A.	6,835
Clothes Dryers				
Electric	8 - 15	12	N.A.	4,482
Gas	8 - 15	12	N.A.	1,307
Water Heaters				
Electric	4 - 20	13	8	4,052
Gas	7 - 15	11	8	4,934
Facsimile Machines	3 - 5	4	N.A.	3,133
Portable Computers	2 - 4	3	N.A.	31,600

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. 2009, p. 37 - 38 for service and average lifetimes and units to be replaced; EIA, 2005 Residential Energy Consumption Survey, Apr. 2008, Table HC 2.6, Table HC 2.8 and Table HC 2.9 for average stock ages.

5.7.16 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.

5.7.17 Commercial Refrigeration - Annual Primary Energy Usage of Commercial Refrigeration Equipment

Equipment Type	Percent of Total
Supermarket Refrigeration	56%
Walk-Ins	12%
Reach-Ins	9%
Refrigerated Vending Machines	8%
Ice Machines	7%
Beverage Merchandisers	4%
Food Service Equipment	4%
Total	**1.23 Quad**

Source(s): DOE/EERE/Navigant Consulting, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Sept. 2009, Figure 1-2, p. 17.

5.7.18 Commercial Refrigeration - Installed Base and Total Energy Consumption by Commercial Refrigeration Type

Equipment	Installed Base (thousand)	Total Energy Consumption (TWh/yr)
Supermarket Refrigeration Systems		
Display Cases	2,100	214
Compressor Racks	140	373
Condensers	140	50
Walk-Ins	245	51
Walk-In Coolers and Freezers (Non-Supermarket)	755	148
Food Preperation and Service Equipment	1,516	55
Reach-In Refrigerators and Freezers	2,712	106
Beverage Merchandisers	920	45
Ice Machines	1,491	84
Refrigerated Vending Machines	3,816	100
Total		**1225**

Note(s): Energy consumption values have been rounded to the nearest whole number, and therefore the total does not exactly equal the sum of the energy consumption values for each equipment type.

Source(s): DOE/EERE/Navigant Consulting, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Sept. 2009, Table 3-1, p. 26.

5.7.19 Commercial Refrigeration - Unit Inventory and Energy Consumption

Application	Estimated Inventory (thousand)	Unit Energy Consumption (kWh/yr)	Total Energy Consumption (TWh/yr)	Primary Energy Consumption (Tbtu/yr)
Walk-In Coolers and Freezers				
Non-Supermarket, Cooler	468	16,200	7.6	78.9
Non-Supermarket, Freezer	234	21,400	5.0	52.1
Non-Supermarket, Combination	53	30,200	1.6	16.6
Supermarket	245	varies	4.9	51.0
Beverage Merchandisers (1)				
One-Door	460	3,076	1.4	14.7
Two-Door	414	6,080	2.5	26.2
Three-Door	46	8,960	0.4	4.3
Reach-In Refrigerators and Freezers (2)				
Freezers	1,156	4,158	4.8	56.0
Refrigerators	1,556	3,455	5.4	50.0
Ice Machine	1,491	5,429	8.1	84.2
Beverage Vending Machine (3)				
Fully-cooled	496	2,743	1.4	14.2
Zone-cooled	3,320	2,483	8.2	85.8

Note(s): 1) Beverage merchandisers are self-contained, upright, refrigerated cabinets that are designed to hold and/or display refrigerated beverage items for purchase without an automatic vending feature. Typically they have glass doors and bright lighting. These cases are commonly used in convenience stores, aisle locations in supermarkets, and some retail stores. Because the refrigeration system is self-contained, the heat is rejected to the building interior, and their energy use is not included in the supermarket refrigeration sections. 2) Commercial reach-in cabinets are upright, self-contained refrigerated cases with solid or glass doors whose purpose is to hold frozen and/or refrigerated food products. These cases are commonly used in commercial and institutional food-service establishments. These are self-contained units, i.e., the entire refrigeration system is built into the reach-in unit and heat is rejected to the surrounding interior air. 3) In a fully cooled beverage vending machine, all beverages enclosed within the machine are visible to the customer and, therefore, the entire internal volume is refrigerated. The zone-cooled packaged beverage vending machine only cools the beverage that are soon-to-be-vended, meaning only a small portion, or zone, of the internal volume is refrigerated.

Source(s): DOE/EERE/Navigant Consulting, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Sept. 2009, Table 3-5, p. 31 for walk-in coolers and freezers, Table 3-12, p. 37 for beverage merchandiser, Table 3-11, p. 35 for reach-in freezers and refrigerators, Table 3-15, p. 41 for ice machines, and Table 3-16, p. 44 for beverage vending machine.

5.7.20 Commercial Refrigeration - Display Case Shipments

Year	Shipments
1999	340,453
2000	347,262
2001	175,000
2002	183,300
2003	191,549
2004	185,000
2005	170,000
2006	175,500
2007	181,000
2008	185,000

Source(s): DOE/EERE/Navigant Consulting, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Sept. 2009, Table 3-3, p. 28.

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

Type	1980	1990	2000	2006 (2)	2006 Value of Shipments ($million)
Solar Thermal Collectors (3)	19,398	11,409	8,354	20,744	121
Residential	N.A.	5,851	7,473	15,123	N.A.
Commercial	N.A.	295	810	1,626	N.A.
Industrial	N.A.	(4)	57	42	N.A.
Utility	N.A.	5,236	5	3,845	N.A.
Other	N.A.	26	10	107	N.A.
Photovoltaics (kW) (5)	(6) 6,897	13,837	88,221	337,268	1,155

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 2006, Aug. 2006, Table 2.9, 2.10, 2.22, and 2.23, p. 20-21, 33-34 for 2005-2006; EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 37 and Table 38, p. 21 and 22 for 2004 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)	2006 (3)	
Pool Heating	7,863	10,800	13,634	15,041	15,362	
Hot Water	367	511	452	640	1,136	
Space Heating	99	76	13	228	330	
Space Cooling		0	0	2	3	
Combined Space/Water Heating	2	23	16	16	66	
Process Heating	20	34	0	0	0	
Electricity Generation	3	0	0	114	3,847	(4)
Total	**8,354**	**11,444**	**14,114**	**16,041**	**20,744**	

Note(s): 1) 5.8% of shipments are exported in 2005. 2) Approximately 51,000 systems in 2005. 3) Approximately 80,000 systems in 2006 4) 2005 to 2006 increase in electricity generation due to shipment to the Nevada Solar One Project.

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; EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2006, Table 2.10, p. 21 for 2006

5.8.3 2007 Top Five Destinations of Thermal Solar Collector Shipments

State	Percent of U.S. Unit Shipments
California	28%
Florida	26%
Arizona	5%
Oregon	4%
Illinois	3%

Source(s): EIA, Solar Thermal Manufacturing Activities 2007, October 2008, Table 2.4, p. 11.

5.8.4 Thermal Solar Collector Manufacturer Statistics (1)

-	Number of Manufacturers in 2007:	60
-	Companies with 90% of their revenue coming from solar collector sales:	36
-	Percentage of shipped solar collectors produced by top 5 manufacturers:	86%

Note(s): 1) Preliminary.
Source(s): EIA, Solar Thermal Collector Manufacturing Activities 2007, Oct. 2008, p. 2.

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

Market	1995	2000	2003(2)	2004	2005	2006
Industrial	7,198	28,808	27,951	30,493	22,199	28,618
Residential	**6,272**	**24,814**	**23,389**	**53,928**	**75,040**	**95,815**
Commercial	**8,100**	**13,692**	**32,604**	**74,509**	**89,459**	**180,852**
Transportation	2,383	5,502	11,089	1,380	1,621	2,458
Utility	3,759	6,298	8,474	3,233	143	3,981
Government	2,000	4,417	5,538	3,257	28,683	7,688
Other	1,347	4,690	313	14,316	9,772	17,857
Total	**31,059**	**88,221**	**109,357**	**181,116**	**226,916**	**337,268**

Note(s): 1) Includes imports and exports. 2) 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
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	29	134,465	92,451	226,916
2006	41	206,511	130,757	337,268
2007(1)	46	280,475	237,209	517,684

Note(s): 1) Preliminary.
Source(s): EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2006, October 2007, Table 2.17 and Table 2.19, p. 28 and p. 30; EIA, Solar Photovoltaic Cell/Module Manufacturing Activities 2007, December 2008, Table 3.1 and Table 3.2, p. 8-9.

5.8.7 2007 Top 5 Destinations of U.S. Photovoltaic Cell and Module Export Shipments, by Country

Country	Peak Kilowatts	Percent of U.S. Exports
Germany	152,654	64%
Spain	31,384	13%
Italy	10,364	4%
France	10,228	4%
China	7,238	3%
All Countries	**237,209**	100%

Source(s): EIA, Solar Photovoltaic Cell/Module Manufacturing Activities 2007, Dec. 2008, Table 3.14, p. 22.

5.8.8 Annual New Installations of Grid-Tied Photovoltaic Cells and Modules, by Market (MW)

Peak Capacity by Use	2002	2003	2004	2005	2006	2007
Residential	**9.6**	**13.3**	**21.6**	**21.5**	**37.9**	**53.3**
Non-Residential	**8.0**	**25.4**	**29.6**	**42.1**	**60.6**	**85.7**
Utility	2.0	3.0	1.8	0.6	0.2	8.7
Unknown	3.0	1.7	1.7	3.2	4.4	2.4
Total New Capacity	22.6	43.4	54.7	67.4	103.1	150.1
Cumulative Capacity	51.1	94.5	149.2	216.6	319.8	469.9
Number of Installations	3,438	4,217	6,275	6,339	10,634	13,287

Source(s): Sherwood, Larry. Interstate Renewable Energy Council. Personal Communication. July, 2008.

5.8.9 2007 Total Grid-Tied PV Capacity, by State

	PV Capacity (MW)				Net Metering Utility (2006)		
State	Total (1)	Residential	Non-Res.	Unknown	Utility Participants (2)	Residential Customers	Non-Res. Customers
California	328.8	118.3	193.7	16.8	19	24,160	1,972
New Jersey	43.6	14.5	27.6	1.5	5	1,789	203
Arizona	18.9	3.2	13.1	2.6	4	185	3
Nevada	18.8	1.2	17.6	-	2	213	23
New York	15.4	9.7	5.2	0.5	5	1,088	119
Colorado	14.6	4.8	9.6	0.2	17	380	25
Massachusetts	4.6	1.5	3.2	-	5	454	104
Hawaii	4.5	1.3	2.4	0.8	4	184	23
Texas	3.2	1.6	1.7	-	9	375	56
All Other States	8.3	9.4	22.6	17.7	180	2,495	617
Total	**475.0**	**164.4**	**283.5**	**22.4**	**232**	**31,323**	**3,146**

Note(s): 1) Projections totals may not add due to rounding. 2) Includes entities with participants in more than one state. 3) Arizona does not have state-wide net metering provisions.

Source(s): Sherwood, Larry. Interstate Renewable Energy Council (IREC). Personal Communication. July, 2008; EIA. Green Pricing and Net Metering Programs, 2006. July 2008. Table 4.2, p. 10.

5.8.10 Annual Installed Capacity of Photovoltaic Cells and Modules, Off-Grid and On-Grid(DC MW)

	On-Grid	Off-Grid	Total
1997	1.4	9.0	10.4
1998	1.8	9.7	11.5
1999	2.6	12.0	14.6
2000	3.7	13.5	17.2
2001	11.1	16.0	27.1
2002	22.5	21.4	43.9
2003	43.4	25.0	68.4
2004	54.7	28.0	82.7
2005	67.4	33.0	100.4
2006	103.2	37.0	140.2
2007	150.1	55.0	205.1
Cumulative	**469.9**	**282.0**	**751.9**

Source(s): Sherwood, Larry. Interstate Renewable Energy Council. Personal Communication. July, 2008.

5.9.1 United States Small Wind Units and Capacity Added per Year

	Units	On-Grid Units	Off-Grid Units	Capacity kW	On-Grid kW	Off-Grid kW	Sales ($million)
2001 (1)	2100	-	-	2100	-	-	-
2002 (1)	3100	-	-	3100	-	-	-
2003 (1)	3200	-	-	3200	-	-	-
2004	4671	-	-	4878	-	-	14.9
2005	4324	-	-	3285	-	-	9.9
2006	8329	453	7876	8565	4522	4043	33.2
2007	9092	1292	7800	9737	5720	4017	42.0

	Remote Off-Grid(2) < 1 kW	Residential-Scale On-Grid (1 - 10 kW)	Commericial Scale On-Grid (11 - 100 kW)
% 2007 Units	86%	13%	1%
% 2007 Capacity	41%	34%	25%

Note(s): 1) Estimates. 2) Turbines under 1 kW are often used on marine vehicles to charge batteries and to pump water for irrigation or ranching.

Source(s): American Wind Energy Association, Stimmel, Ron, 2008 AWEA Small Wind Turbine Global Market Study, June 2008.

5.10.1 Average Combined Heat and Power Capacity, Principal Building Type and Prime Mover (kW)

	Combustion Turbine	Reciprocating Engine	Fuel Cell	Microturbine
Apartment Building		241	330	262
Colleges/Univ	15,786	2,117	223	179
Food Sales/Services		260		150
Hospitals/Healthcare	4,146	1,308	242	187
Hotels	3,450	646	381	143
Justice/Public Order	10,304	1,251	521	58
Mercantile	4,100	1,602		360
Nursing Homes		180		467
Office	4,735	1,117	326	218
Public Assembly	11,170	259	165	184
Schools K-12		326	200	120
Service	3,700	252	250	45

Source(s): Energy and Environmental Analysis Inc, The Combined Heat and Power Database, http://www.eea-inc.com/chpdata/index.html

5.10.2 Installed Combined Heat and Power Capacity, Principal Building Type and Prime Mover (MW)

	Combustion Turbine	Reciprocating Engine	Fuel Cell	Microturbine	**Total**
Apartment Building		33	0	3	37
Colleges/Univ	821	155	3	2	981
Food Sales/Services		8		0	8
Hospitals/Healthcare	129	152	1	1	282
Hotels	17	55	3	2	78
Justice/Public Order	52	18	3	0	72
Mercantile	4	27		0	32
Nursing Homes		21		3	24
Office	52	97	3	3	154
Public Assembly	34	27	1	2	63
Schools K-12		66	1	4	71
Service	11	24	0	0	36
Total	1,119	683	15	21	**1,838**

Source(s): Energy and Environmental Analysis Inc, The Combined Heat and Power Database, http://www.eea-inc.com/chpdata/index.html

5.10.3 Installed Combined Heat and Power Capacity, Principal Building Type and Census Region (MW)

	Northeast	South	Midwest	West	**Total**
Apartment Building	35			2	37
Colleges/Univ	347	230	238	166	981
Food Sales/Services	3	4	0	1	8
Hospitals/Healthcare	75	71	72	64	282
Hotels	19	9	0	50	78
Justice/Public Order	14	4	2	52	72
Mercantile	23	2	5	1	32
Nursing Homes	16	0	3	5	24
Office	51	35	26	43	154
Public Assembly	9	35	9	11	63
Schools K-12	27	0	24	20	71
Service	11	3	1	21	36
Total	**629**	**393**	**379**	**436**	**1,838**

Source(s): Energy and Environmental Analysis Inc, The Combined Heat and Power Database, http://www.eea-inc.com/chpdata/index.html

5.10.4 Installed Combined Heat and Power Capacity, Prime Mover and Census Region (MW)

Prime Mover	Northeast	South	Midwest	West	**Total**
Combustion Turbine	347	265	258	249	1,119
Reciprocating Engine	266	129	119	170	683
Fuel Cell	7	0	1	8	15
Microturbine	9	0	1	10	21
Total	**629**	**393**	**379**	**436**	**1,838**

Source(s): Energy and Environmental Analysis Inc, The Combined Heat and Power Database, http://www.eea-inc.com/chpdata/index.html

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

	Buildings						*Delivered* Total
	Residential	Commercial	**Total**	Industry	Transportation	Total	(10^15 Btu)
1980	34.3%	26.7%	60.9%	38.9%	0.2%	100%	7.15
1990	34.1%	30.9%	65.0%	34.9%	0.2%	100%	9.26
2000	34.9%	33.9%	68.7%	31.1%	0.2%	100%	11.67
2006	**36.9%**	**35.5%**	**72.4%**	**27.4%**	**0.2%**	**100%**	**12.49**
2010	37.5%	35.8%	73.3%	26.5%	0.2%	100%	13.20
2015	36.3%	37.5%	73.8%	26.1%	0.2%	100%	13.85
2020	36.1%	39.0%	75.1%	24.7%	0.2%	100%	14.54
2025	36.2%	40.3%	76.5%	23.3%	0.2%	100%	15.26
2030	36.6%	41.3%	77.9%	22.0%	0.2%	100%	16.05

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

Source(s): EIA, State Energy Data 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, and Table A3, p. 120-121 expenditures.

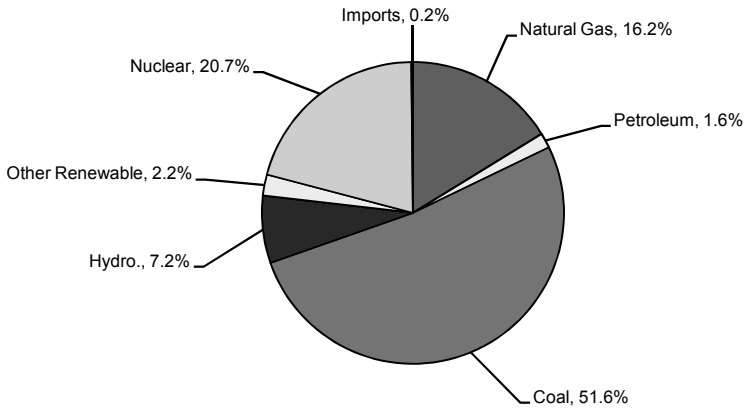
6.1.2 U.S. Electricity Generation Input Fuel Shares (Percent)

				Renewables				Net Electric	
	Natural Gas	Petroleum	Coal	Hydro.	Oth(2)	Total	Nuclear	Imports	Total
1980	15.6%	10.8%	50.0%	11.8%	0.5%	12.3%	11.3%	(1)	100%
1990	10.9%	4.2%	53.0%	9.8%	2.2%	12.0%	19.9%	(1)	100%
2000	13.9%	3.0%	53.0%	7.3%	2.1%	9.4%	20.6%	(1)	100%
2006	**16.2%**	**1.6%**	**51.6%**	**7.2%**	**2.2%**	**9.4%**	**20.7%**	**0.2%**	**100%**
2010	16.6%	1.3%	50.7%	7.0%	4.0%	10.9%	20.0%	0.1%	100%
2015	15.6%	1.3%	51.4%	6.9%	4.8%	11.7%	19.5%	0.1%	100%
2020	13.5%	1.3%	52.4%	6.6%	5.9%	12.5%	20.0%	0.1%	100%
2025	11.5%	1.3%	54.1%	6.3%	6.3%	12.6%	20.1%	0.1%	100%
2030	10.4%	1.3%	56.0%	6.0%	6.4%	12.5%	19.4%	0.2%	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 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2005; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption and Table A17, p. 143-144 for renewables.

2006 U.S. Electricity Generation Input Fuel Shares (Percent)



6.1.3 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	2006-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	0.67	3.69	6.10	(1)	30.67	-
2000	5.32	1.14	20.22	2.77	0.81	3.58	7.86	(1)	38.12	-
2006	**6.42**	**0.64**	**20.48**	**2.86**	**0.88**	**3.74**	**8.21**	**0.06**	**39.68**	**-**
2010	6.89	0.56	21.01	2.89	1.64	4.53	8.31	0.05	41.46	1.1%
2015	6.75	0.57	22.18	2.96	2.09	5.05	8.41	0.04	43.12	0.9%
2020	6.09	0.59	23.67	2.97	2.67	5.64	9.05	0.04	45.21	0.9%
2025	5.45	0.61	25.51	2.97	2.97	5.94	9.50	0.05	47.19	0.9%
2030	5.13	0.63	27.55	2.97	3.16	6.13	9.57	0.08	49.21	0.9%

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 2005: Consumption, Feb. 2008, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for 2006-2030 consumption, and Table A17, p. 143-144 for renewables.

6.1.4 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)	2006-year
1980	346	246	1162	276	6	282	251	N.A.	2286	-
1990	265	118	1560	290	35	324	577	61	2901	-
2000	399	98	1911	271	45	316	754	165	3638	-
2006	**608**	**55**	**1930**	**285**	**61**	**347**	**787**	**173**	**3899**	**-**
2010	695	49	2002	289	131	421	797	160	4124	1.4%
2015	682	50	2122	297	168	465	807	160	4287	1.1%
2020	614	52	2287	298	220	518	868	145	4483	1.0%
2025	543	54	2502	298	242	540	911	136	4685	1.0%
2030	503	56	2756	299	255	553	917	133	4918	1.0%

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 2008, Mar. 2008, Table A8, p. 131-132; EIA, Annual Energy Review 2007, July 2008, Table 8.2c, p. 230 for 1990-2000; and EIA, Annual Energy Review 2002, Oct. 2003, Table 8.2b, p. 149 for 1980.

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

	Coal Steam	Other Fossil	Combine Cycle	Combustion Turbine	Nuclear	Pumped	Total
1980	N.A.	N.A.	N.A.	N.A.	51.8	0.0	495.9
1990	302.3	N.A.	N.A.	N.A.	99.6	19.5	628.4
2000	310.2	N.A.	N.A.	N.A.	97.9	19.5	693.3
2006	**305.2**	**119.3**	**144.7**	**128.06**	**100.2**	**21.5**	**819.0**
2010	311.4	118.0	158.2	134.55	100.9	21.5	844.5
2015	319.3	93.2	159.9	127.08	102.1	21.5	823.1
2020	338.5	93.0	164.2	129.20	110.9	21.5	857.2
2025	367.6	92.6	173.3	140.92	115.7	21.5	911.6
2030	401.5	92.6	177.5	161.81	114.9	21.5	969.8

Note(s): 1) Nuclear capacity includes 3 GW of uprates from 2006 to 2030. New nuclear plants are expected to come online 2013-2019.
Source(s): EIA, Annual Energy Outlook 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 2008, Mar. 2008, Table A9, p. 133-134 and Table A16, p. 142 for 2006-2030.

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

	Conv. Hydropower	Geothermal	MSW (1)	Biomass	Solar Thermal	Solar PV	Wind	Total
1980	81.7	0.9	0.0	0.1	N.A.	N.A.	N.A.	82.7
1990	73.3	2.7	2.1	1.2	0.3	N.A.	1.8	81.4
2000	78.2	2.8	3.3	1.7	0.4	N.A.	2.4	88.8
2006	**76.7**	**2.3**	**3.4**	**2.0**	**0.4**	**0.0**	**11.5**	**96.3**
2010	76.7	2.5	4.0	2.2	0.5	0.1	25.6	111.6
2015	77.1	2.9	4.0	2.7	0.8	0.1	29.6	117.3
2020	77.3	3.3	4.0	4.4	0.8	0.2	33.6	123.6
2025	77.3	3.8	4.1	4.8	0.8	0.3	37.2	128.3
2030	77.3	4.2	4.1	5.6	0.9	0.4	40.1	132.5

Note(s): 1) MSW = Municipal Solid Waste.

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 2008, Mar. 2008, Table A9, p. 133-134 and Table A16, p. 142 for 2006-2030.

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

	Typical New	Number of New Power Plants to Meet Demand				
Electric Generator	Plant Capacity (MW)	2010	2015	2020	2025	2030
Coal Steam	600	13	29	62	110	167
Combined Cycle	400	34	40	50	73	84
Combustion Turbine/Diesel	160	45	53	66	139	271
Nuclear Power (2)	1,000	-	-	8	13	17
Pumped Storage	143 (3)	-	-	-	-	-
Fuel Cells	10	-	-	-	-	-
Conventional Hydropower	20 (3)	1	22	28	28	31
Geothermal	50	4	12	20	30	38
Municipal Solid Waste	30	20	20	21	23	23
Wood and Other Biomass	80	2	9	30	35	45
Solar Thermal	100	1	4	4	4	5
Solar Photovoltaic	5	8	24	37	55	72
Wind	50	282	363	443	514	573
Total		**412**	**581**	**785**	**1,060**	**1,385**
Distributed Generation	160 (4)					

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) 2008, Mar. 2008, Table A9, p. 153-154 and Table A16, p. 162; EIA, Assumption to the AEO 2008, June 2008, Table 39, p. 77; and EIA, Electric Power Annual 2006, Sept. 2007, Table 2.2, p. 19 for pumped storage plant capacity and Table 2.6, p. 21 for hydroelectric plant capacity.

6.2.1 2006 Existing Capacity, by Energy Source (GW)

Plant Fuel Type	Number of Generators	Generator Nameplate Capacity	Net Summer Capacity	Net Winter Capacity
Coal	1,493	336	313	315
Petroleum	3,744	64	58	63
Natural Gas	5,470	443	388	417
Other Gases	105	3	2	2
Nuclear	104	106	100	102
Hydroelectric Conventional	3,988	77	78	77
Other Renewables	1,823	26	24	24
Pumped Storage	150	20	21	21
Other	47	1	1	1
Total	**16,924**	**1,076**	**986**	**1,022**

Source(s): EIA, Electric Power Annual 2006, Oct. 2007, Table 2.2, p. 24.

6.2.2 Net Internal Demand, Capacity Resources, and Capacity Margins in the Contiguous United States (GW)

	Net Internal Demand (1)	Capacity Resources (2)	Capacity Margin (3)
1995	589.9	727.5	18.9%
1996	602.4	730.4	17.5%
1997	618.4	737.9	16.2%
1998	638.1	744.7	14.3%
1999	653.9	765.7	14.6%
2000	680.9	808.1	15.7%
2001	674.8	789.0	14.5%
2002	696.4	833.4	16.4%
2003	696.8	856.1	18.6%
2004	692.9	875.9	20.9%
2005	746.5	882.1	15.4%
2006	760.1	906.2	16.1%

Note(s): 1) Net internal demand represent the system demand that is planned for by the electric power industry`s reliability authority and is equal to internal demand less direct control load management and interruptible demand. Direct control load management: Customer demand that can be interrupted at the time of the seasonal peak by direct control of the system operator by interrupting power supply to individual appliances or equipment on customer premises. This type of control usually reduces the demand of residential customers. Interruptible demand: Customer demand that can be interrupted (through contractual agreement) during peak loads by direct control of the system operator or by the customer at direct request of the system operator. This type of control usually reduces the demand of large-volume commercial and industrial consumers. 2) Capacity Resources: Utility- and IPP-owned generating capacity that is existing or in various stages of planning or construction, less inoperable capacity, plus planned capacity purchases from other resources, less planned capacity sales. 3) Capacity Margin is the amount of unused available capability of an electric power system at peak load as a percentage of capacity resources.

Source(s): EIA, Electric Power Annual 2006, Oct. 2007, Table 3.2, p. 34.

6.2.3 Electric Capacity Factors, by Year and Fuel Type

	Coal	Petroleum	Natural Gas	Nuclear	Conventional Hydroelectric	Solar/PV	Wind	Total
1990	58%	17%	25%	66%	45%	13%	18%	46%
1995	62%	12%	27%	77%	44%	17%	21%	47%
2000	70%	19%	27%	88%	39%	15%	27%	51%
2001	68%	21%	25%	89%	31%	16%	20%	50%
2002	69%	17%	22%	90%	37%	16%	27%	46%
2003	71%	21%	18%	88%	39%	15%	21%	46%
2004	71%	22%	19%	90%	39%	17%	25%	45%
2005	73%	23%	20%	89%	39%	15%	23%	46%
2006	72%	12%	22%	90%	42%	14%	27%	46%
2007(1)	73%	12%	24%	91%	36%	14%	23%	46%

Note(s): 1) Preliminary.

Source(s) EIA, Annual Energy Review 2007, June 2008, 8.2a, p. 226, Table 8.11a, p. 260.

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

	Average Utility Delivery Efficiency (1, 2)	Average Utility Delivery Ratio (Btu/kWh) (2, 3)	Growth Rate (2006-year)
1980	29.3%	11,644	-
1990	30.2%	10,815	-
2000	30.5%	10,644	-
2006	**31.5%**	10,405	**-**
2010	31.8%	10,270	0.3%
2015	32.1%	10,151	0.3%
2020	32.2%	10,098	0.2%
2025	32.3%	10,005	0.2%
2030	32.6%	9,896	0.2%

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

Percent of Electric Generator Fuel Input	3.2%
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 2008, Mar. 2008, Table A2, p. 117-119 for generator consumption and Table A8, p. 131-132 for electricity sales; EIA, Annual Energy Review 2006, July 2007, Diagram 5, p. 223 for T&D losses; EIA, 2005 State Energy Data Report, Tables 8-12 for Electricity Consumption and Generator Fuel Consumption.

6.2.5 2006 Impacts of Saving an Electric Quad (1)

Plant Fuel Type	Utility Fuel Input Shares (%)	Average-Sized Utility Unit (MW) in 2006	Aggregate Number of Units to Provide the Fuel's Share of the Electric Quad (2)
Natural Gas	16%	81	138
Petroleum	2%	17	94
Coal	52%	225	38
Nuclear	21%	1,015	3
Renewable (3)	9%	21	154
Total	100%		**427**

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 2006. Use this table to estimate the avoided capacity implied by saving one electric quad. 2) Based on typical U.S. power plants operating less than full load throughout the year. 3) Includes pumped storage.

Source(s): EIA, Electric Power Annual 2006, Oct. 2007, Table 2.2, p. 24; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119 for consumption and Table A8, p. 131-132 for electricity supply.

6.2.6 Cost of an Electric Quad Used in the Buildings Sector ($2006 Billion)

	Residential	Commercial	**Buildings Sector**
1980	9.92	10.14	**10.02**
1990	9.89	9.13	**9.53**
2000	8.59	7.65	**8.13**
2006	**9.90**	**9.00**	**9.46**
2010	10.30	9.15	**9.74**
2015	9.95	8.45	**9.19**
2020	10.01	8.50	**9.23**
2025	10.11	8.57	**9.30**
2030	10.30	8.80	**9.51**

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 2008, Mar. 2008, Table A2, p. 117-119 and Table A3, p. 120-121; EIA, State Energy Data 2005: Consumption, February 2008, Tables 8-12, p. 18-22 for 1980-2005; EIA, State Energy Data 2005: Prices and Expenditures, Feb. 2008, Tables 2-3, p. 24-25 for 1980-2005 and prices; and EIA, Annual Energy Review 2007, July 2008, Appendix D, Gross Domestic Product and Implicit Price Deflators, p. 377.

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

New Plant Type	2006 Heat Rate (Btu/kWh)	2015 Heat Rate (Btu/kWh)	2006 Installed Capital Costs of a Typical Power Plant: Price ($2006 thousand per MW)	Size (MW)	Cost ($2006 million)
Pulverized Coal	9,200	9,069	1,534	600	920
Coal-Gasification Comb. Cycle	8,765	8,389	1,773	550	975
Combined Cycle	7,196	7,064	703	250	176
Advanced Combined-Cycle	6,752	6,612	706	400	282
Combustion Turbine	10,833	10,675	500	160	80
Advanced Combustion Turbine	9,289	9,012	473	230	109
Fuel Cell	7,930	6,960	5,374	10	54
Wind	10,022	10,280	1,434	50	72
Advanced Nuclear	10,400	10,400	2,475	1,350	3,341

Stock Plant Type	2006	2010	2015	2020	2025	2030
Fossil Fuel Steam Heat Rate (Btu/kWh)	10,542	10,455	10,311	10,181	10,024	9,825
Nuclear Energy Heat Rate (Btu/kWh)	10,517	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 2008, Mar. 2008, Table A2, p. 117-119, and Table A8, p. 131-132. EIA, Assumptions to the AEO 2008, June 2008, Table 48, p. 89 for fossil fuel heat rates, Table 39, p. 77 for other generator data.

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

New Plant Type	Efficiency (HHV): Electrical	Efficiency (HHV): Electrical + Thermal	2006 Installed Capital Costs of Typical DG Technologies: Price ($2006 per kW)	Size (kW)	Cost ($2006 thousand)	Service Life (years)
Solar Photovoltaic	0.16	N.A.	6,547	25	164	30
Fuel Cell	0.36	0.72	5,674	200	1,135	20
Natural Gas Engine	0.32	0.77	1,233	200	247	20
Oil-Fired Engine	0.31	0.82	1,353	200	271	20
Natural Gas Turbine	0.23	0.66	1,974	1000	1,974	20
Natural Gas Microturbine	0.30	0.63	1,768	200	354	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 2007, July 2008, Appendix D, p. 373.

6.2.9 NERC Regions Map

Source(s): EIA, Form EIA-411, Cordinated Bulk Power Supply Program Report, Feb. 2007

6.2.10 Peak Hour Demand and Capacity Margin, Summer and Winter by NERC Region (MW)

		Summer 2006 (1)			Winter 2005/2006 (2)		
Region	Sub-region	Peak Hour Demand	Month	Capacity Margin (3)	Peak Hour Demand	Month	Capacity Margin (3)
ERCOT	-	62,339	August	12%	47,948	December	21%
FRCC	-	45,751	August	10%	43,413	February	19%
MRO	-	47,892	July	4%	39,045	February	16%
NPCC	-	63,241	August	13%	46,828	December	38%
NPCC	New England	28,130	August	10%	21,768	December	34%
NPCC	New York	35,111	August	16%	25,060	December	42%
RFC	-	191,920	August	11%	153,600	December	33%
SERC	-	198,831	August	11%	158,984	February	30%
SERC	Central	41,976	August	8%	34,640	February	27%
SERC	Delta	27,620	August	17%	21,442	December	42%
SERC	Gateway	19,313	July	12%	14,511	December	43%
SERC	Southeastern	47,535	August	15%	38,466	February	31%
SERC	VACAR	62,608	August	7%	50,804	February	29%
SPP	-	42,556	July	12%	31,764	December	33%
WECC	-	142,096	July	11%	107,493	December	29%
WECC	AZ-NM-SNV	30,111	July	14%	17,130	December	47%
WECC	CA-MX US	62,324	July	9%	40,537	December	25%
WECC	NWPP	38,753	July	27%	40,298	December	29%
WECC	RMPA	10,908	July	12%	9,528	December	24%
U.S. TOTAL		776,193	July	13%	609,564	December	31%

Note(s): 1) Summer Demand includes the months of June, July, August, and September. 2) Winter Demand includes December of the previous year and January-March of the current year. 3) Capacity Margin is the amount of unused available capability of an electric power system at peak load as a percentage of net capacity resources. Net Capacity Resources: Utility- and IPP-owned generating capacity that is existing or in various stages of planning or construction, less inoperable capacity, plus planned capacity purchases from other resources, less planned capacity sales.

Source(s): NERC, Electricity Supply and Demand Database 2007, Novemeber 2007, Tables used: Capacity and Demand 1990-2007 and Monthly Demand and Energy 1997-2007.

6.3.1 Natural Gas Overview (Trillion Cubic Feet)

	Production	Supplemental Gas	Net Import	Storage Withdrawal	Balancing Item (1)	Consumption (2)
1980	19.40	0.16	0.94	0.02	-0.64	19.88
1990	17.81	0.12	1.45	-0.51	0.31	19.17
2000	19.18	0.09	3.54	0.83	-0.31	23.33
2006	**18.51**	**0.06**	**3.46**	**-0.74**	**0.37**	**21.66**
2010	19.29	0.06	3.85	0.09	-0.05	23.25
2015	19.52	0.06	4.03	0.09	-0.05	23.66
2020	19.67	0.06	3.55	0.09	-0.05	23.33
2025	19.60	0.06	3.28	0.09	-0.04	22.99
2030	19.43	0.06	3.18	0.09	-0.05	22.72

Note(s): 1) Net internal demand represent the system demand that is planned for by the electric power industry`s reliability authority and is equal to

Source(s): EIA, Annual Energy Review 2007, June 2008, Table 6.1, p. 181 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A13, p. 139 for 2006-2030.

6.3.2 Natural Gas in Underground Storage (Billion Cubic Feet)

	Base Gas	Working Gas	Total	Underground Storage Capacity	
1980	3642	2655	6297	7434	85%
1990	3868	3068	6936	7794	89%
2000	4352	1719	6071	8241	74%
2001	4301	2904	7204	8415	86%
2002	4340	2375	6715	8207	82%
2003	4303	2563	6866	8206	84%
2004	4201	2696	6897	8255	84%
2005	4200	2635	6835	8268	83%
2006	4211	3070	7281	8330	87%
2007	4234	2879	7113	8368	85%

Source(s): EIA, Annual Energy Review 2007, June 2008, Table 6.6, p. 193.

6.3.3 Natural Gas Well Productivity

	Gross Withdrawals from Wells (billion cubic feet)	Producing Wells	Average Productivity (thousand cubic feet per day)
1980	17,573	182	263.8
1990	16,054	269	163.4
2000	17,726	276	158.8
2001	18,129	373	133.1
2002	17,795	388	125.7
2003	17,882	393	124.6
2004	17,885	406	120.3
2005	17,472	426	112.4
2006	17,942	449	109.6
2007	18,437	427	118.3

Source(s): EIA, Natural Gas Annual 2006, October 2007, p. 26

6.3.4 Natural Gas End-Use Deliveries by Type of Distributor for 1996, 2000, and 2006

	1996			2000			2006		
	Volume Delivered		Customers	Volume Delivered		Customers	Volume Delivered		Customers
Type of Distributor	(Tcf)	(Percent)	(millions)	(Tcf)	(Percent)	(millions)	(Tcf)	(Percent)	(millions)
Local Distribution Comp.	14.3	72%	58.7	14.2	67%	57.8	11.1	56%	61.4
Investor-Owned	13.3		54.0	13.2		4.3	0.8		4.9
Municipal	0.8		4.0	0.8		0.5	0.2		0.8
Privately-Owned	0.2		0.7	0.2		0.1	0.0		0.1
Cooperative	0.0		0.1	0.0		62.8	12.0		67.2
Interstate Pipeline	1.6	8%	0.0	2.5	12%	0.0	3.5	17%	0.0
Intrastate Pipeline	3.8	19%	1.4	4.3	20%	1.4	4.3	21%	2.7
Other	0.3	1%	0.0	0.2	1%	0.0	0.2	1%	0.0
Total	20.0	100%	60.2	21.2	100%	64.2	19.9	100%	69.9

Source(s): EIA, Distribution of Natural Gas: The Final Step in the Transmission Process, June 2008, Table 1, p. 6.

6.3.5 Natural Gas Consumption, by Sector (Trillion Cubic Feet)

	Residential	Commercial	Industrial	Transportation	Electric Power	Total
1980	4.75	2.61	8.20	0.64	3.68	19.88
1990	4.39	2.62	8.26	0.66	3.25	19.17
2000	5.00	3.18	9.29	0.66	5.21	23.33
2006	**4.37**	**2.83**	**7.62**	**0.60**	**6.24**	**21.66**
2010	4.81	2.96	8.13	0.66	6.70	23.25
2015	5.01	3.20	8.19	0.69	6.56	23.66
2020	5.15	3.37	8.15	0.74	5.92	23.33
2025	5.19	3.53	8.20	0.78	5.30	22.99
2030	5.17	3.67	8.11	0.78	4.99	22.72

Source(s): EIA, Annual Energy Review 2007, June 2008, Table 6.5, p. 191 for 1980-2000; and EIA, Annual Energy Outlook 2008, Mar. 2008, Table A13, p. 139 for 2006-2030.

6.4.1 Emissions of Carbon Dioxide from Electric Utilities (Million Metric Tons)

1990	1980
1995	1955
2000	2301
2006	**2344**
2010	2413
2015	2519
2020	2627
2025	2771
2030	2948

Source(s): EIA, Emissions of Green House Gases in the United States 2006, p. 16, November 2007; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A18, p. 145.

6.4.2 Electric Quad Average Carbon Dioxide Emissions with Average Utility Fuel Mix (Million Metric Tons) (1)

	Petroleum	Natural Gas	Coal	Nuclear	Renewable	Total
2006	**1.38**	**8.57**	**48.91**	**0.00**	**0.30**	**59.16**
2007	0.00	0.75	0.59	0.00	0.00	1.34
2008	0.00	0.81	0.35	0.00	0.00	1.17
2009	0.00	0.72	0.86	0.00	0.00	1.58
2010	0.00	0.63	1.32	0.00	0.00	1.95
2011	0.00	0.54	2.25	0.00	0.00	2.79
2012	0.00	0.58	2.80	0.00	0.00	3.38
2013	0.00	0.25	3.13	0.00	0.00	3.38
2014	0.00	0.24	3.62	0.00	0.00	3.86
2015	0.00	0.43	3.88	0.00	0.00	4.31
2016	0.00	0.55	4.24	0.00	0.00	4.80
2017	0.00	0.44	4.86	0.00	0.00	5.31
2018	0.00	0.18	5.69	0.00	0.00	5.87
2019	0.00	0.00	6.32	0.00	0.00	6.32
2020	0.00	0.00	6.85	0.00	0.01	6.85
2021	0.00	0.00	7.61	0.00	0.01	7.61
2022	0.00	0.00	8.21	0.00	0.01	8.22
2023	0.00	0.00	8.94	0.00	0.01	8.94
2024	0.00	0.00	9.68	0.00	0.01	9.69
2025	0.00	0.00	10.29	0.00	0.01	10.30
2026	0.00	0.00	10.88	0.00	0.01	10.88
2027	0.00	0.00	11.55	0.00	0.01	11.55
2028	0.00	0.00	12.19	0.00	0.01	12.20
2029	0.00	0.00	12.87	0.00	0.01	12.88
2030	0.00	0.00	13.78	0.00	0.01	13.79

Note(s): 1) This table provides estimates of the carbon emissions resulting from consumption of a primary quad at electric utilities. Projected (2007-2030) 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 2008, Mar. 2008, Table A2, p. 137-139 and Table A18, p. 164.

6.4.3 The Clean Air Act

1970 Amenements

- Established the National Ambient Air Quality Standards(NAAQS) for staionary sources and placed limits on moble sources.
- Established the New Source Performance Standards(NSPS) which manadated a strict limit on emissions from new pollution sources.
- Expanded on the State Implementation Plans(SIPs) to carry out mandates.

1977 Amendments

- Categorized regions into attainment and non-attainment regions.
- Non-attainment designation occurred if region emitted in excess of any federal standard.
- If a region complied with federal standards, it was designated as a PSD, which stands for prevention of significant deterioration.
- Lengthened federal deadlines for meeting pollution reduction, particularly in regards to moble emissions sources.

1990 Amendments

- Established a sulfer dioxide(SOx) and a nitrous oxide(NOx) cap and trade program. Under this program, an emissions cap is set and permits are issued. An emitter of SOx or NOx must have a permit for each unit of pollutant they release. These emissions permits may be traded(bought and sold) amongst polluting parties to minimize costs.
- Manadated the control of 189 Hazardeous Pollutants.
- Updated and expanded provisions of the National Ambient Air Quality Standards.

Source(s): The United States Congress, Public Law 108-201, The Clean Air Act as amended through February 24, 2004; EPA, The History of the Clean http://www.epa.gov/air/caa/caa_history.html

6.5.1 Funding for States with Active Public Benefit Efficiencies Programs as of 2003 (Nominal Dollars)

	Reporting Year	Program Budget	Percent of Utility Revenues
Arizona	2002	2.0	0.1%
California	2003	240.0	1.5%
Connecticut	2002	87.1	3.1%
Illinois	2003	2.0	0.0%
Massachusetts	2002	138.0	3.0%
Maine	2003	2.9	0.3%
Michigan	2002	7.8	0.1%
Montana	2002	14.3	2.0%
New Hampshire(1)	2002-2003	5.2	0.5%
New Jersey	2002	99.6	1.5%
New York	2002	129.0	1.3%
Nevada	2003	11.2	0.5%
Ohio	2002	14.3	0.1%
Oregon(2)	2002	19.1	0.9%
Rhode Island	2002	16.4	2.7%
Texas	2002	69.0	0.4%
Vermont	2002	16.8	3.3%
Wisconsin	FY2003	49.7	1.4%
Total		**924.4**	

Note(s): 1) Due to a start-up date of June 1, 2002 and counted til March 2003; remainder of year estimated 2) Partial year; program began March 1, 2002

Source(s): American Council for an Energy Efficient Economy, Kushle, York, Wittie, Five Years In: An Examination of the First Half Decade of Public Benefit Energy Effciency Policies, April 2004, Table 3, p. 27

6.5.2 Demand-Side Management Funds Collected for Energy Efficiency Programs in 2000 ($2006) (1)

	Total Expenditures ($ million)	Per Capita Spendings ($/person)
Connecticut	77.4	22.69
Massachusetts	115.6	18.18
Rhode Island	16.3	15.53
New Jersey	129.6	15.38
Vermont	7.3	12.00
Maine	14.7	11.50
Wisconsin	57.3	10.67
Hawaii	12.8	10.57
New York	189.7	9.99
California	334.0	9.82
National(2)	**1,276**	**4.52**

Note(s): 1) This table shows demand side management funds(including Public Benefit Funds) collected in 2000 that were spent of energy efficiency programs. 2) The top ten states in spending per capita represent 74.8% of total U.S. funds collected for energy effciency programs.

Source(s): American Council for an Energy Efficient Economy, Kushle, York, Wittie, Five Years In: An Examination of the First Half Decade of Public Benefit Energy Effciency Policies, April 2004, Table 3, p. 27

7.1.1 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.

7.1.2 Federal Minimum Efficiency Standard for Commercial Cooling Equipment from the Energy Policy Act of 2005 (1)

Type	65 - 134 kBtu/h	135 - 239 kBtu/h	240 - 759 kBtu/h
Central Air Conditioner (EER)			
without heating or electrical resistance heating	11.2	11.0	10.0
without heating equipment	11.0	10.8	9.8
Central Air Heat Pump (EER) -- Cooling			
without heating or electrical resistance heating	11.0	10.6	9.5
without heating equipment	10.8	10.4	9.3
Central Air Heat Pump (COP) -- Heating	3.3	3.2	3.2

Note(s): 1) The effective date of these manufacturing standards is January 1, 2010.

Source(s): U. S. Government, Energy Policy Act of 2005, August 2005, Section 136, Paragraphs 7-9.

7.1.3 HVAC Tax Incentives of the Energy Policy Act of 2005

Equipment Type	Qualifying Efficiency	Credit
Central air conditioner	15 SEER and 12.5 EER	300
Central air-source heat pump	15 SEER, 9 HSPF, and 13 EER	300
Ground-source heat pump		
Closed loop	14.1 EER and 3.3 COP	300
Open loop	16.2 EER and 3.6 COP	300
Direct expansion (DX)	15.0 EER and 3.5 COP	300
Gas, oil, or propane furnace or boiler	95% AFUE	150
Furnace Blower	Electricity use <2% of total furnace	50
	site energy consumption	300
Electric heat pump water heater	2.0 EF	300
Gas, oil, or propane water heater	0.80 EF	

Source(s): ACEEE, The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts, Sept. 2005, Table 1, p. 6.

7.1.4 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)	1986	1989	75%	1994	75%	1994
			100%	1996 (4)	100%	1996
Bromofluorocarbons (Halons)	1986	1992	100%	1994 (4)	100%	1994
Hydrochlorofluorocarbons (HCFCs)	1989 HCFC consumption + 2.8 % of 1989 CFC consumption	1996	35%	2004	35%	2003
			75%	2010	75%	2010
			90%	2015	90%	2015
			99.5%	2020	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. 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.

7.2.1 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.

7.2.2 Energy Independence and Security Act 2007, Lighting Standards for General Service Incandescent Lamps

General Service Incandescent

Effective Date	Maximum Wattage	Rated Lumen Range	Minimum Life
2012	72	1,490-2,600	1000 hrs.
2013	53	1,050-1,498	1000 hrs.
2014	43	750-1,049	1000 hrs.
2015	29	310-749	1000 hrs.

Modified Spectrum General Service Incandescent

Effective Date	Maximum Wattage	Rated Lumen Range	Minimum Life
2012	72	1,118-1,950	1000 hrs.
2013	53	788-1,117	1000 hrs.
2014	43	563-787	1000 hrs.
2015	29	232-563	1000 hrs.

By 2020, the minimum efficacy for general service incandescent will be 45 lm/W unless the Secretary of Energy has implemented another standard which saves as much or more energy than a 45 lm/W standard.

Source(s): U. S. Government, Energy Independence and Security Act of 2007, January 2007, Section 321.

7.2.3 Federal Minimum Efficiency Standard for Commercial Refrigeration Equipment from the Energy Policy Act of 2005 (1)

Type of Equipment	Consumption Maximum (kWh/day) (2)
Refrigerator with Solid Doors	0.10 V + 2.04
Refrigerator with Transparent Doors	0.12 V + 3.34
Freezers with Solid Doors	0.40 V + 1.38
Freezers with Transparent Doors	0.75 V + 4.10
Refrigerators/Freezers with Solid Doors (3)	0.27 AV - 0.71, or 0.70

Note(s): 1) The effective date of these manufacturing standards is January 1, 2010. 2) V = volume in cubic feet. 3) AV = Adjusted Volume in cubic feet. Standard is the greater of the two numbers.

Source(s): U. S. Government, Energy Policy Act of 2005, August 2005, Section 136, Paragraphs 7-9

7.2.4 Federal Minimum Efficiency Standards from the Energy Policy Act of 2005

	Effective Data	Standard
Residential		
Ceiling Fan Light Kits	Jan. 2007	Packaged with ENERGY STAR v2 screw-in CFLs
Dehumidifiers	Oct. 2007	ENERGY STAR v1 criteria
CFLs	Jan. 2006	ENERGY STAR v2 criteria
Torchiere Lighting Fixtures	Jan. 2006	190 Watt maximum
Commercial		
Clothes Washers	Jan. 2007	MEF at least 1.26 and WF no more than 9.5 (1)
Distribution Transformer	Jan. 2007	Meet NEMA TP-1-2002
Exit Signs	Jan. 2006	ENERGY STAR v2 criteria
Fluorescent Lamp Ballasts (F34 and F96ES)	Jan. 2009	Closes loophole in DOE regulations so that these ballasts will be electronic, like other covered ballasts.
Ice-Makers (Cube type, 50-2,500 lbs/day)	Jan. 2010	CEC Standard (2)
Mercury Vapor Lamp Ballasts	Jan. 2008	Bans sale of mercury vapor lamp ballasts
Pre-Rinse Spray Valves	Jan. 2006	Maximum 1.6 gallon/minute
Unit Heaters	Aug. 2008	Equipped with an intermittent ignition device and have power venting or an automatic flue damper

Note(s): 1) MEF = Modified Energy Factor. WF = Water Factor. 2) California Energy Commission.

Source(s): ACEEE, The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts, Sept. 2005, Table 2, p. 10.

7.2.5 Tax Incentive of the Energy Policy Act of 2005

Appliance Manufacturers
- -- Refrigerator manufactures receive a $75 credit for each unit sold that uses 15-19.9% less energy than required by the 2001 Federal minimum efficiency; $125 for 20-24.9% less; and $175 for at least 25% less.
- -- Clothes washer manufacturers receive a $100 credit for each unit sold that meeting the 2007 ENERGY STAR criteria.
- -- Dishwasher manufacturers receive a $3 credit per percentage of energy savings greater than the current ENERGY STAR criteria for each unit sold. For example, a dishwasher is 15% more efficient than the current ENERGY STAR criteria, the credit is $3 X 15 = $45.
- -- Credits are only available for products manufactured in the U.S.
- -- Each manufacturer is capped at $75 million for available credits.

Stationary Fuel Cells and Microturbines
- -- Tax credit of 30%, up to $1000 per kW for fuel cells that at 500 kW or greater and have an efficiency of at least 30%. Residential applications do not have a capacity or efficiency requirement. Units must be put in place between January 1, 2006 and December 31, 2007.
- -- Tax credit of 10%, up to $200 per kW for microturbines that are less than 2,000 kW and have an efficiency of at least 26%. Units must be put in place between January 1, 2006 and December 31, 2007.

Source(s): ACEEE, The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts, Sept. 2005, p. 1-7.

7.2.6 Daylight Savings Time from the Energy Policy Act of 2005 (1)

- -- Daylight saving time starts second Sunday of March and now begins 3 weeks earlier in the spring.
- -- Daylight saving time ends the first Sunday of November, one week later in the fall.
- -- New schedule starts in 2007. The last time daylight saving time schedule was last adjusted in 1986.
- -- Congress retains the right to revert the daylight saving time back to the 2005 time schedule.
- -- Secretary of Energy to report to Congress the impact of extending daylight saving time.

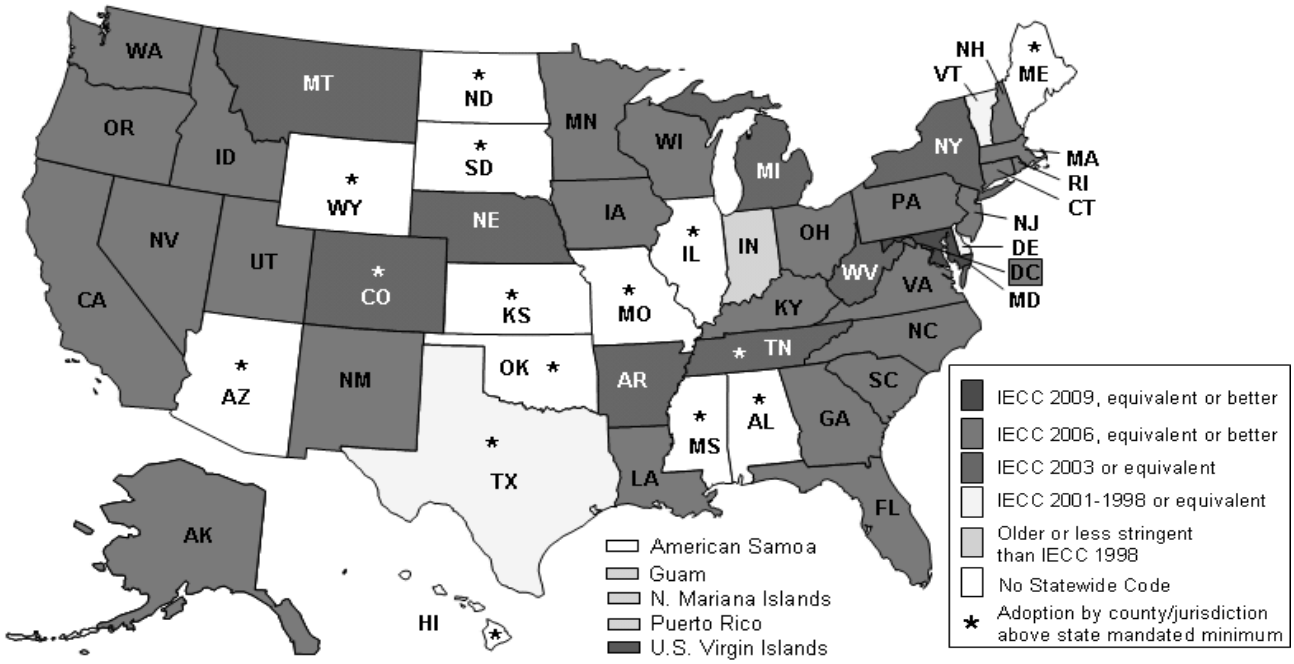
Source(s): U.S. Government, Energy Policy Act of 2005, August 2005, Section 110.

7.2.7 Energy Policy Act of 1992, Appliance and Equipment Efficiency Standards

- -- DOE is to: (1) detail energy conservation and labeling requirements for specified commercial and industrial equipment (including lamps and plumbing products); and (2) delineate standards for heating and air-conditioning equipment, electric motors, high intensity discharge lamps, and distribution transformers.
- -- DOE is to provide financial and technical assistance to support a voluntary national testing and information program for widely used commercial office equipment and luminaries with potential for significant energy savings.
- -- Requires DOE to report to the Congress on: (1) the potential for the development and commercialization of appliances which are substantially more efficient than required by Federal or State law; and (2) the energy savings and environmental benefits of early appliance replacement programs.

Source(s): U.S. Government, Energy Policy Act of 1992 Conference Report, Oct. 1992.

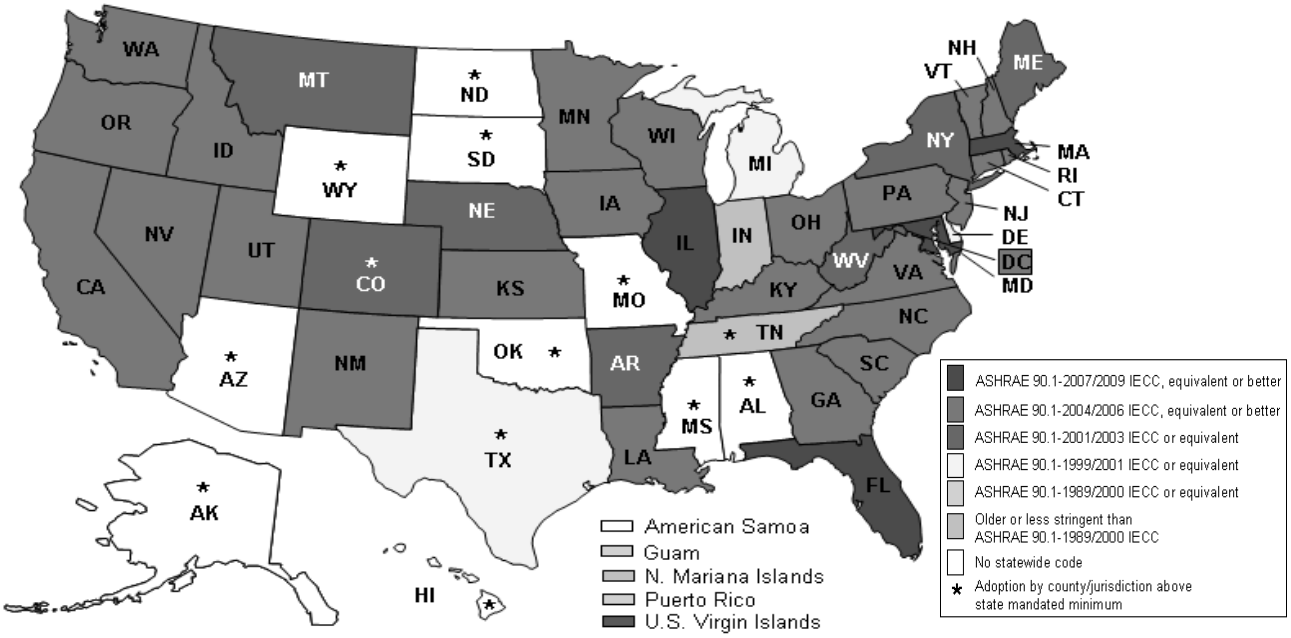
7.3.1 Status of State Energy Codes: Residential Sector (1)



Note(s): 1) These are the current residential codes as of October 2009.

Source(s): The Department of Energy, Energy Efficiency and Renewable Energy, The Status of State Energy Codes, www.energycodes.gov/implement/state_codes/;

7.3.2 Status of State Energy Codes: Commercial Sector (1)



Note(s): 1) These are the current Commercial codes as of October 2009.

Source(s): The Department of Energy, Energy Efficiency and Renewable Energy, The Status of State Energy Codes, www.energycodes.gov/implement/state_codes/;

7.3.3 Buildings-Related DOE Funding in the American Recovery and Reinvestment Act of 2009

Innovative Technology Loan Guarantee Program
- -- $6.0 billion to provide loans to the commercial sector for renewable energy and transmission projects. This program was originally created under the Energy Policy Act of 2005

Weatherization Assistance Program
- -- $5.0 billion for grants that are distributed to states and territories. Funding is used to improve the energy efficiency of homes owned by households earning less than 200% of the federal poverty level. Fiscal year 2008 funding was $227.2 million.

Electricity Delivery and Energy Reliability
- -- $4.5 billion provided to the Office of Electricity Delivery and Energy Reliability to modernize the electric grid, including deployment of smart meters and electricity storage systems.

Energy Efficiency and Conservation Block Grants
- -- $3.2 billion to be distributed to local governments for energy efficiency programs. Program was established under the Energy Independence and Security Act (EISA) and $2.8 billion will be allocated based on the formula provided in EISA. $400 million is to be allocated on a competitive basis.

State Energy Program
- -- $3.1 billion is available to states that put in place utility rate decoupling and improved building codes.

Appliance Rebate Program
- -- $300 million for consumer rebates to replace of old appliances with ENERGY STAR-qualified appliances.

Source(s): American Recovery and Reinvestment Act of 2009. February 17, 2009. Public Law 111-5;
Congressional Research Service, American Recovery and Reinvestment Act of 2009, Public Law 111-5, February 2009;
ACEEE, Summary of Energy Efficiency Provisions in ARRA 2009, October 2009.

7.3.4 Buildings-Related Funding in the American Recovery and Reinvestment Act of 2009

Department of Education
- -- $8.8 billion is provided to fund renovation, repair, and modernization of education facilites through the State Fiscal Stabilization Fund. These measures are to follow the guidelines of one of four recognized green building rating systems.

Department of Housing and Urban Development
- -- $3 billion to the Public Housing Capital Fund, awarded based on the existing formula to public housing agencies to improve or build new affordable housing.
- -- $1 billion to the Public Housing Capital Fund "for priority investments, including investments that leverage private sector funding or financing for renovations and energy conservation retrofit investments." This funding is awarded competitively.
- -- $2.25 billion for the HOME Investment Partnership Program to provide state grants to buy, renovate, and create affordable housing.
- -- $250 million in grants and loans available to HUD-assisted housing owners for energy retrofits and "green" investments.

General Services Administration (GSA)
- -- $4.5 billion to convert GSA facilities to high performance green buildings as defined in the Energy Independence and Security Act of 2007. By 2015, existing buildings must use 30% less fossil energy compared to 2005 levels. New buildings and major renovations must use 55% less fossil energy than 2003 levels by 2010, and use no fossil energy by 2030.

Department of Defense
- -- $3.69 billion for "energy efficiency projects and to repair and modernize" facililites.

Department of Interior
- -- $884 million to be used for construction activities and energy retrofits at the U.S. National Park Service, U.S. Fish and Wildlife Service, and the Bureau of Land Management.

Source(s): American Recovery and Reinvestment Act of 2009. February 17, 2009. Public Law 111-5;
Congressional Research Service, American Recovery and Reinvestment Act of 2009, Public Law 111-5, February 2009;
ACEEE, Summary of Energy Efficiency Provisions in ARRA 2009, October 2009.

7.3.5 Tax Incentive of the American Recovery and Reinvestment Act of 2009

Envelope Improvements to Existing Homes (1)
-- Increases existing tax credit to 30% of costs up to $1,500 to upgrade building envelope to be compliant with codes for new construction. Upgrades to building shell, HVAC system, and windows and doors may qualify. Improvements must be installed between January 1, 2008 and December 31, 2010.

Renewable Energy Production Tax Credits
-- Tax credit to 30% of costs for installation of on-site renewable energy equipment, with no caps on total investment. Tax credits for wind energy are available through 2012, while other renewables can receive a tax credit if placed into service through 2013.

Renewable Energy Investment Tax Credits
-- Provides the option to take an investment tax credit in lieu of the production tax credit. This allows the full credit to be provided once a system is placed into service, rather than over the production period of the system. The goal of this option is to make financing a project less difficult.

Clean Renewable Energy Bonds
-- $1.6 billion to finance renewable energy generation. Funds are to be available in equal proportion to state/local/tribal governments, municipal utilities, and electric cooperatives.

Energy Conservation Bonds
-- $2.4 billion issued to states based on population. Bonds can be used to finance a variety of projects that reduce energy use.

Note(s): 1) Based on tax credit from Energy Policy Act of 2005. See the table "Tax Incentive of the Energy Policy Act of 2005."
Source(s): American Recovery and Reinvestment Act of 2009. February 17, 2009. Public Law 111-5;
Sissine, et al. "American Recovery and Reinvestment Act of 2009. February 17, 2009. Public Law 111-5." Congressional Research Service. 2009;
McDermott Will & Emory. "Energy Tax Provisions Included in American Recovery and Reinvestment Act of 2009." 2009.

7.3.6 Tax Incentives of the Emergency Economic Stabilization Act of 2008 (1)

New Homes
-- Extends tax credits for efficient new homes to December 31, 2009.

Envelope Improvements to Existing Homes
-- Reinstates 10% tax credit for building shell, HVAC and windows to include installations during 2009.

Commercial Buildings
-- Extends tax deductions for efficiency upgrades in commercial buildings to December 31, 2013.

Note(s): 1) Tax incentives detailed are extensions to incentives found in the Energy Policy Act of 2005. See the table "Tax Incentive of the Energy Policy Act of 2005" for details.
Source(s): Emergency Economic Stabilization Act of 2008, Public Law 110-343, October 2008.

7.3.7 Energy Independence and Security Act 2007, High Performance Commercial Buildings

- Create the Office of Commercial High Performance Green Buildings
- The Office of Commercial High Performance Green Buildings with The Office of Federal High Performance Green Buildings will establish a High Performance Green Buildings Clearinghouse to disseminate research through outreach, education, and technical assistance
- Zero Net Energy Initiative for Commercial Buildings was also included establishing specific goals
  Net zero energy use in all new commercial buildings constructed by 2030
  Net zero energy use in 50% of the United State commercial building stock by 2040
  Net zero energy use in the entire United States commercial building stock by 2050

Source(s): The 110th Congress of the United States, The Energy Independence and Security Act of 2007, January 2007, Section 422.

7.3.8 Tax Incentive of the Energy Policy Act of 2005

New Homes
- -- Builders who build homes that use 50% less energy for space heating and cooling than the IECC 2003 are eligible for a $2,000 tax credit per home.
- -- Manufactured housing builder that either uses 30% less energy than this reference code or that meet the then-current ENERGY STAR criteria are eligible for $1,000 tax credit per home. At least 10% of energy savings must be obtained through building envelope improvements.

Envelope Improvements to Existing Homes
- -- 10% tax credit up to $500 for upgrading building envelope to be compliant with codes for new construction. Window replacement is capped at $200. $500 is the cap for all for envelope and HVAC improvements. Improvements must be installed between January 1, 2006 and December 31, 2007.

Commercial Buildings
- -- Tax deduction up to $1.80/SF for new commercial buildings which are 50% more efficient than the requirements of ASHRAE 90.1-19XX.
- -- Tax deduction up to $0.60/SF for existing commercial buildings which upgrade the envelope, lighting, or HVAC building systems to 50% more efficient than ASHRAE 90.1-19XX.. The deduction can be combined when improvements are made to two building components.
- -- Deductions apply to new buildings placed in service and improvements to existing buildings completed between August X, 2005 and December 31, 2007.

Source(s): ACEEE, The Federal Energy Policy Act of 2005 and its Implications for Energy Efficiency Program Efforts, Sept. 2005, p. 1-7.

7.3.9 Energy Policy Act of 1992, Building Energy Codes

- -- Each State must certify to the Secretary of Energy whether its energy efficiency standards with respect to residential and commercial building codes meet or exceed those of the Council of American Building Officials (CABO) Model Energy Code, 1992, and of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, respectively.
- -- Requires DOE to provide technical assistance and incentive funding to the States to promote increased use of energy efficiency codes for buildings.
- -- Directs the Secretary to: (1) establish standards that require energy efficiency measures that are technologically feasible and economically justified in new Federal buildings; and (2) review them every five years. Mandates Federal agency compliance with such standards.
- -- Prescribes guidelines under which DOE shall support the upgrading of voluntary building energy codes for new residential and commercial buildings.
- -- The Department of Housing and Urban Development (HUD) and Agriculture are to jointly establish energy efficiency standards for residential housing. Amends Federal law regarding veterans' readjustment benefits to condition a loan for new residential housing upon compliance with such standards.
- -- DOE is to: (1) issue voluntary building energy code guidelines for use by the private and public sectors to encourage the assignment of energy efficiency ratings for new residential buildings; (2) establish a technical assistance program for State and local organizations to encourage the use of residential energy efficiency rating systems consistent with such guidelines; (3) provide matching grants for the establishment of regional building energy efficiency centers in each of the regions served by a DOE regional support office; and (4) establish an advisory task force to evaluate grant activities.
- -- HUD is to: (1) assess the energy performance of manufactured housing and make recommendations to the National Commission on Manufactured Housing regarding thermal insulation and energy efficiency improvements; and (2) test the performance and determine the cost effectiveness of manufactured housing constructed in compliance with certain statutory standards. Authorizes the States to establish thermal insulation and energy efficiency standards for manufactured housing if the Secretary of HUD has not issued final regulations by October 1993.
- -- HUD is to promulgate a uniform affordable housing plan using energy efficient mortgages (mortgages that provide financing incentives either for the purchase of energy efficient homes, or for incorporating the cost of such improvements into the mortgage).
- -- DOE is to provide financial assistance to support a voluntary national window rating program that will develop energy ratings and labels for windows and window systems. Requires the National Fenestration Rating Council to develop such rating program according to specified procedures. Requires the Secretary to develop specified alternative rating systems if a national voluntary window rating program consistent with this Act has not been developed.

Source(s): U.S. Government, Energy Policy Act of 1992 Conference Report, Oct. 1992.

8.1.1 Total Use of Water by Buildings (Billion Gallons per Day) (1)

Year	All Buildings	% of Total Water Use	Residential	% of Total Water Use	Commercial	% of Total Water Use
1985	31,260	7.8%	24,320	6.1%	6,940	1.7%
1990	33,580	8.2%	25,290	6.2%	8,290	2.0%
1995	35,670	8.9%	26,090	6.5%	9,580	2.4%
2000 (2)	38,342	11.1%	28,028	6.9%	10,314	2.5%
2005 (3)	39,601	10.1%	29,430	6.4%	10,171	2.2%

Note(s): 1) Includes water from the public supply and self-supplied sources (e.g., wells) for residential and commercial sectors. 2) USGS did not estimate water use in the commercial and residential sectors for 2000. Estimates are based on available data and 1995 splits between domestic and commercial use. 3) USGS did not estimate commercial sector use for 2005. Estimated based on available data and commercial percentage in 1995.

Source(s): U.S. Geological Survey, Estimated Use of Water in the U.S. in 1985, U.S. Geological Survey Circular 1004, 1988; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1990, U.S. Geological Survey Circular 1081, 1993; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1995, U.S. Geological Survey Circular 1200, 1998; U.S. Geological Survey, Estimated Use of Water in the U.S. in 2000, U.S. Geological Survey Circular 1268, 2004; and U.S. Geological Survey, Estimated Use of Water in the U.S. in 2005, U.S. Geological Survey Circular 1344, 2009.

8.1.2 Average Energy Intesity of Public Water Supplies by Location (kWh per Million Gallons)

Location	Sourcing		Treatment (1)	Distribution	Wastewater	Total
United States (2)	836		627	437	1,363	3,263
United States (3)	2,230		65	(6)	1,649	2,295
Northern California Indoor	2,117		111	1,272	1,911	5,411
Northern California Outdoor	2,117		111	1,272	0	3,500
Southern California Indoor	9,727	(5)	111	1,272	1,911	13,021
Southern California Outdoor	9,727		111	1,272	0	11,110
Iowa	2390		(6)	380	1,570	4,340
Massachusetts	1,500		(6)	(6)	1,750	3,250
Wisconsin Class AB (4)	-		-	-	not included	1,510
Wisconsin Class C (4)	-		-	-	not included	1,850
Wisconsin Class D (4)	-		-	-	not included	1,890
Wisconsin Total (4)	-		-	-	not included	1,601

Note(s): 1) Treatment before delivery to customer. 2) Source: Electric Policy Research Institute (EPRI) 2009. Wastewater estimated based on EPRI 2002. 3) Source: TIAX 2006. 4) Based on water treatment facility size: Class AB >4000 customers, Class C: 1000 to 4000, Class D <1000. Median energy use value reported. 5) Southern California sourcing energy is high because of energy used to pump water from Northern California. 6) Included with Sourcing.

Source(s): Electric Power Research Institute, Program on Technology Innovation: Electric Efficiency Through Water Supply Technologies A Roadmap, Publication 1019360, 2009; EPRI, Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply & Treatment – The Next Half Century, 2002; DOE/TIAX LLC, Commercial and Residential Sector Miscellaneous Electricity Consumption: Y2005 and Projections to 2030, 2006; California Energy Commission/Navigant Consulting, Refining Estimates of Water Related Energy Use in California, Public Interest Energy Research Program, CEC-500-2006-118; Iowa Association of Municipal Utilities/Iowa Energy Center, Energy Consumption and Costs to Treat Water and Wastewater in Iowa Part II: Survey Results Tables and Charts, 2002; EPA, Ensuring a Sustainable Future: An Energy Management Guidebook for Wastewater and Water Utilities, 2008; and Wisconsin Focus on Energy, Energy Use at Wisconsin's Drinking Water Utilities, 2003.

8.1.3 Energy Use for Wastewater Treatment by Plants by Capacity andTreatment Level (kWh per Million Gallons)

	Level Of Treatment				
		Secondary		Tertiary	
Treatment Capacity (Million Gallons per Day)	Less than Secondary	Trickling Filter	Activated Sludge	Advanced	Advanced with Nitrification
1	-	1,811	2,236	2,596	2,951
5	-	978	1,369	1,573	1,926
10	-	852	1,203	1,408	1,791
20	-	750	1,114	1,303	1,676
50	-	687	1,051	1,216	1,588
100	-	673	1,028	1,188	1,558

Note(s): The level of treatment indicates the amount of processing involved before water is released from the treatment facility. Primary treatment removes solids and oils from wastewater. Secondary treatment uses biological processes to remove organic material from the water. Tertiary treatment includes additional processes to further refine the water. Nitrification is a process to remove nitrogen from water.

Source(s): Electric Power Research Institute, Water & Sustainability (Volume 4): U.S. Electricity Consumption for Water Supply & Treatment – The Next Half Century, 2002.

8.1.4 Municipal Wastewater Treatment Facilities by Treatment Level and Population Served (Millions) (1)

	Less than Secondary		Secondary		Tertiary		No Discharge		Partial Treatment	
	Facilities	Pop.	Facilities	Pop.	Facilities	Pop.	Facilities	Pop.	Facilities	Pop.
1996	176	17.2	9388	81.9	4428	82.9	2032	7.7	0	-
2000	47	6.4	9156	88.2	4892	100.9	1938	12.3	222	-
2004	40	3.3	9221	96.5	4916	108.5	2188	14.6	218	-

Note(s): 1) The level of treatment indicates the amount of processing involved before water is released from the treatment facility. Primary treatment removes solids and oils from wastewater. Secondary treatment uses biological processes to remove organic material from the water. Tertiary treatment includes additional processes to further refine the water. No Discharge refers to facilities that do not discharge effluent to surface waters (e.g. groundwater discharge). Partial Treatment facilities perform some treatment before transferring water to another facility for further treatment.

Source(s): EPA, Clean Watersheds Needs Survey 2004 Report to Congress, 2008.

8.2.1 Residential Water Use by Source (Billion Gallons per Day)

Year	Total Residential Water Use	Public Supply (1)	Self-Supply (2)
1980	25,400	22,000	3,400
1985	24,320	21,000	3,320
1990	25,290	21,900	3,390
1995	26,090	22,700	3,390
2000	28,028 (3)	24,438 (3)	3,590
2005	29,430	25,600	3,830

Note(s): 1) Public supply water use: water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum c connections. 2) Self-supply water use: Water withdrawn from a groundwater or surface-water source by a user rather than being obtained fr public supply. 3) USGS did not provide estimates of residential use from public supplies in 2000. This value was estimated based on the res portion of public supply in 1995 and applied to the total public supply water use in 2000.

Source(s): U.S. Geological Survey, Estimated Use of Water in the U.S. in 1985, U.S. Geological Survey Circular 1004, 1988; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1990, U.S. Geological Survey Circular 1081, 1993; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1995, U.S. Geological Survey Circular 1200, 1998; U.S. Geological Survey, Estimated Use of Water in the U.S. in 2000, U.S. Geological Survey Circular 1268, 2004; and U.S. Geological Survey, Estimated Use of Water in the U.S. in 2005, U.S. Geological Survey Circular 1344, 2009.

8.2.2 1999 Single Family Home End-Use of Water Consumption per Day (Gallons per Capita) (1)

Fixture/End Use	Average gallons per capita per day	Total Use Percent
Toilet	18.5	18.3%
Clothes Washer	15	14.9%
Shower	11.6	11.5%
Faucet	10.9	10.8%
Other Domestic	1.6	1.6%
Bath	1.2	1.2%
Dishwasher	1	1.0%
Leaks	9.5	9.4%
Outdoor Use (2)	31.7	31.4%
Total (2)	**101**	**100%**

Note(s): 1) Based analysis of 1,188 single-family homes at 12 study locations. 2) Total Water use derived from USGS. Outdoor use is the difference between total and indoor uses.

Source(s): American Water Works Association Research Foundation, Residential End Uses of Water, 1999; U.S. Geological Survey, Estimated Use of Water in the U.S. in 2000, U.S. Geological Survey Circular 1268, 2004, Table 6, p. 17; and Vickers, Amy; Handbook of Water Use and Conservation, June 2002, p. 15.

8.2.3 2004 Water Use in Multi-Family Housing Units, In-Rent and Submetered Billing (Gallons per Unit per Day)

	In-Rent	Submetering	Estimated Savings from Submetering	Estimated Potential Range of Savings from Submetering
Indoor Water Use	143	121	-15.3%	6% - 24.6%

Note(s): Based on a regression analysis on a sample of 7,942 properties at 13 sample locations. Results are significant at the 95th percentile.

Source(s): Aquacraft, Inc./East Bay Municipal Utility District W; National Multiple Family Submetering and Allocation Billing Program Study, 2004.

8.2.4 Per Capita Use of Hot Water in Single Family Homes by End Use (Gallons per Capita per Day) (1)

Fixture/End Use	Average gallons per capita per day	Household Use gallons per day	Percent of Total Hot Water Use	Percent of End Use that is Hot Water
Toilet	0.0	0.0	0.0%	0.0%
Clothes Washer	3.9	10.1	15.5%	27.8%
Shower	6.3	16.4	25.1%	73.1%
Faucet	8.6	22.4	34.2%	72.7%
Other	0.0	0.0	0.0%	35.1%
Bath	4.2	10.9	16.7%	78.2%
Dishwasher	0.9	2.3	3.6%	100%
Leaks	1.2	3.1	4.8%	26.8%
Total	**25.1**	**65.2**	**100%**	**39.6%**

Note(s): 1) Based analysis of 10 single family homes in Seattle, WA.
Source(s): Aquacraft, Inc.; Residential End Uses of Hot Water in Single-Family Homes from Flow-Trace Analysis, 2000.

8.2.5 2008 Community Water Systems by Size and Type

System Size (1)	Facilities	Population Served (Millions)
Less than 500	29,160	4.9
501 - 3,300	13,858	19.9
3,301 - 10,000	4,838	28.1
10,001 - 100,000	3,728	106.3
More than 100,000	404	133.1
Total	**51,988**	**292.3**

Note(s): 1) Population served by each system. 2) Community water systems provide water to the same population year-round.
Source(s): EPA, Factoids: U.S. Drinking Water and Groundwater Statistics for 2008, EPA 816-K-08-004, November 2008.

8.2.6 Residential Water Billing Rate Structures for Community Water Systems

	Population Served by System (1)	
Rate Structure	10,001 - 100,000	More than 100,000
Uniform Rates	56.6%	55.6%
Declining Block Rate	34.5%	24.5%
Increasing Block Rate	18.3%	27.5%
Peak Period or Seasonal Rate	1.3%	9.6%
Separate Flat Fee	26.8%	25.3%
Combined Flat Fee	5.2%	2.0%
Other Rate Structures	1.9%	3.7%

Note(s): 1) Systems serving more than 10,000 users provide service to 82% of the population served by community water systems. Columns do not s to 100% because some systems use more than one rate structure. 2) Uniform rates charge a set price for each unit of water. Block rates cha a different price for each additional increment of usage. The prices for each increment is higher for increasing block rates and lower for decrea block rates. Peak rates and seasonal rates charge higher prices when demand is highest. Flat fees charge a set price for water delivery, with restrictions on use. Combined flat fees charge one fee for water and other charges, such as rental fees. Separate flat fees bill water and othe charges separately.
Source(s): EPA, Community Water System Survey 2000 Volume 1: Overview, EPA 815-R-02-005A, December 2002.

8.3.1 Commercial Water Use by Source (Billion Gallons per Day)

Year	Total Residential Water Use	Public Supply (1)	Self-Supply (2)
1980	-	-	-
1985	6,940	5,710	1,230
1990	8,290	5,900	2,390
1995	9,580	6,690	2,890
2000 (3)	10,314	7,202	3,111
2005 (3)	10,171	7,102	3,068

Note(s): 1) Public supply water use: water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum connections. 2) Self-supply water use: Water withdrawn from a groundwater or surface-water source by a user rather than being obtained fro public supply. 3) USGS did not estimate commercial water use in this year. Estimates are based on available data and percentage breakdown of commercial use in the 1995 survey.

Source(s): U.S. Geological Survey, Estimated Use of Water in the U.S. in 1985, U.S. Geological Survey Circular 1004, 1988; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1990, U.S. Geological Survey Circular 1081, 1993; U.S. Geological Survey, Estimated Use of Water in the U.S. in 1995, U.S. Geological Survey Circular 1200, 1998; U.S. Geological Survey, Estimated Use of Water in the U.S. in 2000, U.S. Geological Survey Circular 1268, 2004; and U.S. Geological Survey, Estimated Use of Water in the U.S. in 2005, U.S. Geological Survey Circular 1344, 2009.

8.3.2 Average Water Use of Commercial and Institutional Establishments (Gallons per Establishment per Day)

	Average Daily Use	Variation In Use (1)	% Total CI Use	% of CI Customers	% Seasonal Use (2)
Hotels and Motels	7,113	5.41	5.8%	1.9%	23.1%
Laundries/Laundromats	3,290	8.85	4.0%	1.4%	13.4%
Car Washes	3,031	3.12	0.8%	0.4%	14.2%
Urban Irrigation	2,596	8.73	28.5%	30.2%	86.9%
Schools and Colleges	2,117	12.13	8.8%	4.8%	58.0%
Hospitals/Medical Offices	1,236	78.5	3.9%	4.2%	23.2%
Office Buildings	1,204	6.29	10.2%	11.7%	29.0%
Restaurants	906	7.69	8.8%	11.2%	16.1%
Food Stores	729	16.29	2.9%	5.2%	19.4%
Auto Shops (3)	687	7.96	2.0%	6.7%	27.2%
Membership Organizations (4)	629	6.42	2.0%	5.6%	46.2%
Total	**23,538**		**77.6%**	**83.3%**	

Note(s): Estimated from 24 months of water utility billing data in five Western locations: four locations in Southern California and one in Arizona. 1) Ratio of standard deviation of daily use to average of daily use. 2) Percent seasonal use is the difference between the average monthly use and the lowest monthly use over the average monthly use. 3) Includes auto repair shops, dealers, and service stations. 4) Includes religious organizations and other membership-based organizations.

Source(s): American Water Works Association Research Foundation, Commercial and Institutional End Uses of Water, 2000.

8.3.3 Normalized Annual End Uses of Water in Select Restaurants in Western United States (1)

Fixture/End Use (2)	Range of Water Use (gal/SF)	Range of Water Use (gal/seat)	Range of Water Use (gal/meal/day)
Faucets	68.9 - 250	1225 - 4630	1.1 - 2.6
Dishwashing	54.4 - 183.3	970 - 3000	0.9 - 1.4
Toilets/Urinals	25.6 - 75	455 - 1230	0.4 - 0.5
Ice Making	7.8 - 44.6	140 - 1440	0.1 - 0.9
Total Indoor Use	163.3 - 563.3 (3)	2910 - 15350 (4)	2.7 - 16.2 (4)

Building Size (SF) 1200 - 9800 **Seats:** 73 - 253 **Meals:** 190 - 800

Logged average daily use (thousand gal)	Indoor peak instantaneous demand, gpm (5)
1.5 - 9.7	21.1 - 59.6

Benchmarking Values for Restaurants (6)	N	25th Percentile of Users
Gal./SF/year	90	130 - 331
Gal./meal	90	6 - 9
Gal./seat/day	90	20 - 31
Gal./employee/day	90	86 - 122

Note(s): Familiy-style dine-in establishments. Four restaurants in southern California, one in Phoenix, AZ. 1) Water use data for the buildings was collected over a few days. Estimates of annual use were created by accounting for seasonal use and other variables, billing data, and interviews with building managers. 2) Based on three restaurants. 3) Based on four restaurants. 4) Based on five restaurants. 5) gpm = gallons per minute. 6) The study derived efficiency benchmarks by analyzing measured data and audit data. The benchmark was set at the lower 25th percentile of users.

Source(s): American Water Works Association Research Foundation, Commercial and Institutional End Uses of Water, 2000.

8.3.4 Normalized Annual End Uses of Water in Select Supermarkets in Western United States (1)

Fixture/End Use	Range of Water Use (gal/SF)
Toilets/Urinals	190 - 320
Other/Misc. Indoor (2)	895 - 1,405
Cooling	2,190 - 3,390
Total	3,560 - 5,075
Building Size (SF)	3,8000 - 66,000

Logged average daily use (thousand gal)	Indoor peak instantaneous demand (gpm)
9.71 - 14.33	29.7 - 58.8

Benchmarking Values for Supermarkets (3)	N	25th Percentile of Users
Indoor Use with Cooling, gal./SF/year	38	52 - 64
Indoor Use with Cooling, gal./SF/daily transaction	38	9 - 16

Note(s): 1) Water use data for the buildings was collected over a few days. Estimates of annual use were created by accounting for seasonal use and other variables, billing data, and interviews with building managers. 2) Includes water for sinks, spraying vegetables, cleaning, etc. 3) The study derived efficiency benchmarks by analyzing measured data and audit data. The benchmark was set at the lower 25th percentile of users.

Source(s): American Water Works Association Research Foundation, Commercial and Institutional End Uses of Water, 2000.

8.3.5 Normalized Annual End Uses of Water in Select Hotels in Western United States (Gallons per Room per Year) (1)

Fixture/End Use	Budget Hotels Range of Water Use (gal/room)	Luxury Hotel Range of Water Use (gal/room)
Bathtub	986 (2)	2,331
Faucets	2,196 - 2,683	6,297
Showers	10,203 - 13,724	32,453
Toilets	9,493 - 11,986	28,047
Leaks	439 - 8,007	5,351
Laundry	6047 - 12,027	74,480
Ice making	811 - 1,568 (3)	0
Other/misc. indoor	946 - 9,953	0
Total Indoor Use	37,703 - 50,696	82,770
Number of Rooms	140 - 209	297
Logged average daily use, kgal:	18.6 - 29.3	59.3
Peak instantaneous demand, gpm:	40.5 - 106.9	130.7

Benchmarking Values for Hotels	N	25th Percentile of Users
Indoor Use, gal./day/occupied room	98	60 - 115
Cooling Use, gal./year/occupied room	97	7,400 - 41,600

Note(s): Based on four budget hotels and one luxury hotel. Three budget hotels in Southern California, one in Phoenix, AZ. Luxury hotel in Los Angeles, CA. 1) Water use data for the buildings was collected over a few days. Estimates of annual use were created by accounting for seasonal use and other variables, billing data, and interviews with building managers. 2) Based on one hotel. 3) Based on three hotels. 5) The study derived efficiency benchmarks by analyzing measured data and audit data. The benchmark was set at the lower 25th percentile of users.

Source(s): American Water Works Association Research Foundation, Commercial and Institutional End Uses of Water, 2000.

8.3.6 Normalized Annual End Uses of Water in Two California High Schools

Fixture/End Use	Range of Water Use (gal/room)	Range of Water Use (gal/person)
Toilet	2.9 - 3.2	206 - 271
Urinal	1.2 - 2.6	106 - 186
Faucet	1.0 - 2.3	87 - 165
Shower	0.5 - 0.7	44 - 47
Kitchen	0.7 - 1.0	58 - 58
Misc. uses (2)	0.9	68
Cooling	-	-
Leaks	1.6 - 3.6	112
Swimming Pool	0.4 - 0.9	31
Total Use	**11.1 - 12.3**	**883**

Average Building Size (SF)	Logged average daily use (thousand gal)	Indoor peak instantaneous demand (gpm)
222326	9.1 - 16.4	41 - 60

Benchmarking Values for Schools (3)	N	25th Percentile of Users
Indoor Use, Gal./sq. ft./year	142	8 - 16
Indoor Use, Gal./school day/student	141	3 - 15
Cooling Use, Gal./sq. ft./year	35	8 - 20

Note(s): 1) Water use data for the buildings was collected over a few days. Estimates of annual use were created by accounting for seasonal use and other variables, billing data, and interviews with building managers. 2) One high school. 3) The study derived efficiency benchmarks by analyzing measured data and audit data. The benchmark was set at the lower 25th percentile of users.

Source(s): American Water Works Association Research Foundation, Commercial and Institutional End Uses of Water, 2000.

8.4.1 WaterSense List of Covered Products and Efficiency Specifications

Covered Product	Specification Effective Date	WaterSense Criteria		Federal Standard Level
Lavatory Faucets	October 2007	1.5 gpm	(1)	2.2 gpm
Toilets	January 2007	1.28 gpf	(2)	1.6 gpf
Urninals	In Progress	0.5 gpf	(3)	1.0 gpf
Shower Heads	In Progress	1.5 -2.0 gpm	(3)	2.5 gpm
Pre-Rinse Spray Valves	In Progress	1.25 gpm	(3)	1.6 gpm
Irrigation Control Equipment	In Progress	Under development		-

WaterSense Landscape Irrigation Partners as of 9/9/2009 (4): 762

Note(s): 1) GPM = gallons per minute. 2) GPF = gallons per flush. 3) Final criteria for these urinals and shower heads have not been set. These are criteria levels that WaterSense is considering. 4) WaterSense qualifies individuals as partners via private programs certified by WaterSense.

Source(s): EPA, High-Efficiency Lavatory Faucet Specification, October 2007; EPA, Tank-Type High-Efficiency Toilet Specification, January 2007; EPA, Notification of Intent to Develop Draft Performance Specifications for Showerheads and Related Devices, August, 2007; EPA, Notification of Intent to Develop Draft Performance Specifications for High-Efficiency Urinals, May 2008; and EPA, Find a WaterSense Irrigation Partner List as of 5/19/2008, http://www.epa.gov/watersense/pp/lists/irr_partners.htm.

9.1.1 Market Indices for 2008 ENERGY STAR Qualified New Single-Family Homes, by Selected State

	ENERGY STAR Qualified New Homes	New Single-Family Housing Permits	Market Penetration
Nevada	4,572	7,110	64%
Iowa	3964	6285	63%
Hawaii	1347	2510	54%
Vermont	553	1057	52%
New Jersey	4194	9169	46%
Texas	32097	79626	40%
Utah	2726	7084	38%
New Hampshire	773	2333	33%
Connecticut	994	3139	32%
Arizona	6023	19153	31%
New York	3190	12738	25%
California	7217	32432	22%
Ohio	2773	12873	22%
Delaware	350	2680	13%
Georgia	2908	24879	12%
Florida	2332	38709	6%
United States	109,857	575,554	19%

Source(s): EPA, ENERGY STAR Qualified New Homes Market Indices for States, for top states; e-mail correspondence with EPA ENERGY STAR New Homes program for top states; e-mail correspondence with EPA ENERGY STAR program for complete data set.
DOC/Census Bureau, Building Permits, New Privately Owned Housing Units Authorized Unadjusted Units for Regions, Divisions, and States, October 2009, Table 2au.

9.1.2 ENERGY STAR Commercial and Institutional Buildings

	Qualified Buildings	Floorspace Million SF	Building Type	Floorspace Million SF	% of Total	Buildings
1999	87	33.7	Office	770.4	65.9%	2,509
2000	424	69.3	School	135.7	11.6%	1,424
2001	213	55.0	Supermarket/Grocery	72.55	6.2%	1,461
2002	348	89.5	Hospital	61.82	5.3%	80
2003	385	83.7	Hotel	57.16	4.9%	369
2004	657	84.4	Bank	37.76	3.2%	74
2005	590	84.7	Retail	15.94	1.4%	183
2006	792	107.0	Courthouse	9.564	0.8%	37
2007	1,004	226.8	Warehouse	5.021	0.4%	26
2008	1,705 (1)	335.6	Medical Office	2.228	0.2%	19
Total	**6,205**	**1,170**	Residence Hall/Dormitory	1.473	0.1%	23
			Total	**1,170**	**100%**	**6,205**

Note(s): 1) Data as of December 31, 2008. Additional buildings may qualify after applications are reviewed.
Source(s): EPA, ENERGY STAR Buildings and Plants 1999–2008, December 2008.

9.1.3 Specification Dates for ENERGY STAR-Labeled Consumer Electronics and Office Equipment

Labeled (Covered) Product	Inception - End Date	Dates of updated specification
Computers	1992	1995, 1999, 2000, 2007, 2009
Computer Monitors	1992	1995, 1998, 1999, 2005, 2006, 2009
Printers	1993	1995, 2000, 2001, 2007, 2009
Fax Machines	1995	1995, 2000, 2001, 2007, 2009
Copiers	1995	1997, 1999, 2007, 2009
Scanners	1997	2007, 2009
Multi-Function Devices	1997	1999, 2007, 2009
Televisions	1998	2002, 2004, 2005, 2008, 2010, 2012
VCRs	1998 - 2008	2002, 2004, 2005
Consumer Audio Equipment	1999	2003, 2010
DVD Players	1999	2003, 2010
Bottled Water Coolers	2000	2004
Set-Top Boxes	2001-2005, 2009 (1)	2009
Telephony	2002	2004, 2006, 2008
External Power Adapters	2005	2008
Battery Charging Systems	2006	

Note(s): 1) Program relaunched in 2009.

Source(s): LBNL, Calendar Year 2007 Program Benefits for ENERGY STAR Labeled Products, October 2008; and EPA, Revisions to Existing Standards, energystar.gov, October 2009.

9.1.4 Specification Dates for ENERGY STAR-Labeled HVAC and Residential Appliances

Heating and Cooling Equipment	Inception - End Date	Dates of updated specification
Central AC	1995	2002, 2006, 2009
Air-Source Heat Pumps	1995	2002, 2006, 2009
Oil Furnaces	1995	2006, 2008
Gas Furnaces	1995	2006, 2008
Programable Thermostats	1995-2009	
Insulation	1996-2002	
Gas Boilers	1996	2002
Oil Boilers	1996	2002
Gas-Fired Heat Pumps	1995-2000	
Roof Products	1999	2005, 2007
Geothermal Heat Pumps	2001	2001
Exhaust Fans	2001	2003
Ceiling Fans	2001	2003, 2006
Light Commercial HVAC	2002	2004, 2010
Residential Appliances		
Dishwashers	1996	2001, 2007, 2009, 2011
Room AC	1996	2000, 2003, 2005
Refrigerators	1996	2001, 2003, 2004, 2008
Clothes Washers	1997	2001, 2004, 2007, 2009, 2011
Dehumidifiers	2001	2006, 2007, 2008
Air Cleaners	2004	
Water Heaters	2009	
Other Products		
Residential Lighting Fixtures	1997	2001, 2002, 2003, 2005, 2007, 2008
Windows, Doors, Skylights	1997	2003, 2005, 2010
Screw base CFLs	1999	2001, 2004, 2008
Decorative Light Strings	2008	
Solid State Lighting	2008	2009

Source(s): LBNL, Calendar Year 2007 Program Benefits for ENERGY STAR Labeled Products, October 2008; and EPA, Revisions to Existing Standards, energystar.gov, October 2009.

9.1.5 Specification Dates for ENERGY STAR-Labeled Commercial and Miscellaneous Products

Commercial Products	Inception - End Date	Dates of updated specification
Commercial Refrigerators and Freezers	2001	2010
Hot Food Holding Cabinets	2003	
Commercial Steam Cookers	2003	
Commercial Fryers	2003	
Cold Beverage Vending Machines	2004	2006, 2007
Solid State Lighting	2008	
Commercial Dishwashers	2007	
Commercial Icemakers	2008	
Commercial Griddles	2009	
Commercial Ovens	2009	
Computer Servers	2009	2010
Other Products		
Transformers	1995-2007	
Exit Signs	1996 -2008	1999, 2004
Traffic Signals	2000-2007	2003

Source(s): LBNL, Calendar Year 2007 Program Benefits for ENERGY STAR Labeled Products, October 2008; and EPA, Revisions to Existing Standards, energystar.gov, October 2009.

9.1.6 Total Appliance Shipments (Millions) and ENERGY STAR Penetration Rate

	Dishwashers		Room AC		Refrigerators		Clothes Washers		Dehumidifiers		Air Cleaners	
1997	5.1	6%	4.1	12%	9.0	25%	7.4	4%	-	N/A	-	N/A
1998	5.1	19%	4.4	13%	8.8	19%	7.0	6%	-	N/A	-	N/A
1999	5.7	12%	6.1	13%	9.1	24%	7.5	9%	-	N/A	-	N/A
2000	5.8	11%	6.5	19%	9.2	27%	7.5	9%	1.0	N/A	-	N/A
2001	5.6	20%	5.6	12%	9.3	17%	7.4	10%	0.8	19%	-	N/A
2002	6.2	36%	6.2	36%	9.7	20%	7.7	16%	0.8	39%	-	N/A
2003	6.4	57%	8.2	29%	10.0	26%	8.1	23%	1.3	74%	-	N/A
2004	7.1	78%	8.8	35%	10.9	33%	8.8	27%	1.7	76%	1.6	5%
2005	7.4	82%	8.0	52%	11.1	33%	9.2	36%	2.0	92%	1.6	13%
2006	7.3	92%	10.1	36%	11.1	31%	9.5	38%	1.5	82%	2.0	17%
2007	7.0	77%	9.6	50%	11.3	30%	9.0	42%	2.0	57%	2.5	14%
2008	7.5	70%	11.2	38%	11.4	31%	9.7	45%	1.6	75%	2.6	15%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.

Source(s): LBNL, Climate Change Action Plan spreadsheet (2009) for air cleaners and dehumidifiers; D&R International, Ltd., 2009 for dishwashers, room AC, refrigerator, clothes washers.

9.1.7 Total Lighting Shipments (Millions) and ENERGY STAR Penetration Rate

	Light Fixtures	
1998	221.5	1%
1999	213.2	1%
2000	210.8	2%
2001	196.7	2%
2002	220.5	1%
2003	225.0	3%
2004	237.8	2%
2005	247.4	3%
2006	248.6	4%
2007	217.9	6%
2008	194.6	10%

Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.1.8 Total Cooling Equipment Shipments (Thousands) and ENERGY STAR Penetration Rate

	Central AC		Air-Source Heat Pump		Geothermal Heat Pump		Exhaust Fan		Ceiling Fan	
1995	3,300	15%	850	27%	32	N/A	-	N/A	-	N/A
1996	4,251	16%	1,125	30%	31	N/A	-	N/A	-	N/A
1997	4,024	18%	1,110	29%	37	N/A	-	N/A	-	N/A
1998	4,681	18%	1,236	31%	38	N/A	-	N/A	-	N/A
1999	5,011	20%	1,267	30%	42	N/A	-	N/A	-	N/A
2000	5,003	19%	1,310	29%	36	N/A	5,835	N/A	19,500	N/A
2001	4,839	22%	1,442	29%	36	40%	5,909	2%	17,680	18%
2002	5,263	14%	1,484	14%	37	29%	5,975	3%	19,500	8%
2003	5,181	17%	1,626	19%	36	37%	6,036	6%	18,500	17%
2004	5,515	19%	1,886	22%	44	58%	6,102	11%	19,700	14%
2005	6,471	19%	2,137	27%	48	68%	6,199	13%	19,800	18%
2006	4,951	21%	2,118	23%	64	79%	6,285	12%	20,800	15%
2007	4,500	23%	1,900	20%	86	100%	6,354	13%	19,830	14%
2008	3,968	19%	1,865	22%	130	58%	6,432	11%	19,972	13%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.1.9 Total Heating Equipment Shipments (Thousands) and ENERGY STAR Penetration Rate

	Oil Boiler		Oil Furnace		Gas Furnace		Gas Boiler	
1995	156	N/A	146	1%	2,592	22%	109	N/A
1996	161	48%	152	1%	2,871	24%	198	4%
1997	160	55%	124	1%	2,779	27%	206	6%
1998	148	67%	128	1%	2,977	29%	185	8%
1999	149	74%	125	1%	3,126	31%	201	10%
2000	144	85%	121	3%	3,104	35%	224	15%
2001	149	89%	122	4%	3,063	39%	221	17%
2002	148	98%	117	6%	3,202	40%	214	21%
2003	167	54%	127	7%	3,266	42%	235	21%
2004	162	71%	130	7%	3,519	47%	237	41%
2005	146	57%	111	7%	3,512	37%	224	25%
2006	121	90%	100	6%	3,197	37%	196	38%
2007	123	80%	84	13%	2,782	37%	201	38%
2008	122	62%	59	12%	2,300	43%	192	57%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.1.10 Total Commercial Product Shipments (Thousands) and ENERGY STAR Penetration Rate

	Exit Signs		Comm. Refrigeration		Hot Food Holding Cabinets		Comm. Steam Cookers		Cold Beverage Vending Machines		Bottled Water Coolers	
1996	1,847	10%	-	N/A	-	N/A	-	N/A	-	N/A	-	N/A
1997	2,170	13%	-	N/A	-	N/A	-	N/A	-	N/A	-	N/A
1998	2,493	20%	-	N/A	-	N/A	-	N/A	-	N/A	-	N/A
1999	2,816	27%	-	N/A	-	N/A	-	N/A	-	N/A	-	N/A
2000	3,140	34%	200	N/A	-	N/A	-	N/A	251	N/A	822	1%
2001	3,463	41%	220	14%	-	N/A	-	N/A	249	N/A	822	1%
2002	3,786	44%	226	12%	-	N/A	-	N/A	246	N/A	885	1%
2003	3,831	91%	232	17%	13	8%	35	10%	246	N/A	948	38%
2004	3,877	63%	238	30%	20	62%	35	11%	255	26%	1,012	56%
2005	3,924	50%	244	43%	31	34%	35	12%	246	28%	1,075	68%
2006	3,971	89%	248	49%	31	59%	24	14%	246	31%	1,138	44%
2007	4,019	0%	251	59%	31	64%	23	22%	246	26%	1,201	52%
2008	4,067	0%	292	66%	30	79%	23	23%	246	32%	1,264	41%

	Comm. Dishwashers		Ice Machines		Comm. Fryers	
2003	-	N/A	-	N/A	72	2%
2004	-	N/A	-	N/A	74	10%
2005	-	N/A	-	N/A	77	7%
2006	-	N/A	-	N/A	82	11%
2007	25	0%	-	N/A	85	7%
2008	28	83%	138	40%	90	7%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.1.11 Total Consumer Electronics Shipments (Millions) and ENERGY STAR Penetration Rate

	TV		Telephony		TV-DVD/VCR		Audio Equipment		DVD Player	
1998	28.2	N/A	-	N/A	3.1	17%	12.2	N/A	1.1	N/A
1999	25.1	39%	-	N/A	4.1	71%	14.2	12%	4.1	35%
2000	25.4	46%	40.9	N/A	5.0	76%	15.4	17%	8.5	37%
2001	22.8	45%	48.8	N/A	4.6	77%	14.9	20%	12.7	59%
2002	23.2	45%	49.7	52%	5.7	82%	12.4	27%	17.1	71%
2003	25.6	47%	52.0	59%	4.4	78%	13.0	48%	12.5	72%
2004	23.1	83%	54.3	34%	7.2	64%	14.3	13%	10.4	52%
2005	26.3	39%	56.0	26%	6.7	55%	12.5	21%	11.8	32%
2006	32.3	54%	50.3	29%	3.2	4%	9.9	29%	19.8	4%
2007	31.7	53%	39.6	25%	2.4	34%	9.6	20%	22.1	38%
2008	32.7	79%	34.8	50%	1.7	67%	10.1	14%	22.8	44%

	External Power Adaptors		Battery Charging Systems	
1998	-	N/A	-	N/A
1999	-	N/A	-	N/A
2000	-	N/A	-	N/A
2001	-	N/A	-	N/A
2002	77.8	N/A	39.4	N/A
2003	79.7	N/A	39.6	N/A
2004	268.7	N/A	40.0	N/A
2005	457.7	3%	40.4	N/A
2006	505.7	30%	40.8	0%
2007	554.7	56%	41.3	16%
2008	565.7	47%	41.7	15%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.1.12 Total Office Equipment Shipments (Millions) and ENERGY STAR Penetration Rate

	Computer		Monitor		Printer		Fax		Copier		Scanner		Multi-Function Device	
1992	-	-	-	-	-	N/A	-	N/A	-	N/A	-	N/A	-	N/A
1993	12.1	41%	12.0	19%	6.9	80%	-	N/A	-	N/A	-	N/A	-	N/A
1994	14.8	50%	14.6	50%	9.4	98%	-	N/A	-	N/A	-	N/A	-	N/A
1995	18.4	73%	18.2	93%	11.3	98%	1.3	14%	1.6	24%	-	N/A	-	N/A
1996	20.5	79%	20.3	95%	13.2	100%	2.1	57%	1.6	35%	-	N/A	-	N/A
1997	25.9	86%	24.6	95%	15.1	100%	3.4	74%	1.7	45%	4.2	30%	0.1	30%
1998	32.4	92%	30.2	95%	18.3	100%	5.6	91%	1.6	65%	5.4	30%	0.4	30%
1999	44.5	47%	33.9	48%	23.0	100%	6.5	99%	1.1	87%	4.9	40%	1.3	91%
2000	49.7	86%	33.4	95%	22.6	100%	7.0	99%	0.9	94%	4.4	50%	1.7	92%
2001	52.9	85%	35.9	95%	28.8	85%	7.2	99%	0.6	90%	3.9	50%	2.2	92%
2002	52.9	83%	36.7	95%	19.7	95%	6.0	99%	0.3	90%	3.4	60%	7.6	98%
2003	58.2	83%	35.1	95%	16.4	98%	4.5	99%	1.4	90%	2.9	70%	13.2	98%
2004	64.1	83%	36.6	95%	16.4	100%	4.2	99%	1.4	90%	2.4	75%	14.9	98%
2005	70.2	83%	38.2	65%	17.5	100%	3.8	99%	1.4	90%	1.9	80%	17.1	98%
2006	71.6	81%	42.0	78%	13.9	100%	3.1	99%	1.4	90%	1.6	85%	18.7	98%
2007	93.0	67%	42.8	92%	10.9	21%	3.9	2%	0.3	27%	1.0	43%	21.2	28%
2008	94.9	21%	32.8	84%	8.8	43%	3.8	4%	0.2	91%	0.6	87%	19.9	49%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.

Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009.

9.2.1 LEED for New Construction, by Selected States

	Certified	Bronze	Silver	Gold	Platinum	Total
California	40	0	35	41	11	127
Pennsylvania	17	0	30	22	0	69
Oregon	13	1	16	33	3	66
Washington	21	0	20	21	1	63
Michigan	34	0	15	11	1	61
Virginia	20	0	13	10	0	43
Massachusetts	21	0	8	15	3	47
Texas	17	0	16	12	2	47
Ilinois	16	0	15	9	4	44
New York	15	0	14	9	3	41
All Other States	167	2	175	105	25	474
National Totals	**381**	**3**	**357**	**288**	**53**	**1082**

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, July 2008.

9.2.2 LEED for New Construction, by Version

	NC 1.0	NC 2.0	NC 2.1	NC 2.2	All New Construction
Platinum	3	12	35	3	53
Gold	1	75	187	25	288
Silver	1	76	239	41	357
Bronze	3	0	0	0	3
Certified	0	98	264	19	381
Total	**8**	**261**	**725**	**88**	**1,082**

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, July 2008.

9.2.3 LEED for Core and Shell 2.0

Platinum	3
Gold	4
Silver	10
Certified	2
Total	**19**

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, July 2008.

9.2.4 LEED for Commercial Interiors 2.0

Platinum	9
Gold	68
Silver	66
Certified	47
Total	**190**

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, July 2008.

9.2.5 LEED for Existing Buildings 2.0

Platinum	10
Gold	19
Silver	21
Certified	11
Total	**61**

Source(s): U.S. Green Building Council Web site, accessed July 2008, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx.

9.2.6 U.S. LEED Registered Projects as of 2003, 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 and Construction, White Paper on Sustainability, Nov. 2003.

9.3.1 North American Technician Excellence Program (1)

Individuals Certified: 25,906
Number of Certificates(2): 49,014

Certifications	Installation	Service
Air Conditioning	1,054	5,425
Air Distribution	243	1,499
Heat Pump	645	12,015
Gas Furnance	1,364	8,577
Oil Furnance	51	966
Hydronics Gas	39	388
Hydronics Oil	10	187

Regional Breakdown	Individuals Certified
Northeast	4,231
South	10,469
Midwest	5,956
West	4,068

Note(s): 1)Third party certification program for heating and cooling professionals to ensure knowledge of proper installation and servicing of HVAC/R equipment. 2) Includes individuals holding refrigeration certifications.
Source(s): North American Technician Excellence; North American Technician Excellence Program, http://www.natex.org/about.htm.

9.4.1 Case Study, The Adam Joseph Lewis Center for Environmental Studies, Oberlin College; Oberlin, Ohio (Education)

Building Design

Floor Area: 13,600 SF Floors: 2 Footprint: 140 ft. x 45 ft. with attached 100-seat auditorium

3 Classrooms (1)	1 Conference Room	1 Adminstration Office
Auditorium, 100 seats	6 Small Offices	Atrium
Wastewater Treatment Facility		

Shell

Windows Material: Green Tint Triple Pane Argon Fill Insulating Glass
Grey Tint Double Pane Argon Fill Insulating Glass

Fenestration(square feet)

	Window	Wall(2)	window/wall		Atrium, Triple Pane (3)		Building, Double Pane	
North	1,675	4,372	38%		U-Factor	0.34	U-Factor	0.46
South	2,553	4,498	58%		SHGC	0.26	SHGC	0.46
East	1,084	2,371	46%					
West	350	2,512	14%					
Overall	6,063	14,153	43%					

Wall/Roof

	Main Material	R-Value
Wall :	Face Brink	19
Roof:	Steel/Stone Ballast	30

HVAC

		COP(4)
Offices/Classrooms:	Individual GSHPs (5)	3.9-4.6
	1 Large GSHP for ventilation	3.8
Atrium:	Radiant Flooring Hydronic Heating System	
Auditorium:	1 Standard Range Water Heat Pump	4.2

Lighting Power Densities (W/SF)

Offices:	0.88	Corridors/Others:	0.45	Total Building:	0.79
Classroom/Lecture Halls:	1.18	Atrium:	0.93		

Energy/Power

PV System: 60 kW grid-tie roof system
Net Annual Energy Usage (thousand Btu/SF*ye 16.4

Note(s): 1) Two classrooms seat 36 and one seats 18. 2) Wall total area includes window area. 3) Atrium has only south, north, and east facing windows. 4) Coefficient of performance ranges due to various sizes; GSHPs have the greatest COP 5) GSHP is Ground water Source Heat Pump.

Source(s): NREL, Energy Performance Evaluation of an Educational Facility: The Adam Joseph Lewis Center for Environmental Studies, Oberlin College, Oberlin, Ohio, November 2004, Table 4.1 p. 10 Table 4.2 p.12 and Table 6.5 p. 94; NREL, Lessons Learned from Case Studies of Six High-Performance Buildings, June 2006, p. 5 Table A-2 p. 130

9.4.2 Case Study, The Cambria Department of Environmental Protection Office Building, Ebensburg, Pennsylvania (Office)

Building Design

Floor Area: 34,500 SF Floors: 2

Open office space (1)	File storage area	Two small labratories	Conference rooms
Break room	Storage areas	Two mechanical rooms	Telecom room

Shell

Windows

Material: Triple Pane, low-e with Aluminum Frames and Wood Frames

Triple Pane Aluminum Frames		Triple Pane Wood Frames	
U-Factor	0.24	U-Factor	0.26

Wall/Roof

	Main Material	R-Value
Wall :	Insulating Concrete Forms	27.0
Roof:	Decking and Insulation	33.0

HVAC

	Total Capacities(thousand Btu/hr)
12 Ground Source Heat Pumps	644 (2)
12 Auxiliary Electric Resistance Heaters	382 (3)

Lighting Power Densities(W/SF)

Open Office Area:	0.75
Office Area Task Lighting(4):	0.5

Energy/Power

PV System:	18.2 kW grid-tie system (5)
Net Annual Energy Usage (thousand Btu/SF*year)	36.0

Note(s): 1) Office space is for 100 people. This accounts for approximately 20,000 SF of the total building floorspace. 2) Cooling capacity 3) Auxiliary heating capacity. 4) Task lighting is in addition to the open office area LPD and is only in select cubicals and offices. 5) Includes 17.2 kW of roof PV array and two 0.5 KW ground level single axis tracking PV arrays.

Source(s): NREL, Analysis of the Design and Energy Performance of the Pennsylvania Department of Enverionmental Proctection Cambria Office Building, March 2005, p. ; NREL, Lessons Learned from Case Studies of Six High-Performance Buildings, June 2006, p. 5 Table A-2 p. 130.

9.4.3 Case Study, The Visitor Center at Zion National Park, Utah (Public Assembly/Retail/Office)

Building Design

Vistors Center (1)	8,800 SF	Comfort Station (2)	2,756 SF	Fee Station	170 SF

Shell

Windows

	Type	U-Factor	SHGC (3)
South/East Glass	Double Pane Insulating Glass, Low-e, Aluminum Frames, Thermally Broken	0.44	0.44
North/West Glass	Double Pane Insulating Glass, Heat Mirror, Aluminum Frames, Thermally Broken	0.37	0.37

Window/Wall Ratio: 28%

Wall/Roof

	Materials	Effective R-Value
Trombe Walls:	Low-iron Patterned Trombe Wall, CMU (4)	2.3
Vistor Center Walls:	Wood Siding, Rigid Insulation Board, Gypsum	16.5
Comfort Station Walls:	Wood Siding, Rigid Insulation Board, CMU (4)	6.6
Roof:	Wood Shingles; Sheathing; Insulated Roof Panels	30.9

HVAC

Heating	Cooling
Trombe Walls	Operable Windows
Electric Radiant Ceiling Panels	3 Cooling Towers

Lighting Power Densities(W/SF)

Main Area:	(5)
Offices:	1.0
Bookstore:	0.9

Energy/Power:

PV System:	7.2 kW grid-tie system
Net Annual Energy Usage (thousand Btu/SF*year):	27.0

Note(s): 1) Includes office, bookstore, and service areas 2) restroom complex 3) Solar heat gain coefficient 4) Concrete masonry unit 5) The main vistors center area is handled almost entirely with daylighting. Auxiliary fluorescent lighting is used only occasionally to supplement.

Source(s): NREL, Evaluation of the Low-Energy Design and Energy Performance of the Zion National Park Visitors Center, Feb. 2005, p. 23-37; NREL, Lessons Learned from Case Studies of Six High-Performance Buildings, June 2006, p. 5 Table A-2 p. 130.

9.4.4 Case Study, The Philip Merrill Environmental Center, Annapolis, Maryland (Office)

Building Design

Floor Area: 31,000 SF Floors: 2 Footprint: 220 ft. x (1)

2 Floors of open office space
Attached pavalion containing: Meeting space Kitchen Staff dining Conference room

Shell

Windows

		U-Factor	SHGC (2)
Type:	Double Pane, Low-e, Argon Filled Insulating Glass	0.244	0.41

Wall/Roof

	Material	Effective R-Value
Interior Wall	plywood, gypsum, SIP foam, and sheathing	28.0
Exterior Wall	gypsum and insulated metal framing	9.3
Roof	plywood, gypsum, SIP foam, and sheathing	38.0

HVAC

18 ground source heat pumps
fin and tube radiators connected to a propane boiler
1 air condtioning unit

Lighting Power Densities (W/SF)

First Floor:	1.2
Second Floor:	1.6
Conference Room:	1.4

Energy/Power

PV System:	4.2 kW thin-film system
Net Annual Energy Usage (thousand Btu/SF*year):	39.9

Note(s): 1) Width varies from about 74 ft. to 59 ft. along different sections of the length. 2) Solar heat gain coefficient
Source(s): NREL, Analysis of the Energy Performance of the Chesapeake Bay Foundation's Philip Merrill Environmental Center, April 2005, p. 6-24;
NREL, Lessons Learned from Case Studies of Six High-Performance Buildings, June 2006, p. 5 Table A-2 p. 130.

9.4.5 Case Study, The Thermal Test Facility, National Renewable Energy Laboratory, Golden, Colorado (Office/Laboratory)

Building Design

Floor Area:	10,000 SF	Floors(1):	2	Aspect Ratio:	1.75
Offices	Laboratories	Conference Room		Mechanical Level	

Shell

Windows

	Material	U-factor	SHGC(2)
Viewing Windows:	Double Pane, Grey Tint, Low-e	0.42	0.44
Clerestory Windows:	Double Pane, Clear, Low-e	0.45	0.65

	Window Area(SF)
North	38
South(3)	1134
East	56
West	56

Wall/Roof

	Material	Effective R-Value
North Wall	Concrete Slab/Rigid Polystyrene	5.0
South/East/West	Steel Studs/Batt Insulation/Concrete	23.0
Roof:	Built-up/Polyisocianurate Covering/Steel Supports	23.0

HVAC

VAV air handling unit
Hot water supply paralell VAV boxes
Direct and Indirect evaporative cooling system
Single zone roof top unit(4)
Hot Water Coil(4)

Lighting Power Densities(W/SF)

Interior Overhead	0.73	Exterior	0.05
Emergency	0.02	Building	0.80

Energy/Power

Net Annual Energy Usage (kBtu/SF*year): 23.02

Note(s): 1) That second floor is actually and mechanical mezzaine level. 2) Solar heat gain coefficient 3) Includes 492 SF of viewing windows and 642 SF of clerestory windows. 4) Only used to handle the conference room.

Source(s): NREL, Evaluation of the Energy Performance and Design Process of the Thermal Test Facility at the National Renewable Energy Laboratory, February 2005, p. 29-54; NREL, Lessons Learned from Case Studies of Six High-Performance Buildings, June 2006, p. 5 Table A-2 p. 130.

9.4.6 Case Study, The Solaire, New York, New York (Apartments/Multi-Family)

Building Design

Floor Area:	357,000 SF	Units:	293	Maximum Occupancy:	700
Floors:	27	Site Size:	0.38 Acres	Typical Occupancy(1):	578

Black-Water Treatment Facility (2)

Shell

Windows

Material: Double Glazed, Low-e, Thermal Breaks with Insulated Spacers

	Operable windows	Fixed Windows
Visual Transminttance	0.68	0.68
Solar Heat Gain Coefficient	0.35	0.35
U-Factor	0.47	0.41

Wall/Roof

	Material	R-Value
Exterior Walls:	Insulated brick and concrete block	8.4
Roof:	Roof top garden(green roof)	22.7

HVAC

Two direct-fired natural gas absorption chillers
4-Pipe fan-coil units in individual aparments

Power/Energy(3)

PV System(4): 1,300 SF (76 custom panels) of west facing PV rated for 11 kW . These panels are integrated into the building façade.
151 SF PV located in the entrance canopy. Rated for 662 W.
286 standard PV modules mounted on the south and west walls. Rated for 21 kW.

Unit Average Electricity Consumption(5):	15,681	kBtu/year
Building Natural Gas Consumption(6):	104.1	kBtu/SF*year

Predicted End-Use Consumption(kBtu/SF*year)

Heating	60.8	Plug Loads and Equipment	6.7
Cooling	20.7	Domestic Hot Water	7.9
Lighting	7.4	Cooking, Vertical Transportation, and Other	6.8
Fans/Pumps	11.4	**Total**	**121.7**

Note(s): 1) 84 hours per person weekly, 89 visitors weekly, 8 hours per visitor weekly. 2)30,000 gallon storage tank. Water is used for toilets and cooling tower. 3) Appliances in units are ENERGY STAR qualified. 4) PV system designed to handle 5% of building peak non-residential electrical load (i.e. corridor lighting). 5) Includes only electric that was submetered to each apartment. 6) 2007 building consumption.

Source(s): ASHRAE, High Peformance Buildings, NYC's Living Lesson, p. 56-65, Summer 2008; USGBC, LEED Case Studies, The Solaire, http://leedcasestudies.usgbc.org/overview.cfm?ProjectID=273.

Thermal Conversion Factors

Fuel	Units	Approximate Heat Content
Coal		
Production	million Btu per short ton	20.310
Consumption	million Btu per short ton	20.183
Coke Plants	million Btu per short ton	26.263
Industrial	million Btu per short ton	21.652
Residential and Commercial	million Btu per short ton	22.016
Electric Power Sector	million Btu per short ton	19.952
Imports	million Btu per short ton	25.073
Exports	million Btu per short ton	25.378
Coal Coke	million Btu per short ton	24.800
Crude Oil		
Production	million Btu per barrel	5.800
Imports	million Btu per barrel	5.980
Petroleum Products		
Consumption	million Btu per barrel	5.338
Motor Gasoline	million Btu per barrel	5.218
Jet Fuel	million Btu per barrel	5.670
Distillate Fuel Oil	million Btu per barrel	5.790
Residual Fuel Oil	million Btu per barrel	6.287
Liquefied Petroleum Gas	million Btu per barrel	3.605
Kerosene	million Btu per barrel	5.670
Petrochemical Feedstocks	million Btu per barrel	5.554
Unfinished Oils	million Btu per barrel	6.118
Imports	million Btu per barrel	5.450
Exports	million Btu per barrel	5.727
Ethanol	million Btu per barrel	3.539
Biodiesel	million Btu per barrel	5.376
Natural Gas Plant Liquids		
Production	million Btu per barrel	3.712
Natural Gas		
Production, Dry	Btu per cubic foot	1,029
Consumption	Btu per cubic foot	1,029
End-Use Sectors	Btu per cubic foot	1,030
Electric Power Sector	Btu per cubic foot	1,028
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 2008, Mar. 2008, Table G1, p. 215.

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