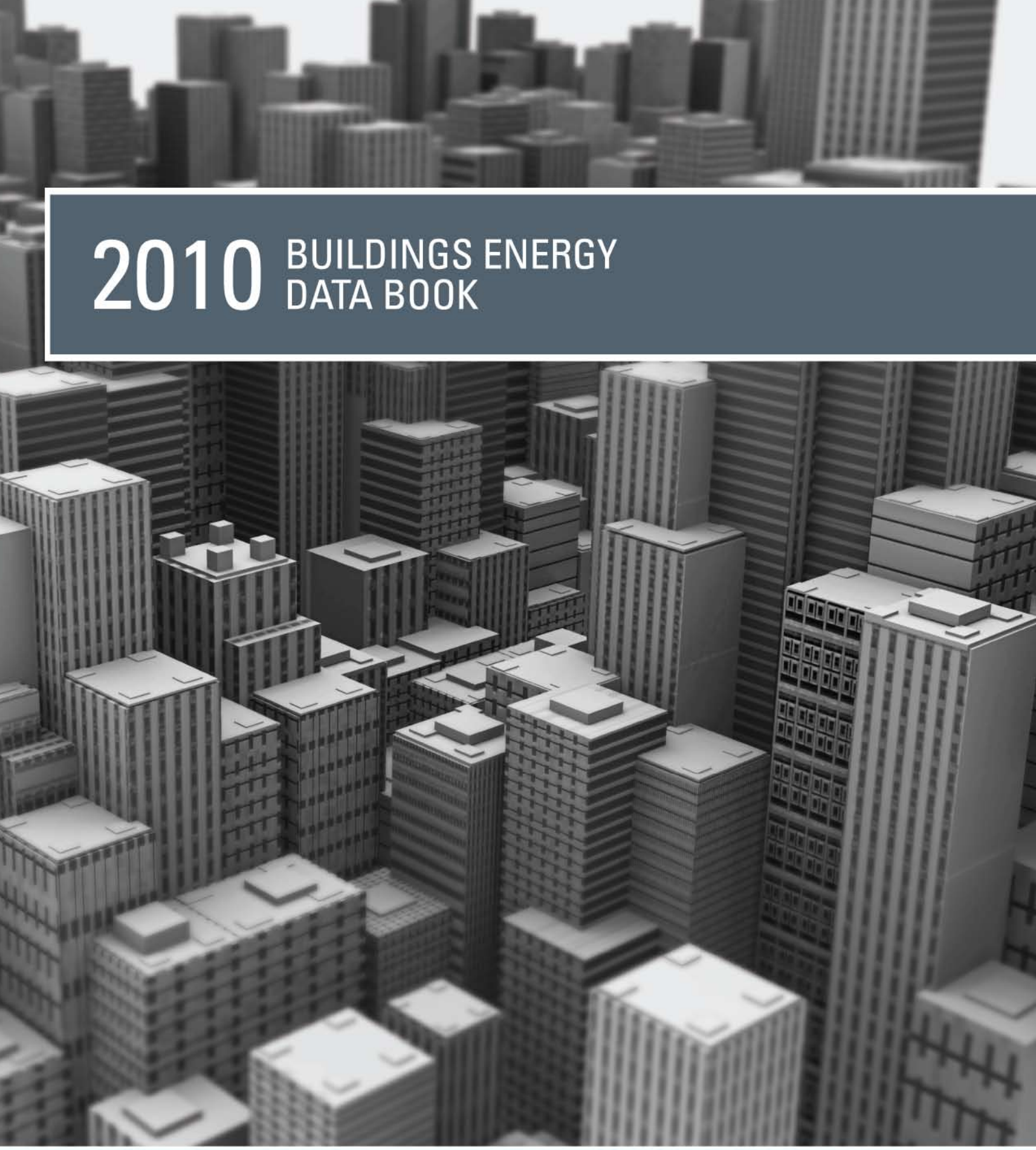
2010 BUILDINGS ENERGY DATA BOOK



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

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D I S C L A I M E R

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2010 Buildings Energy Data Book

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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 – Law, Energy Codes, and Standards, Chapter 8 – Water, and Chapter 9 – Market Transformation. New data tables on existing commercial building energy benchmarks were added to their relevant sections. New data tables were also developed covering federal efficiency standards for various products. You will also find updated market transformation data from the ENERGY STAR program and the U.S. Green Building Council.

We hope you find the *2010 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 data or information on an existing table should be referred to D&R International.

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The *2010 Buildings Energy Data Book* can be found on the web at:

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

Introduction

The *2010 Buildings Energy Data Book* is a statistical compendium prepared and published under contract with the Pacific Northwest National Laboratory (PNNL) with support from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE). 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 National Energy Technology Laboratory 2007-2009.

The Department of Energy's Office of Energy Efficiency and Renewable Energy has developed this *2010 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

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 2008-Year
1980	7.52	28.5%	3.04	11.5%	0.15	0.6%	0.87	3.3%	4.35	10.50	14.86	56.2%	26.43	100%	-
1985	7.07	25.6%	2.62	9.5%	0.18	0.6%	1.03	3.7%	5.06	11.66	16.72	60.5%	27.62	100%	-
1990	7.22	23.7%	2.36	7.8%	0.15	0.5%	0.74	2.4%	6.01	13.92	19.93	65.6%	30.40	100%	-
1995	8.10	24.3%	2.12	6.3%	0.13	0.4%	0.71	2.1%	6.81	15.47	22.28	66.8%	33.34	100%	-
2000	8.35	22.2%	2.32	6.2%	0.10	0.3%	0.63	1.7%	8.02	18.26	26.28	69.7%	37.68	100%	-
2005	8.04	20.3%	2.18	5.5%	0.10	0.3%	0.62	1.6%	8.99	19.66	28.65	72.4%	39.60	100%	-
2008	**8.22**	**20.5%**	**1.84**	**4.6%**	**0.08**	**0.2%**	**0.59**	**1.5%**	**9.27**	**20.02 (3)**	**29.29**	**73.2%**	**40.02**	**100%**	**-**
2010	8.08	20.0%	1.70	4.2%	0.07	0.2%	0.58	1.4%	9.57	20.41	29.98	74.2%	40.40	100%	0.5%
2015	8.37	21.2%	1.62	4.1%	0.07	0.2%	0.62	1.6%	9.42	19.38	28.80	73.0%	39.47	100%	-0.2%
2020	8.54	20.7%	1.53	3.7%	0.07	0.2%	0.65	1.6%	9.95	20.49	30.44	73.8%	41.22	100%	0.2%
2025	8.60	20.0%	1.47	3.4%	0.07	0.2%	0.66	1.5%	10.56	21.70	32.27	74.9%	43.07	100%	0.4%
2030	8.71	19.3%	1.43	3.2%	0.07	0.1%	0.67	1.5%	11.26	22.93	34.19	75.9%	45.06	100%	0.5%
2035	8.79	18.7%	1.39	3.0%	0.07	0.1%	0.68	1.4%	11.94	24.10	36.04	76.7%	46.97	100%	0.6%

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) 2008 site-to-source electricity conversion = 3.16.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 and Table A17, p. 34-35 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 2008-Year
1980	0.867	0.000	0.000	0.000	0.867	-
1985	1.034	0.000	0.000	0.000	1.034	-
1990	0.676	0.056	0.000	0.008	0.740	-
1995	0.633	0.065	0.000	0.011	0.709	-
2000	0.549	0.061	0.000	0.016	0.627	-
2005	0.533	0.061	0.000	0.029	0.623	-
2008	**0.552**	**0.028**	**0.004**	**0.004**	**0.589**	**-**
2010	0.529	0.029	0.012	0.008	0.579	-0.9%
2015	0.516	0.032	0.041	0.023	0.612	0.5%
2020	0.530	0.033	0.049	0.031	0.643	0.7%
2025	0.534	0.034	0.051	0.037	0.655	0.6%
2030	0.536	0.034	0.054	0.042	0.665	0.6%
2035	0.532	0.036	0.057	0.046	0.671	0.5%

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

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-9, p. 24-25 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables,Table A17, p. 34-35 for 2008-2035.

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

	Buildings							Total Consumption
	Residential	Commercial		**Total**	Industry	Transportation	Total	(quads)
1980(1)	20.2%	13.6%	I	**33.8%**	41.1%	25.2%	100%	I 78.3
1985	21.0%	15.0%	I	**36.0%**	37.8%	26.2%	100%	I 76.7
1990	20.1%	15.8%	I	**35.9%**	37.7%	26.4%	100%	I 84.8
1995	20.3%	16.1%	I	**36.4%**	37.3%	26.2%	100%	I 91.5
2000	20.6%	17.4%	I	**38.0%**	35.0%	26.9%	100%	I 99.1
2005	21.5%	17.8%	I	**39.3%**	32.3%	28.4%	100%	I 100.8
2008	**21.5%**	**18.4%**	**I**	**39.9%**	**32.1%**	**28.0%**	**100%**	**I 100.2**
2010	22.5%	18.8%	I	**41.3%**	30.6%	28.1%	100%	I 97.8
2015	20.1%	18.6%	I	**38.7%**	33.3%	28.0%	100%	I 102.0
2020	20.0%	19.3%	I	**39.3%**	33.1%	27.7%	100%	I 104.9
2025	20.1%	19.9%	I	**39.9%**	32.6%	27.5%	100%	I 107.9
2030	20.1%	20.5%	I	**40.6%**	31.8%	27.6%	100%	I 111.1
2035	20.0%	21.0%	I	**41.0%**	31.0%	27.9%	100%	I 114.4

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

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-11, p. 24-27 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables,Table A2, p. 3-5 for 2008-2035 data and Table A17, p. 34-35 for non-marketed renewable energy.

1.1.4 2008 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)	4.96	0.78	0.26	0.11	0.56	0.71	7.37	36.9%	2.24	8.91	22.3%
Lighting						2.01	2.01	10.0%	6.34	6.34	15.9%
Space Cooling	0.03					1.74	1.78	8.9%	5.51	5.54	13.8%
Water Heating	1.77	0.13	0.09		0.03	0.57	2.58	12.9%	1.80	3.81	9.5%
Refrigeration (6)						0.86	0.86	4.3%	2.71	2.71	6.8%
Electronics (7)						0.78	0.78	3.9%	2.45	2.45	6.1%
Ventilation (8)						0.53	0.53	2.7%	1.68	1.68	4.2%
Computers						0.39	0.39	2.0%	1.25	1.25	3.1%
Cooking	0.38		0.03			0.25	0.67	3.3%	0.81	1.22	3.0%
Wet Cleaning (9)	0.05					0.31	0.37	1.8%	0.99	1.04	2.6%
Other (10)	0.29	0.01	0.29	0.05	0.00	0.78	1.43	7.1%	2.48	3.12	7.8%
Adjust to SEDS (11)	0.73	0.18				0.33	1.24	6.2%	1.03	1.95	4.9%
Total	**8.22**	**1.11**	**0.67**	**0.15**	**0.59**	**9.27**	**20.00**	100%	**29.29**	**40.02**	100%

Note(s): 1) Includes distillate fuel oil (1.03 quad) and residual fuel oil (0.07 quad). 2) Kerosene (0.03 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 wood space heating (0.55 quad), biomass (0.11), solar water heating (0.03 quad), geothermal space heating (less than 0.01 quad), solar photovoltaics (PV) less than 0.01 quad), and wind (less than 0.01 quad). 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.16. 5) Includes furnace fans (0.14 quad). 6) Includes refrigerators (2.46 quad) and freezers (0.25 quad). Includes commercial refrigeration. 7) Includes color television (1.05 quad) and other office equipment (0.63 quad). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 9) Includes clothes washers (0.11 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.59 quad) and dishwashers (0.29 quad). Does not include water heating energy. 10) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 11) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A4, p. 9-10, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; 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 2011 Early Release, Dec. 2010, Table 32.

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)	4.90	0.68	0.26	0.09	0.54	0.60	7.07	35.4%	1.89	8.36	20.7%
Lighting						1.69	1.69	8.5%	5.42	5.42	13.4%
Space Cooling	0.04					0.51	0.55	2.8%	5.31	5.35	13.2%
Water Heating	1.80	0.12	0.08		0.03	0.53	2.55	12.8%	1.67	3.69	9.1%
Refrigeration (6)						0.83	0.83	4.2%	2.61	2.61	6.5%
Electronics (7)						1.73	1.73	8.6%	1.89	1.89	4.7%
Ventilation (8)						0.13	0.13	0.7%	1.60	1.60	4.0%
Computers						0.39	0.39	2.0%	1.22	1.22	3.0%
Wet Cleaning (9)	0.05					0.60	0.65	3.3%	0.97	1.02	2.5%
Cooking	0.40		0.03			0.31	0.74	3.7%	0.41	0.83	2.1%
Other (10)	0.30	0.01	0.30	0.04	0.01	1.55	2.22	11.1%	4.85	5.52	13.7%
Adjust to SEDS (11)	0.58	0.15				0.69	1.42	7.1%	2.15	2.89	7.2%
Total	**8.08**	**0.96**	**0.67**	**0.14**	**0.58**	**9.57**	**20.00**	100%	**29.98**	**40.40**	100%

Note(s): 1) Includes distillate fuel oil (0.92 quad) and residual fuel oil (0.04 quad). 2) Kerosene (0.03 quad) and coal (0.07 quad) are assumed attributable to space heating. Motor gasoline (0.04 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.42 quad), biomass (0.11), solar water heating (0.03 quad), geothermal space heating (0.01 quad), solar photovoltaics (PV) (0.01 quad), and wind (less than 0.01 quad). 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.13. 5) Includes furnace fans (0.14 quad). 6) Includes refrigerators (2.37 quad) and freezers (0.25 quad). Includes commercial refrigeration. 7) Includes color television (1.07 quad). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 9) Includes clothes washers (0.10 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.58 quad) and dishwashers (0.28 quad). Does not include water heating energy. 10) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 11) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A4, p. 9-10, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; and EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

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)	5.04	0.62	0.22	0.10	0.56	0.63	7.17	34.6%	1.93	8.47	20.5%
Lighting						1.62	1.62	7.8%	4.97	4.97	12.1%
Space Cooling	0.04					1.40	1.43	6.9%	4.27	4.31	10.5%
Water Heating	1.95	0.08	0.05		0.03	0.58	2.70	13.0%	1.79	3.90	9.5%
Refrigeration (6)						0.78	0.78	3.8%	2.40	2.40	5.8%
Electronics (7)						0.70	0.70	3.4%	2.15	2.15	5.2%
Ventilation (8)						0.60	0.60	2.9%	1.83	1.83	4.4%
Computers						0.36	0.36	1.8%	1.11	1.11	2.7%
Wet Cleaning (9)	0.05					0.30	0.35	1.7%	0.92	0.97	2.4%
Cooking	0.44		0.03			0.15	0.61	3.0%	0.45	0.92	2.2%
Other (10)	0.39	0.01	0.33	0.05	0.06	2.02	2.86	13.8%	6.17	7.01	17.0%
Adjust to SEDS (11)	0.63	0.11				0.80	1.54	7.4%	2.44	3.18	7.7%
Total	**8.54**	**0.83**	**0.63**	**0.14**	**0.65**	**9.95**	**20.73**	100%	**30.44**	**41.22**	100%

Note(s): 1) Includes distillate fuel oil (0.76 quad) and residual fuel oil (0.06 quad). 2) Kerosene (0.03 quad) and coal (0.07 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.42 quad), biomass (0.11), solar water heating (0.03 quad), geothermal space heating (0.03 quad), solar photovoltaics (PV) (0.05 quad), and wind (less than 0.01 quad). 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.06. 5) Includes furnace fans (0.51 quad). 6) Includes refrigerators (2.15 quad) and freezers (0.24 quad). Includes commercial refrigeration. 7) Includes color television (1.03 quad). 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 9) Includes clothes washers (0.08 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.55 quad) and dishwashers (0.28 quad). Does not include water heating energy. 10) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 11) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A4, p. 9-10, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010,

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)	5.05	0.53	0.20	0.10	0.58	0.67	7.12	32.2%	2.04	8.50	18.9%
Lighting						1.72	1.72	7.8%	5.24	5.24	11.6%
Space Cooling	0.04					1.53	1.57	7.1%	4.66	4.70	10.4%
Water Heating	1.98	0.06	0.04		0.03	0.59	2.70	12.2%	1.78	3.89	8.6%
Electronics (6)						0.83	0.83	3.7%	2.51	2.51	5.6%
Refrigeration (7)						0.82	0.82	3.7%	2.49	2.49	5.5%
Ventilation (8)						0.68	0.68	3.1%	2.06	2.06	4.6%
Computers						0.39	0.39	1.8%	1.19	1.19	2.6%
Wet Cleaning (9)	0.05					0.32	0.38	1.7%	0.99	1.04	2.3%
Cooking	0.47		0.03			0.16	0.66	3.0%	0.49	0.99	2.2%
Other (10)	0.63	0.02	0.36	0.05	0.06	2.66	3.77	17.0%	8.07	9.18	20.4%
Adjust to SEDS (11)	0.49	0.11				0.88	1.48	6.7%	2.67	3.27	7.3%
Total	**8.71**	**0.72**	**0.63**	**0.14**	**0.67**	**11.26**	**22.13**	100%	**34.19**	**45.06**	100%
							22.13				

Note(s): 1) Includes distillate fuel oil (0.65 quad) and residual fuel oil (0.07 quad). 2) Kerosene (0.03 quad) and coal (0.07 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of wood space heating (0.54 quad), biomass (0.11 quad), solar water heating (0.03 quad), geothermal space heating (0.04 quad), solar photovoltaics (PV) (0.05 quad), and wind (less than 0.01 quad). 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.04. 5) Includes furnace fans (0.58 quad). 6) Includes color television (1.18 quad) and other office equipment (2.53 quad). 7) Includes refrigerators (2.24 quad) and freezers (0.26 quad). Includes commercial refrigeration. 8) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 9) Includes clothes washers (0.09 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.58 quad) and dishwashers (0.32 quad). Does not include water heating energy. 10) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial service station equipment, ATMs, telecommunications equipment, medical equipment, pumps, emergency electric generators, combined heat and power in commercial buildings, and manufacturing performed in commercial buildings. 11) Energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sector, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A4, p. 9-10, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010,

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

	Natural Gas	Petroleum	Coal	Renewables (2) Hydroelectric	Renewables (2) Other	Renewables (2) Total	Nuclear	Total
1980	37%	18%	29%	7%	4%	10%	6%	100%
1985	33%	12%	34%	7%	4%	11%	9%	100%
1990	31%	11%	35%	6%	4%	10%	13%	100%
1995	33%	8%	35%	6%	4%	10%	14%	100%
2000	32%	8%	37%	5%	3%	8%	14%	100%
2005	31%	8%	38%	5%	3%	8%	15%	100%
2008	**33%**	**6%**	**38%**	**5%**	**4%**	**8%**	**15%**	**100%**
2010	34%	5%	36%	4%	4%	9%	16%	100%
2015	34%	5%	34%	5%	6%	11%	16%	100%
2020	33%	5%	34%	5%	6%	11%	17%	100%
2025	32%	4%	36%	5%	6%	12%	16%	100%
2030	32%	4%	37%	5%	7%	12%	16%	100%
2035	32%	4%	37%	5%	7%	12%	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.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 data and Table A17, p. 34-35 for non-marketed renewable energy.

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

	Buildings								
	Residential	Commercial		**Total**	Industry	Transportation	Total		*Delivered Total* (quads)
1980	34%	27%	I	**61%**	39%	0%	100%	I	7.15
1985	34%	30%	I	**64%**	36%	0%	100%	I	7.93
1990	34%	31%	I	**65%**	35%	0%	100%	I	9.26
1995	35%	32%	I	**66%**	34%	0%	100%	I	10.28
2000	35%	34%	I	**69%**	31%	0%	100%	I	11.67
2005	37%	35%	I	**72%**	28%	0%	100%	I	12.49
2008	**37%**	**36%**	**I**	**73%**	**27%**	**0%**	**100%**	**I**	**12.73**
2010	39%	36%	I	**75%**	25%	0%	100%	I	12.79
2015	35%	37%	I	**73%**	27%	0%	100%	I	12.97
2020	35%	38%	I	**73%**	26%	0%	100%	I	13.54
2025	35%	40%	I	**75%**	25%	0%	100%	I	14.11
2030	36%	41%	I	**77%**	23%	0%	100%	I	14.70
2035	36%	42%	I	**78%**	21%	0%	100%	I	15.27

Note(s): 1) Buildings accounted for 80.9% (or $295 billion) of total U.S. electricity expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 consumption, Table A3, p. 4-6 for 2008 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%	I	**48%**	49%	3%	20.38
1985	**40%**	40%	18%	3%	I	**51%**	46%	3%	17.84
1990	**37%**	43%	17%	3%	I	**47%**	49%	3%	19.75
1995	**35%**	42%	19%	3%	I	**48%**	49%	3%	22.83
2000	**35%**	40%	22%	3%	I	**50%**	47%	3%	23.80
2005	**36%**	35%	27%	3%	I	**55%**	42%	3%	22.63
2008(1)	**34%**	34%	29%	3%	I	**55%**	42%	3%	23.85
2010	**33%**	33%	31%	3%	I	**56%**	41%	3%	24.52
2015	**33%**	37%	27%	3%	I	**53%**	45%	3%	25.53
2020	**33%**	37%	27%	3%	I	**53%**	44%	3%	25.81
2025	**34%**	37%	26%	3%	I	**53%**	44%	3%	25.61
2030	**33%**	36%	28%	3%	I	**54%**	43%	3%	26.37
2035	**32%**	35%	29%	3%	I	**55%**	41%	3%	27.15

Note(s): 1) Buildings accounted for 64% (or $215.5 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 consumption, Table A3, p. 4-6 for 2008 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
1985	**8%**	25%	4%	63%	**11%**	26%	63%	30.9
1990	**7%**	25%	4%	64%	**10%**	26%	64%	33.6
1995	**6%**	25%	2%	67%	**8%**	26%	67%	34.6
2000	**6%**	24%	3%	67%	**8%**	25%	67%	38.4
2005	**5%**	24%	3%	68%	**8%**	25%	68%	40.7
2008	**5%**	**23%**	**1%**	**71%**	**6%**	**23%**	**71%**	**38.5**
2010	**5%**	22%	1%	72%	**6%**	22%	72%	37.0
2015	**4%**	24%	1%	71%	**5%**	24%	71%	39.1
2020	**4%**	23%	1%	72%	**5%**	24%	72%	39.4
2025	**4%**	23%	1%	72%	**5%**	23%	72%	39.9
2030	**4%**	22%	1%	73%	**4%**	22%	73%	40.6
2035	**3%**	22%	1%	74%	**4%**	22%	74%	41.8

Note(s): 1) Buildings accounted for an estimated 5.2% (or $37.6 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 consumption, Table A3, p. 4-6 for 2008 expenditures.

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

	Buildings					
	Residential	Commercial	**Total**	Industry	Transportation	Total
1980	1.28	0.93	**2.22**	5.29	9.55	19.27
1985	0.98	0.67	**1.65**	4.24	9.84	17.38
1990	0.93	0.66	**1.60**	4.50	10.89	18.59
1995	0.86	0.49	**1.35**	4.71	11.67	19.07
2000	1.04	0.59	**1.63**	5.06	13.01	21.33
2005	1.01	0.58	**1.59**	5.25	13.96	22.39
2008	**0.65**	**0.38**	**1.03**	**4.29**	**12.87**	**19.21**
2010	0.61	0.34	**0.95**	3.91	12.61	18.43
2015	0.57	0.33	**0.91**	4.47	13.12	19.41
2020	0.54	0.34	**0.88**	4.44	13.32	19.52
2025	0.52	0.34	**0.86**	4.40	13.59	19.70
2030	0.50	0.34	**0.84**	4.32	14.03	20.04
2035	0.41	0.35	**0.75**	4.25	14.61	20.37

Source(s): EIA, Annual Energy Review 2009, August 2010, Table 5.13a for 1980-2007 buildings, Table 5.13b for 1980 to 2007 industry, Table 5.13c for 1980-2007 transportation, and Table 5.13d for 1980-2007 electricity generators; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 consumption; EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007.

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

	Energy Consumption (Quad)				Population (million)				Annual Growth Rate 1990-2000		Annual Growth Rate 2000-2008	
Region/Country	1990	2000	2008		1990	2000	2008		Energy	Pop.	Energy	Pop.
United States	84.9	99.3	99.5	20.2%	250	282	304	4.5%	1.6%	1.2%	0.0%	1.0%
China	27.0	36.4	85.1	17.3%	1,148	1,264	1,317	19.7%	3.0%	1.0%	11.2%	0.5%
OECD Europe	52.2	76.8	81.2	16.5%	402	522	545	8.1%	3.9%	2.6%	0.7%	0.5%
Other Non-OECD Asia	12.6	26.3	35.7	7.3%	781	1,014	1,142	17.0%	7.7%	2.6%	3.9%	1.5%
Russia (1)	61.0	27.2	30.4	6.2%	288	147	141	2.1%	-7.7%	-6.5%	1.4%	-0.5%
Central & S. America	14.5	20.8	25.8	5.2%	359	422	469	7.0%	3.7%	1.6%	2.7%	1.3%
Middle East	11.2	17.3	25.5	5.2%	135	173	205	3.1%	4.5%	2.5%	4.9%	2.1%
Japan	19.6	22.8	22.3	4.5%	124	127	127	1.9%	1.5%	0.3%	-0.3%	0.1%
India	7.9	13.5	20.0	4.1%	838	1,006	1,141	17.0%	5.5%	1.8%	5.0%	1.6%
Canada	11.0	13.1	14.0	2.8%	28	31	33	0.5%	1.8%	1.1%	0.9%	0.8%
Oth. Non-OECD Europe	24.1	12.0	13.2	3.3%	154	128	124	1.9%	-6.8%	-1.8%	1.2%	-0.4%
Africa	9.5	12.0	16.1	2.7%	631	804	970	14.5%	2.4%	2.4%	3.7%	2.4%
South Korea	3.8	7.8	9.9	2.0%	43	47	48	0.7%	7.4%	0.9%	2.9%	0.4%
Mexico	4.7	6.4	7.3	1.5%	85	100	110	1.6%	3.1%	1.6%	1.7%	1.2%
Australia & N. Zealand	4.4	5.7	6.6	1.3%	20	23	25	0.4%	2.5%	1.2%	2.0%	1.2%
Total World	**348.4**	**397.4**	**492.6**	100%	**5,287**	**6,089**	**6,701**	100%	1.3%	1.4%	2.7%	1.2%

Note(s): 1) 1990 Values for Russia approximated by Former USSR. 2) EIA predicts that in 2015, China's primary energy consumption will be approximately equal to that of the U.S. (101.6 quads for the U.S., and 101.4 quads for China).

Source(s): EIA, Country Energy Profiles, available at http://www.eia.gov/country/index.cfm, accessed 2/3/2011; and EIA, International Energy Outlook 2010, July 2010, Table A1, p, 145 for note 2.

1.2.1 Building Energy Prices, by Year and Major Fuel Type ($2009 per Million Btu)

	Residential Buildings				Commercial Buildings				Building
	Electricity	Natural Gas	Petroleum (1)	Avg.	Electricity	Natural Gas	Petroleum (2)	Avg.	Avg. (3)
1980	36.11	8.28	16.63	17.43	36.92	7.64	12.96	18.31	17.77
1985	38.61	10.59	14.49	19.88	37.98	9.52	11.58	21.18	20.40
1990	34.90	8.56	13.17	18.44	32.23	7.15	9.24	18.42	18.43
1995	33.16	7.93	10.25	17.32	30.01	6.65	6.98	17.33	17.32
2000	29.89	9.46	14.07	17.89	26.65	8.12	10.35	17.49	17.72
2005	30.39	13.55	18.77	21.31	27.89	12.05	15.02	20.74	21.07
2008	**33.16**	**13.62**	**26.75**	**23.50**	**30.50**	**11.99**	**22.62**	**22.83**	**23.21**
2010	33.59	11.14	23.23	22.52	28.49	9.04	18.91	20.44	21.62
2015	32.00	10.31	25.07	21.21	27.01	8.59	21.04	19.45	20.41
2020	31.43	10.95	28.08	21.62	26.62	9.05	23.78	19.71	20.73
2025	31.22	11.91	29.95	22.31	26.70	9.84	25.50	20.33	21.38
2030	31.18	12.63	31.09	22.90	26.59	10.41	26.40	20.67	21.83
2035	31.67	13.51	31.66	23.78	27.03	11.10	26.85	21.31	22.56

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 2008, buildings average electricity price was $30.23/10^6 Btu or ($0.10/kWh), average natural gas price was $12.11/10^6 Btu ($12.47/1000 CF), and petroleum was $19.65/10^6 Btu ($1.94/gal.). Averages do not include wood or

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, Tables 2-3, p. 24-25 for 1980-2007 and prices for note, Tables 8-9, p. 24-25 for 1980-2007 consumption; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8, Table A12, p. 25-26, and Table A13, p. 27-28 for 2008-2030 consumption and prices; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.2 Building Energy Prices, by Year and Fuel Type ($2009)

	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	12.32	82.84	1.54	2.22	12.60	76.39	1.42	2.04
1985	13.17	105.94	1.37	1.94	12.96	95.19	1.20	1.55
1990	11.91	85.58	1.41	1.68	11.00	71.46	0.78	1.25
1995	11.31	79.32	1.23	1.21	10.24	66.45	0.63	0.87
2000	10.20	94.60	1.51	1.69	9.09	81.20	0.83	1.27
2005	10.37	135.50	1.91	2.34	9.51	120.48	1.23	2.06
2008	**11.31**	**136.20**	**2.52**	**3.40**	**10.41**	**119.95**	**2.37**	**3.00**
2010	11.46	111.44	2.27	2.84	9.72	90.41	2.07	2.51
2015	10.92	103.13	2.55	2.91	9.22	85.88	1.98	2.65
2020	10.72	109.52	2.76	3.34	9.08	90.46	2.27	3.08
2025	10.65	119.08	2.91	3.57	9.11	98.41	2.55	3.31
2030	10.64	126.28	2.99	3.70	9.07	104.08	2.65	3.44
2035	10.80	135.11	3.00	3.79	9.22	111.04	2.72	3.51

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. Tables 2-3, p. 24-25 for 1980-2007; EIA, Annual Energy Outlook 2010, May 2010, Table G1, p. 221 for fuels' heat content; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A3, p. 6-8 for 2008-2030; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.3 Buildings Aggregate Energy Expenditures, by Year and Major Fuel Type ($2009 Billion) (1)

	Residential Buildings				Commercial Buildings				Total Building
	Electricity	Natural Gas	Petroleum (2)	Total	Electricity	Natural Gas	Petroleum (3)	Total	Expenditures
1980	83.2	37.8	26.9	147.9	66.2	19.2	16.0	101.4	249.3
1985	98.4	45.5	21.1	165.0	84.0	22.4	11.7	118.1	283.1
1990	103.5	36.4	17.0	156.9	86.7	18.1	8.6	113.4	270.3
1995	110.9	37.2	13.0	161.2	91.8	19.5	5.0	116.3	277.4
2000	114.4	45.4	20.1	179.9	99.2	24.9	7.8	131.8	311.7
2005	132.6	63.2	25.1	220.9	114.1	34.9	10.7	159.7	380.6
2008	**156.1**	**68.1**	**32.2**	**256.4**	**139.0**	**38.6**	**14.5**	**192.1**	**448.5**
2010	166.8	54.6	26.6	248.0	131.2	28.7	10.5	170.4	418.4
2015	147.0	50.8	26.8	224.6	130.3	29.6	11.5	171.3	395.9
2020	149.3	54.4	27.9	231.6	138.4	32.3	12.7	183.4	415.0
2025	155.6	59.0	28.1	242.7	148.9	35.9	13.5	198.4	441.1
2030	163.7	62.4	27.9	254.0	159.7	39.2	14.0	212.9	466.9
2035	174.3	66.1	27.4	267.8	173.9	43.3	14.2	231.4	499.2

Note(s): 1) Expenditures exclude wood and coal. 2008 U.S. energy expenditures were 1.51 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 2008: Prices and Expenditures, June 2010, Table 1, p. 23 for U.S. energy expenditures and Tables 2-3, p. 24-25 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A3, p. 6-8 for 2008-2030; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.4 FY 2006 Federal Buildings Energy Prices and Expenditures, by Fuel Type ($2009)

Fuel Type	Average Fuel Prices ($/million BTU)		Total Expenditures ($ million) (2)
Electricity	24.16 (1)		3960.63
Natural Gas	14.46		1326.63
Fuel Oil	11.05		433.98
Coal	16.30		64.86
Purchased Steam	3.38		307.56
LPG/Propane	21.41		38.54
Other	15.70		42.54
Average	17.50	**Total**	6177.93

Note(s): Prices and expenditures are for Goal-Subject buildings. 1) $0.078/kWh. 2) Energy used in Goal-Subject buildings in FY 2006 accounted for 32.8% of the total Federal energy bill.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Nov. 2010, Table A-4, p. 74 for prices and expenditures, and Table A-9, p. 78 for total energy expenditures; EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators

1.2.5 2008 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	65.0	17.1	1.2	7.6	0.6	26.4	0.2	22.8	114.4	25.5%
Lighting								63.2	63.2	14.1%
Water Heating (4)	23.3	3.1		2.5		5.6		18.6	47.6	10.6%
Space Cooling	0.4							55.7	56.1	12.5%
Refrigeration (5)								27.4	27.4	6.1%
Electronics (6)								25.1	25.1	5.6%
Ventilation (7)								16.2	16.2	3.6%
Cooking	4.9			0.9		0.9		8.4	14.2	3.2%
Computers								12.5	12.5	2.8%
Wet Cleaning (8)	0.7							10.4	11.1	2.5%
Other (9)	3.4	0.3		8.2	1.2	9.7		24.4	37.6	8.4%
Adjust to SEDS (10)	8.8	4.0				4.0		10.5	23.3	5.2%
Total	**106.7**	**24.5**	**1.2**	**19.2**	**1.8**	**46.7**	**0.2**	**295.2**	**448.7**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.6 billion) and motor gasoline other uses ($1.2 billion). 3) Includes furnace fans ($4.5 billion). 4) Includes residential recreation water heating ($1.4 billion). 5) Includes refrigerators ($24.8 billion) and freezers ($2.6 billion). 6) Includes color televisions ($11.0 billion) and other electronics ($14.1 billion). 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($0.7 billion), electric clothes dryers ($6.2 billion) and dishwashers ($3.1 billion). 9) Includes residential small electric devices, heating elements, motors, swimming pool heaters, hot tub heaters, outdoor grills, and natural gas outdoor lighting. Includes commercial services station equipment, ATMs, telecommunications equipment, medical equipment, pumps, lighting, emergency electric generators, manufacturing performed in commercial buildings. 10) Expenditures related to an energy adjustment EIA uses to relieve discrepancies between data sources. Energy attributable to the residential and commercial buildings sectors, but not directly to specific end-uses.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, Table A4, p. 9-10 for residential energy consumption, and Table A5, p. 11-12 for commercial energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. 24-25 for coal prices; EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential 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.

1.2.6 2010 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	51.2	12.9	0.6	6.8	0.4	20.7	0.2	19.3	91.4	21.8%
Space Cooling	0.4							54.0	54.4	13.0%
Lighting								52.9	52.9	12.6%
Water Heating	19.1	2.4		2.1		4.4		17.4	40.9	9.8%
Refrigeration (4)								26.0	26.0	6.2%
Electronics (5)								18.9	18.9	4.5%
Ventilation (6)								14.6	14.6	3.5%
Computers								12.1	12.1	2.9%
Wet Cleaning (7)	0.6							10.4	11.0	2.6%
Cooking	4.0			0.8		0.8		4.3	9.1	2.2%
Other (8)	2.7	0.3		7.2	1.0	8.5		48.7	59.8	14.3%
Adjust to SEDS (9)	5.3	2.8				2.8		19.6	27.6	6.6%
Total	**83.4**	**18.2**	**0.6**	**16.9**	**1.4**	**37.1**	**0.2**	**298.0**	**418.6**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.4 billion) and motor gasoline other uses ($1.0 billion). 3) Includes furnace fans ($4.7 billion). 4) Includes refrigerators ($23.4 billion) and freezers ($2.6 billion). 5) Includes color televisions ($11.4 billion). 6) Commercial only; residential fan proportionately in space heating and cooling. 7) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($0.6 billion), electric clothes dryers ($6.2 billion) and dishwashers ($3.0 billion). 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, and 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, Table A4, p. 9-10 for residential energy consumption, and Table A5, p. 11-12 for commercial energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. 24-25 for coal prices; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.7 2020 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	51.9	13.2	1.0	7.1	0.6	21.9	0.2	19.0	93.0	22.4%
Water Heating (4)	20.3	1.9		1.6		3.5		17.9	41.7	10.0%
Lighting								45.8	45.8	11.0%
Space Cooling	0.3							41.3	41.6	10.0%
Refrigeration (5)								22.9	22.9	5.5%
Electronics (6)								20.4	20.4	4.9%
Computers								10.5	10.5	2.5%
Wet Clean (7)	0.6							9.4	10.0	2.4%
Cooking	4.4			0.9		0.9		4.5	9.8	2.4%
Ventilation (8)								15.9	15.9	3.8%
Other (9)	3.5	0.3		10.2	1.3	11.8		58.7	74.1	17.9%
Adjust to SEDS (10)	5.7	2.6				2.6		21.2	29.5	7.1%
Total	**86.7**	**18.0**	**1.0**	**19.8**	**1.9**	**40.7**	**0.2**	**287.6**	**415.2**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.6 billion) and motor gasoline other uses ($1.3 billion). 3) Includes furnace fans ($5.2 billion). 5) Includes refrigerators ($20.4 billion) and freezers ($2.5 billion). 6) Includes color televisions ($10.6 billion). 7) Includes clothes washers ($0.8 billion), natural gas clothes dryers ($0.6 billion), electric clothes dryers ($5.7 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, and 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, Table A4, p. 9-10 for residential energy consumption, and Table A5, p. 11-12 for commercial energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. 24-25 for coal prices; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.8 2030 Buildings Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal	Electricity	Total	Percent
Space Heating (3)	59.9	12.2	1.2	7.0	0.7	21.1	0.2	20.2	101.4	21.7%
Water Heating (4)	23.6	1.7		1.3		3.0		33.3	59.9	12.8%
Lighting								48.3	48.3	10.3%
Space Cooling	0.4							45.2	45.5	9.7%
Refrigeration (5)								23.9	23.9	5.1%
Electronics (6)								23.8	23.8	5.1%
Computers								11.3	11.3	2.4%
Cooking	5.4			0.9		0.9		5.0	11.3	2.4%
Wet Clean (7)	0.7							10.1	10.8	2.3%
Ventilation (8)								2.5	2.5	0.5%
Other (9)	6.5	0.4		12.2	1.5	14.1		76.6	97.2	20.8%
Adjust to SEDS (10)	5.1	2.8				2.8		23.4	31.2	6.7%
Total	**101.6**	**17.1**	**1.2**	**21.4**	**2.1**	**41.8**	**0.2**	**323.5**	**467.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.7 billion) and motor gasoline other uses ($1.5 billion). 3) Includes furnace fans ($5.9 billion). 5) Includes refrigerators ($21.3 billion) and freezers ($2.6 billion). 6) Includes color televisions ($12.1 billion). 7) Includes clothes washers ($0.9 billion), natural gas clothes dryers ($0.7 billion), electric clothes dryers ($5.9 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, Table A4, p. 9-10 for residential energy consumption, and Table A5, p. 11-12 for commercial energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. 24-25 for coal prices; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

1.2.9 Implicit Price Deflators (2000 = 1.00)

Year	Implicit Price Deflator	Year	Implicit Price Deflator	Year	Implicit Price Deflator
1980	0.48	1990	0.72	2000	0.89
1981	0.52	1991	0.75	2001	0.91
1982	0.55	1992	0.77	2002	0.92
1983	0.58	1993	0.78	2003	0.94
1984	0.60	1994	0.80	2004	0.97
1985	0.62	1995	0.82	2005	1.00
1986	0.63	1996	0.83	2006	1.03
1987	0.65	1997	0.85	2007	1.06
1988	0.67	1998	0.86	2008	1.08
1989	0.70	1999	0.87	2009	1.10

Source(s): EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383.

1.3.1 Estimated Value of All U.S. Construction Relative to the GDP ($2009)

- 2007 estimated value of all U.S. construction was $1.81 trillion (including renovation; heavy construction; public works; residential, commercial, and industrial new construction; and non-contract work).
- Compared to the $14.5 trillion 2007 U.S. gross domestic product (GDP), all construction held a 12.4% share.
- In 2007, residential and commercial building renovation (valued at $451 billion) and new building construction (valued at $755 billion) was estimated to account for over 67% (approximately $1.21 trillion) of the $1.81 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 2010; DOC, Expenditures for Residential Improvements and Repairs by Property Type, Table S2, May 2008; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators and GDP.

1.3.2 Value of New Building Construction Relative to GDP, by Year ($2009 Billion)

	Value of New Construction Put in Place				Bldgs. Percent of
	Residential	Commercial (1)	All Bldgs. (1)	GDP	Total U.S. GDP
1980	164.6	158.5	323.1	6,409	5.0%
1985	211.7	224.5	436.2	7,518	5.8%
1990	206.7	225.4	432.1	8,819	4.9%
1995	236.0	202.2	438.3	9,982	4.4%
2000	331.9	310.2	642.1	12,323	5.2%
2005	533.9	299.7	833.7	13,873	6.0%
2006	504.8	332.0	836.8	14,244	5.9%
2007	373.5	380.5	754.0	14,549	5.2%
2008	240.4	396.9	637.3	14,613	4.4%
2009	141.5	327.5	469.1	14,256	3.3%

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 1995-2000; DOC, Annual Value of Private Construction Put in Place, August 2010 for 2002-2009; DOC, Annual Value of Public Construction Put in Place, August 2008 for 1995-2000; DOC, Annual Value of Public Construction Put in Place, August 2010 for 2002-2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

1.3.3 Value of Building Improvements and Repairs Relative to GDP, by Year ($2009 Billion) (1)

	Value of Improvements and Repairs				Bldgs. Percent of
	Residential	Commercial	All Bldgs.	GDP	Total U.S. GDP
1980	106.5	N.A.	N.A.	5,839.0	N.A.
1985	146.4	139.1 (2)	285.5	6,849.3	4.2%
1990	175.5	141.2 (3)	316.7	8,033.9	3.9%
1995	168.2	149.7	317.9	9,093.7	3.5%
2000	196.4	135.3	331.7	11,226.0	3.0%
2006	242.6	222.8	465.4	12,976.2	3.6%
2007	233.9	216.6	450.6	13,254.1	3.4%

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, May 2008 for 1994-2007; 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 and DOC, Annual Value of Public Construction Put in place, July 2008 for 1995-2000; DOC, Annual Value of Private Construction Put in Place, August 2010 and DOC, Annual Value of Public Construction Put in Place, August 2010 for 2003-2007; and EIA, Annual Energy Review 2007, June 2008, Appendix D, p. 383 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 2006/2007 International Investment into Construction and Energy R&D

	Construction Percent of Private R&D to Total Private R&D	Electricity, Gas, and Water Percent of Private R&D to Total Private R&D
United States	0.1	0.6
Canada	0.3	1.3
China	1.1	2.3
Germany	0.1	0.2
France	0.4	1.6
Italy	0.2	1.1
Japan	0.9	0.5
United Kingdom	0.3	0.1
Russian Federation	0.1	0.5
Sweden	0.2	0.8
Finland	1.1	0.7

Note(s): Includes all construction (e.g., bridges, roads, dams, buildings, etc.).
Source(s): National Science Board, Science and Engineering Indicators: 2010, Volume 1, Jan. 2010, Appendix Table 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
2005		235	7,336		1997	46.6	33.6	52.1	134.1
2006		221	7,691		2002	95.4	28.0	47.7	167.4
2007		240	7,630		2007	52.4	49.8	69.8	163.1
2008		233	7,162						
2009		204	6,037						

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 for construction employment; Statistical Abstract of the U.S. 2007, 2006, Table 602, p. 388 for 2005 architect employment; DOC, Statistical Abstract of the U.S. 2008, 2007, Table 598, p. 388 for 2006 architect employment; DOC, Statistical Abstract of the U.S. 2009, 2008, Table 596, p. 384 for 2007 architect employment; DOC, Statistical Abstract of the U.S. 2010, 2009, Table 603 for 2008 architect employment; DOC, Statistical Abstract of the U.S. 2011, 2010, Table 629 for 2005-2009 construction employment and Table 615, p. 393 for architect employment; 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; DOC, 2007 Economic Census: Construction – New Single-Family Housing Construction, EC0723SG08, Oct. 2010, for 2007 number of residential builder establishments; 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.

1.3.8 Number of Construction Employees and Total Employees for Select Building Envolope Industries (Thousand Employees)

	2002	2004	2006	2008	2009
Poured Concrete Foundation and Structure Contractors (NAICS 238110)					
-Total Employment	197.5	221.5	254.0	236.2	188.7
-Construction/Extraction Occupations	165.5	187.3	213.1	198.2	157.6
-Construction/Extraction % of Total	83.8%	84.5%	83.9%	83.9%	83.5%
Masonry Contractors (NAICS 238140)					
-Total Employment	228.9	238.4	255.1	229.4	183.6
-Construction/Extraction Occupations	199	208	224	198	158
-Construction/Extraction % of Total	87.0%	87.1%	87.8%	86.4%	85.9%
Roofing Contractors (NAICS 238160)					
-Total Employment	183.2	188.0	201.5	196.1	178.5
-Construction/Extraction Occupations	145.2	152.7	161.9	155.9	141.0
-Construction/Extraction % of Total	79.2%	81.2%	80.4%	79.5%	79.0%
Drywall and Insulation Contractors (NAICS 238310)					
-Total Employment	321.4	342.8	367.7	329.9	269.1
-Construction/Extraction Occupations	279.5	299.2	322.0	286.1	231.0
-Construction/Extraction % of Total	87.0%	87.3%	87.6%	86.7%	85.8%
Painting and Wall Covering Contractors (NAICS 238320)					
-Total Employment	223.1	224.6	245.1	233.6	196.7
-Construction/Extraction Occupations	191.0	193.7	213.0	202.4	168.8
-Construction/Extraction % of Total	85.8%	86.2%	86.9%	86.7%	85.8%

Source(s): Bureau of Labor Statistics, Occupational Employment and Wage Estimates: 2002 OES Estimates for 2002 Data, November 2004 OES Estimates for 2004 Data, May 2006 Estimates for 2006 Data, May 2008 Estimates for 2008 Data, May 2009 Estimates for 2009 Data. Available at http://www.bls.gov/oes/oes_data.htm.

1.3.9 Number of Construction Employees and Total Employees for Select Building Equipment Industries (Thousand Employees)

	2002	2004	2006	2008	2009
Electrical Contractors and Other Wiring Installation Contractors (NAICS 238210)					
-Total Employment	894.3	852.7	890.4	915.2	830.8
-Construction/Extraction Occupations	585.7	562.1	601.1	620.7	557.4
-Construction/Extraction % of Total	65.5%	65.9%	67.5%	67.8%	67.1%
Plumbing, Heating, and Air-Conditioning Contractors (NAICS 238220)					
-Total Employment	837.7	896.8	977.7	996.2	904.0
-Construction/Extraction Occupations	495.6	505.1	542.6	543.0	485.7
-Construction/Extraction % of Total	59.2%	56.3%	55.5%	54.5%	53.7%
Other Building Equipment Contractors (NAICS 238290)					
-Total Employment	107.0	106.8	119.4	132.2	128.8
-Construction/Extraction Occupations	46.4	49.0	54.0	59.7	58.9
-Construction/Extraction % of Total	43.3%	45.8%	45.2%	45.2%	45.7%

Source(s): Bureau of Labor Statistics, Occupational Employment and Wage Estimates: 2002 OES Estimates for 2002 Data, November 2004 OES Estimates for 2004 Data, May 2006 Estimates for 2006 Data, May 2008 Estimates for 2008 Data, May 2009 Estimates for 2009 Data. Available at http://www.bls.gov/oes/oes_data.htm.

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 2008-Year	Total	Growth Rate 2008-Year	Buildings % of Total U.S.	Buildings % of Total Global
1980	630	933	1562	-	4723	-	33%	8.5%
1985	569	1026	1595	-	4559	-	35%	8.2%
1990	566	1179	1745	-	5021	-	35%	8.1%
1995	599	1312	1912	-	5333	-	36%	8.6%
2000	608	1592	2199	-	5857	-	38%	9.2%
2005	570	1720	2289	-	5950	-	38%	8.1%
2008 (3)	**572**	**1715**	**2287**	**-**	**5820**	**-**	**39%**	**7.5%**
2010	553	1719	2272	-0.3%	5639	-1.6%	40%	7.4%
2015	562	1552	2114	-1.1%	5679	-0.3%	37%	6.7%
2020	565	1630	2195	-0.3%	5774	-0.1%	38%	6.5%
2025	564	1766	2330	0.1%	5931	0.1%	39%	6.4%
2030	567	1883	2450	0.3%	6110	0.2%	40%	6.2%
2035	569	1986	2555	0.4%	6315	0.3%	40%	6.0%

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 2010 and difffers from EIA, AEO 2011 Early Release, Table A18. Buildings sector total varies by 0.2% from EIA, AEO 2011 Early Release. 3) U.S. buildings emissions approximately equal the combined carbon emissions of Russia and the United Kingdom.

Source(s): EIA, Emissions of Greenhouse Gases in the U.S. 2008, Dec. 2009, Tables 7-10 for 1980-2007 greenhouse gas emissions; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 energy consumption and Table A18, p. 36 for 2008-2035 emissions; EIA, International Energy Outlook 2010, July 2010, Table A10, p. 155 for 2004-2030 global emissions; and EIA, Country Energy Profiles for global emissions (1980-2007), available at http://www.eia.gov/country/index.cfm, accessed 2/3/2011.

1.4.2 2008 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)	263.2	51.7	5.8	16.3	1.8	75.7	7.7	131.4	477.9	20.9%
Lighting								396.7	396.7	17.3%
Space Cooling	1.8							322.6	324.3	14.2%
Water Heating	93.7	9.3		5.4		14.7		106.2	214.7	9.4%
Refrigeration (5)								158.9	158.9	6.9%
Electronics (6)								143.6	143.6	6.3%
Ventilation (7)								98.3	98.3	4.3%
Computers								73.0	73.0	3.2%
Cooking	20.3			1.9		1.9		47.2	69.5	3.0%
Wet Cleaning (8)	2.8							58.1	60.8	2.7%
Other (9)	15.3	1.0		18.3	3.2	22.6		145.2	183.0	8.0%
Adjust to SEDS (10)	38.9	13.5				13.5		36.4	88.8	3.9%
Total	**436.0**	**75.5**	**5.8**	**42.0**	**5.1**	**128.4**	**7.7**	**1717.6**	**2289.7**	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 2010 and differs from EIA, AEO 2011 Early Release, Table A18. Buildings sector total varies by 0.2% from EIA, AEO 2011 Early Release. 2) Includes kerosene space heating (1.8 MMT) and motor gasoline other uses (3.2 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (25.4 MMT). 5) Includes refrigerators (144.2 MMT) and freezers (14.7 MMT). 6) Includes color television (61.6 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 (6.3 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (34.8 MMT), and dishwashers (17.0 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon 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.

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)	260.1	46.7	3.2	16.2	2.1	68.1	6.2	108.2	442.7	19.5%
Lighting								310.7	310.7	13.7%
Space Cooling	2.3							304.4	306.8	13.5%
Water Heating	95.4	8.6		4.9		13.4		95.5	204.3	9.0%
Refrigeration (5)								149.8	149.8	6.6%
Electronics (6)								108.1	108.1	4.8%
Ventilation (7)								91.7	91.7	4.0%
Computers								70.2	70.2	3.1%
Wet Cleaning (8)	2.8							55.5	58.3	2.6%
Cooking	21.0			1.9		1.9		23.4	46.3	2.0%
Other (9)	16.0	0.9		19.1	3.1	23.1		277.9	317.0	14.0%
Adjust to SEDS (10)	31.0	11.0				11.0		123.5	165.6	7.3%
Total	**428.7**	**67.2**	**3.2**	**42.2**	**5.1**	**117.6**	**6.2**	**1719.0**	**2271.6**	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 (2.1 MMT) and motor gasoline other uses (3.1 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (25.0 MMT). 5) Includes refrigerators (135.8 MMT) and freezers (14.1 MMT). 6) Includes color television (61.1 MMT) and other office equipment (117.3 MMT). 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers (5.8 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (33.4 MMT), and dishwashers (16.3 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. 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon 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)	267.6	40.3	5.1	13.9	2.0	61.3	6.4	103.5	438.9	20.0%
Lighting								266.2	266.2	12.1%
Space Cooling	1.9							228.8	230.7	10.5%
Water Heating	103.4	5.9		3.1		9.0		95.6	208.0	9.5%
Refrigeration (5)								128.3	128.3	5.8%
Electronics (6)								115.3	115.3	5.3%
Ventilation (7)								98.0	98.0	4.5%
Computers								59.6	59.6	2.7%
Wet Cleaning (8)	2.8							49.1	51.9	2.4%
Cooking	23.2			1.7		1.7		24.1	49.1	2.2%
Other (9)	20.7	1.0		21.0	3.3	25.2		330.5	376.4	17.2%
Adjust to SEDS (10)	33.2	8.4				8.4		130.7	172.3	7.9%
Total	**453.0**	**55.6**	**5.1**	**39.7**	**5.3**	**105.7**	**6.4**	**1629.7**	**2194.8**	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 (2.0 MMT) and motor gasoline other uses (3.3 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (27.3 MMT). 5) Includes refrigerators (115.2 MMT) and freezers (13.1 MMT). 6) Includes color television (55.3 MMT) and other office equipment (139.1 MMT). 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers (4.4 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (29.5 MMT), and dishwashers (15.2 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients.

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)	267.9	33.8	5.3	12.7	2.0	53.7	6.4	112.6	440.7	18.0%
Lighting								288.4	288.4	11.8%
Space Cooling	1.9							256.7	258.6	10.6%
Water Heating	105.0	4.7		2.3		7.0		98.0	210.0	8.6%
Electronics (5)								138.3	138.3	5.6%
Refrigeration (6)								137.4	137.4	5.6%
Ventilation (7)								113.5	113.5	4.6%
Computers								65.5	65.5	2.7%
Wet Cleaning (8)	2.9							54.3	57.2	2.3%
Cooking	25.0			1.6		1.6		27.2	53.9	2.2%
Other (9)	33.2	1.0		23.1	3.4	27.5		444.5	505.2	20.6%
Adjust to SEDS (10)	26.1	8.1				8.1		146.9	181.1	7.4%
Total	**462.0**	**47.6**	**5.3**	**39.7**	**5.4**	**98.0**	**6.4**	**1883.4**	**2449.7**	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. 2) Includes kerosene space heating (2.0 MMT) and motor gasoline other uses (3.4 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (31.7 MMT). 5) Includes color television (64.6 MMT) and other office equipment (139.1 MMT). 6) Includes refrigerators (123.2 MMT) and freezers (14.2 MMT). 7) Commercial only; residential fan and pump energy use included proportionately in space heating and cooling. 8) Includes clothes washers (4.7 MMT), natural gas clothes dryers (2.9 MMT), electric clothes dryers (31.9 MMT), and dishwashers (17.7 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients.

1.4.6 World Carbon Dioxide Emissions

	Emissions (million metric tons)				Annual Growth Rate	
Nation/Region	1990	2000	2008		1990-2000	2000-2008
China	2270	2850	6804	22%	2.3%	11.5%
United States	5041	5862	5833	19%	1.5%	-0.1%
OECD Europe	2941	4192	4333	14%	3.6%	0.4%
Other Non-OECD Asia	829	1686	2281	7%	7.4%	3.9%
Russia (1)	3821	1556	1698	6%	-8.6%	1.1%
Middle East	730	1094	1659	5%	4.1%	5.3%
India	579	1003	1474	5%	5.7%	4.9%
Central & S. America	717	992	1229	4%	3.3%	2.7%
Japan	1047	1201	1215	4%	1.4%	0.1%
Africa	726	887	1158	4%	2.0%	3.4%
Oth. Non-OECD Europe	1604	694	772	3%	-8.0%	1.3%
Canada	471	573	598	2%	2.0%	0.5%
South Korea	242	439	522	2%	6.1%	2.2%
Australia & N. Zealand	296	391	465	2%	0.0%	0.0%
Mexico	302	383	452	1%	2.4%	2.1%
Total World	**21616**	**23804**	**30493**	**100%**	**1.0%**	**3.1%**

Note(s): 1) 1990 Values for Russia approximated by estimates for the former USSR.

Source(s): EIA, Country Energy Profiles, available at http://www.eia.gov/country/index.cfm, accessed 2/3/2011.

1.4.7 2008 Methane Emissions for U.S. Buildings Energy Production, by Fuel Type (MMT CO2 Equvalant) (1)

Fuel Type	Residential	Commercial	Buildings Total
Petroleum	0.9	0.5	1.4
Natural Gas	38.0	24.4	62.4
Coal	0.0	0.3	0.3
Wood	2.9	0.4	3.3
Electricity (2)	47.1	45.6	92.7
Total	**88.9**	**71.2**	**160.1**

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. 2008, Dec. 2009, Table 17, p. 30 for energy production emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008, April 2010, Table 3-10, p. 3-9 for stationary combustion emissions; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for energy consumption.

1.4.8 2008 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	63.01	-	-
Residual Fuel Oil	78.80	-	-
Average (2)	69.64	68.77	71.28
Electricity Consumption (3)			
Average - Primary (4)	58.73	58.73	58.73
Average - Site (5)	186.2	187.3	185.6
New Generation			
Gas Combined Cycle - Site (6)	114.8	114.8	114.8
Gas Combustion Turbine - Site (6)	172.8	172.8	172.8
Stock Gas Generator - Site (7)	140.6	140.6	140.6
All Fuels (3)			
Average - Primary	57.16	56.64	57.77
Average - Site	114.7	113.2	123.9

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 2011 Early Release and were adjusted using Assumptions to the AEO 2010. 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 (2010) 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A8, p. 18-19, Table A17, p. 34-35 for consumption and Table A18, p. 36 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 2009, August 2010, Diagram 8, p. 225 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 2008		
	Resid.	Comm.	Bldgs.
Electricity (2)	40.45	45.68	42.86
Petroleum	3.84	2.47	3.21
Natural Gas	12.31	9.24	10.89
Renew. En. (3)	0.00	0.00	0.00
Coal	0.04	0.37	0.19
Total	**56.64**	**57.77**	**57.16**

Note(s): 1) Electricity imports from utility consumptionwere 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A17, p. 34-35 for energy consumption and Table A18, p. 36 for 'carbon emissions; and EIA, Assumptions to the AEO 2008, June 2008, Table 2, p. 9.

1.4.10 2008 Emissions Summary Table for U.S. Buildings Energy Consumption (Thousand Short Tons) (1)

	Buildings				Buildings Percent
	Wood/SiteFossil	Electricity	Total	U.S. Total	of U.S. Total
SO2	561	6,996 (2)	7,557	13,770	55%
NOx	723	2,609	3,332	18,226	18%
CO	3,265	493	3,758	100,552	4%
VOCs	1,364	37	1,401	17,383	8%
PM-2.5	388	364	752	4,574	16%
PM-10	439	450	889	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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5; and EPA, 1970-2006 National Emissions Inventory, Average Annual Emissions, All Criteria Pollutants, July 2007.

1.4.11 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	0.755	0.053		0.239
Nox	0.282	0.068		0.089
CO	0.053	0.306		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,

Source(s): EPA, 2006 Average Annual Emissions, All Criteria Pollutants, July 2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 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 2003 Construction and Demolition Debris Generated from Construction Activities

	Debris (million tons)			Debris (percent of total buildings sector)		
	Residential	Commercial	Buildings	Residential	Commercial	Buildings
Construction	10.0	5.0	15.0	6%	3%	9%
Demolition	38.0	33.0	71.0	22%	19%	42%
Renovation	19.0	65.0	84.0	11%	38%	49%
Total	**67.0**	**103.0**	**170.0**	**39%**	**61%**	**100%**

Note(s): 170 million tons of construction and demolition debris represents approximately 3.2 pounds of debris per person per day in the U.S.

Source(s): EPA/OSW, Estimating 2003 Building-Related Construction and Demolition Materils Amounts, March 2009, Table 2-7, p. 17.

1.4.15 Disposal and Recovery of Construction and Demolition (C&D) Materials in 2003

Reporting State (1)	Tons of C&D Materials Disposed	Recovered (3)	(2) Recovery Rate
Florida	5,277,259	1,998,256	27%
Maryland	1,913,774	2,270,100	54%
Massachusetts	720,000	3,360,000	82%
New Jersey	1,519,783	5,582,336	79%
North Carolina	1,844,409	20,002	1%
Utah	1,054,296	46,461	4%
Virignia	3,465,548	95,131	3%
Washington	1,780,356	2,640,560	60%
Total	17,575,425	16,012,846	48%

Note(s): 1) Only eight states reported recovery and disposal amounts 2003, representing approximately 21% of the US population. 2) State definitions vary regarding what constitutes C&D materials. Some states may include concrete, asphalt pavement, and metals from non-building sources. 3) Recovered materials may include those used for purposes that do not meet state definitions for recycling, such as landfill cover and energy generation.

Source(s): EPA, Estimating 2003 Building-Related Construction and Demolition Materials Amounts, Table 3-1

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 2008

One quad equals:

- 49.5 million short tons of coal
  - = enough coal to fill a train of railroad cars 4,066 miles long (about one and a half times across the U.S.)
- 972.8 billion cubic feet natural gas
- 8.2 billion gallons of gasoline = 21.3 days of U.S. gasoline use
  - = 22. million passenger cars each driven 12,400 miles
  - = 19.2 million light-duty vehicles each driven 12,200 miles
  - = all new passenger cars and light-duty trucks sold, each driven 40,000 miles
  - = 14. 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 9 round-trips from New York to Los Angeles
- 172.4 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 483 supertankers
- 17.8 hours of world energy use
- the electricity delivered from 238 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 3.06 million people in the U.S.
- the approximate annual primary consumption of any one of the following states: Arkansas, Iowa, Kansas, Maryland Massachusetts, Mississippi, South Carolina, Utah, Washington, or Wyoming (1)

Note(s): 1) All states listed have annual energy consumption that is within 20% off one quad.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A1, p. 1-2, Table A2, p. 3-5, Table A7, p. 34-35, Table A8, p. 18-19, Table A9, p. 20-21, and Table A11, p. 23-24 for consumption; EIA, Annual Energy Outlook 2010, May 2010, Table G1, p. 215 for heat rates; EIA, State Energy Data 2008: Consumption, June 2010, Table S3, p. 5, Table R1, p. 15, and Table R2, p. 16; EIA, Electric Power Annual 2009, January 2011, Table 1.1, p. 14; DOC, Statistical Abstract of the United States 2008, May 2008, No. 1080 p. 690; DOC, Statistical Abstract of the United States 2011, 2010, No. 1031, p. 658, and No. 1074, p. 686; and Newport News Shipbuilding Web site.

1.5.3 Carbon Emission Comparisons

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

- the combustion of 525 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 118 million gallons of gasoline = the combustion of gasoline for 7 hours in the U.S.
  - = 310 thousand new cars, each driven 12,400 miles
  - = 272 thousand new light-duty vehicles, each driven 12,200 miles
  - = 260 thousand new light trucks, each driven 11,000 miles
  - = 0.14 million new passenger cars, each making 5 round trips from New York to Los Angeles
- the combustion of 190 million gallons of LPG
- the combustion of 107 million gallons of kerosene
- the combustion of 102 million gallons of distillate fuel
- the combustion of 87 million gallons of residual fuel
- 17 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 52,000 people in the U.S.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A7, p. 16-17 for consumption and Table A18, p. 36 for emissions; EIA, Annual Energy Outlook 2010, May 2010, Table G1, p. 221 for heat rates; EIA, Electric Power Annual 2009, January 2011, Table 1.2, page 17; EIA, Country Energy Profiles for global emissions, available at http://www.eia.gov/country/index.cfm, accessed 2/3/2011; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 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)	1,359	kWh - Electricity	0.9	1,900
Stock Electric Water Heater	2,814	kWh - Electricity	1.8	3,900
Stock Gas Water Heater	24	million Btu - Natural Gas	1.3	2,800
Stock Oil Water Heater	32	million Btu - Fuel Oil	2.3	5,100
Single-Family Home	108	million Btu	12.3	27,000
Mobile Home	70	million Btu	8.0	17,600
Multi-Family Unit in Large Building	54	million Btu	6.2	13,600
Multi-Family Unit in Small Building	85	million Btu	9.6	21,200
School Building	2,125	million Btu	263.3	580,600
Office Building	1,376	million Btu	170.5	375,900
Hospital, In-Patient	60,152	million Btu	7,453.4	16,434,700
Stock Vehicles				
Passenger Car	522	gallons - Gasoline	4.6	10,127
Van, Pickup Truck, or SUV	605	gallons - Gasoline	5.3	11,738
Heavy Truck	1,456	gallons - Diesel Fuel	13.2	29,181
Tractor Trailer Truck	12,100	gallons - Diesel Fuel	110.0	242,476

Note(s): 1) Stock refrigerator consumption is per household refrigerator consumption, not per refrigerator.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for consumption and Table A18, p. 36 for emissions; EIA, Annual Energy Outlook 2008, Mar. 2008, Table G1, p. 215 for gasoline heat rate; EIA, A Look at Residential Energy Consumption in 2005, January 2009, Tables WH6 and WH7 for water heater energy consumption, Table AP2 for refrigerators energy, and Table US9 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 29, 2010, 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 ($2009 Billion) (1)

	Residential	Commercial	**Buildings**
1980	9.96	10.18	**10.05**
1985	10.90	10.95	**10.92**
1990	9.81	9.03	**9.47**
1995	9.22	8.39	**8.86**
2000	9.35	8.14	**8.80**
2005	10.83	9.49	**10.23**
2008	**10.73**	**10.36**	**10.56**
2010	9.43	9.27	**9.36**
2015	9.22	9.02	**9.12**
2020	9.30	9.04	**9.17**
2025	9.51	9.23	**9.37**
2030	9.63	9.33	**9.48**
2035	9.89	9.59	**9.74**

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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A17, p. 34-35 for energy consumption and Table A3, p. 6-8 for energy prices(2008-2030). EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-9, p. 24-25 for 1980-2007; EIA, State Energy Data 2008: Prices and Expenditures, June 2010, Tables 2 and 3 (1980-2007); and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

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%
1985	34%	10%	35%	7%	4%	11%	10%	100%
1990	32%	8%	36%	7%	4%	11%	13%	100%
1995	33%	7%	36%	6%	4%	10%	14%	100%
2000	32%	6%	38%	5%	3%	8%	15%	100%
2005	32%	6%	39%	5%	3%	8%	15%	100%
2008	**30%**	**5%**	**41%**	**5%**	**3%**	**8%**	**17%**	**100%**
2010	31%	4%	39%	5%	4%	9%	17%	100%
2015	31%	4%	36%	6%	6%	11%	17%	100%
2020	30%	4%	37%	6%	6%	12%	18%	100%
2025	29%	4%	39%	6%	6%	12%	17%	100%
2030	29%	3%	39%	5%	7%	12%	17%	100%

Note(s): 1) See Table 1.5.1 for generic quad definition. 2) The total 2008 Buildings sector primary energy consumption was 40.02 quads.

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A17, p. 34-35 for energy consumption; and EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-9, p. 24-25 for 1980-2007.

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.

1.6.1 Embodied Energy of Commercial Windows in the U.S.

Window Type	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Aluminium	0.973	190.1
PVC-clad Wood	0.447	88.3
Wood	0.435	90.9
Vinyl (PVC)	0.557	111.7
Curtainwall Viewable Glazing	0.233	66.1

Note(s): 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. Assumptions: Low rise building. Values are general estimations for the U.S. 60 year building lifetime. Low-e, double-pane, argon-filled glazing. All assemplies are insulated to IECC 2009 minimums for zones 3 and 6.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

Exterior Wall Type	Embodied Energy (MMBtu/SF) (1)		CO2 Equivalent Emissions (lbs/SF)	
	U.S. North (2)	U.S. South (3)	U.S. North (2)	U.S. South (3)
2x4 Steel Stud Wall (4)				
16" OC with brick cladding	0.10	0.10	14.46	14.04
24" OC with brick cladding	0.10	0.09	13.47	13.03
16" OC with wood cladding	0.07	0.07	8.71	8.27
24" OC with wood cladding	0.06	0.06	7.69	7.28
16" OC with steel cladding (26 ga)	0.24	0.24	38.65	38.23
2x6 Wood Stud Wall (5)				
16" OC with brick cladding	0.09	0.09	11.29	10.91
16" OC with PVC cladding	0.09	0.08	7.98	7.61
24" OC with steel cladding	0.23	0.23	36.29	35.91
24" OC with stucco cladding	0.07	0.07	8.66	8.29
24" OC with wood cladding	0.05	0.05	5.34	4.96
Structural Insulated Panel (SIP) (6)				
with brick cladding	0.15	0.14	15.98	15.06
with steel cladding	0.30	0.29	41.18	40.23
with stucco cladding	0.14	0.13	13.58	12.63
with PVC cladding	0.14	0.13	12.70	11.75
with wood cladding	0.12	0.11	10.23	9.30

Note(s): Assumptions: Low rise building. 60 year building lifetime. All assemplies are insulated to IECC 2009 minimums for zones 3 and 6. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Northern values represent ASHRAE climate zone 6. 3) Southern Values represent ASHRAE climate zone 3. 4) Includes cladding, continuous insulation sheathing, cavity insulation, polyethylene membrane, gypsum board, and latex paint. 5) Includes cladding, wood structural panel (WSP) sheathing, cavity insulation, polyethylene membrane, gypsum board, and latex paint. 6) Includes cladding, builder's paper, gypsum board, and latex paint.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

	Embodied Energy (MMBtu/SF) (1)		CO2 Equivalent Emissions (lbs/SF)	
	U.S. North (2)	U.S. South (3)	U.S. North (2)	U.S. South (3)
8" Concrete Block (4)				
Brick Cladding	0.26	0.26	42.59	42.37
Stucco Cladding	0.25	0.25	40.17	39.95
Steel Cladding	0.41	0.41	67.77	67.57
2x4 Steel Stud Wall (16" OC)	0.24	0.24	39.46	39.24
6" Cast-In-Place Concrete (3)				
Brick Cladding	0.13	0.13	24.43	24.21
Stucco Cladding	0.11	0.11	22.00	21.78
Steel Cladding	0.28	0.27	49.60	49.41
2x4 Steel Stud Wall (16" OC)	0.11	0.11	21.30	21.08
8" Concrete Tilt-Up (4)				
Brick Cladding	0.14	0.14	28.26	28.04
Stucco Cladding	0.12	0.12	25.84	25.62
Steel Cladding	0.29	0.28	53.44	53.24
2x4 Steel Stud Wall (16" OC)	0.12	0.12	25.13	24.91
Insulated Concrete Forms (5)				
Brick Cladding	0.16	0.16	29.45	29.45
Stucco Cladding	0.14	0.14	27.03	27.03
Steel Cladding	0.30	0.30	54.63	54.63

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. All assemplies are insulated to IECC 2009 minimums for zones 3 and 6. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Northern values represent ASHRAE climate zone 6. 3) Southern Values represent ASHRAE climate zone 3. 4) Includes continuous insulation, polyethylene membrane, gypsum board, and latex paint. 5) Includes gypsum board and latex paint.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Glulam Joist with Plank Decking		
with EPDM membrane	0.16	11.05
with PVC membrane	0.25	20.70
with Modified bitumen membrane	0.25	21.78
with 4-Ply built-up roofing	0.43	41.49
with Steel Roofing	0.10	10.05
Wood I-Joist with WSP Decking		
with EPDM membrane	0.14	10.10
with PVC membrane	0.23	19.75
with Modified bitumen membrane	0.24	20.81
with 4-Ply built-up roofing	0.42	40.54
with Steel Roofing	0.09	9.11
Solid Wood Joist with WSP Decking		
with EPDM membrane	0.15	10.36
with PVC membrane	0.24	20.02
with Modified bitumen membrane	0.24	21.10
with 4-Ply built-up roofing	0.43	40.81
with Steel Roofing	0.10	9.39
Wood Chord/Steel Web Truss with WSP Decking		
with EPDM membrane	0.17	14.09
with PVC membrane	0.26	23.74
with Modified bitumen membrane	0.26	24.80
with 4-Ply built-up roofing	0.44	44.53
with Steel Roofing	0.11	13.10
Wood Truss (Flat) with WSP Decking		
with EPDM membrane	0.15	10.71
with PVC membrane	0.24	20.37
with Modified bitumen membrane	0.24	21.43
with 4-Ply built-up roofing	0.42	41.16
with Steel Roofing	0.09	9.72
Wood Truss (4:12 Pitch) with WSP Decking		
with 30-yr. fiberglass shingles	0.11	7.80
with 30-yr. organic shingles	0.12	8.38
with Clay tile roof	0.16	19.36
with Steel roof	0.09	9.19

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. All roof assemplies include R-20 continuous insulation, polyethylene membrane, latex paint, and gypsum board. All assemplies are insulated to IECC 2009 minimums for zones 3 and 6. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Precast Hollow-Core Concrete		
EPDM Membrane	0.17	21.23
PVC Membrane	0.26	30.89
Modified Bitumen Membrane	0.26	31.94
4-Ply Built-Up Roofing System	0.44	51.68
Steel Roofing System	0.11	20.24
Precast Double-T		
EPDM Membrane	0.15	17.42
PVC Membrane	0.24	27.05
Modified Bitumen Membrane	0.25	28.13
4-Ply Built-Up Roofing System	0.43	47.86
Steel Roofing System	0.10	16.42
Suspended Concrete Slab		
EPDM Membrane	0.24	37.32
PVC Membrane	0.33	46.96
Modified Bitumen Membrane	0.33	48.04
4-Ply Built-Up Roofing System	0.51	67.75
Steel Roofing System	0.18	36.33
Open-Web Steel Joist, Steel Decking (2)		
EPDM Membrane	0.17	15.28
PVC Membrane	0.26	24.93
Modified Bitumen Membrane	0.26	26.01
4-Ply Built-Up Roofing System	0.45	45.72
Steel Roofing System	0.12	14.29

Note(s): Assumptions: 60 year building lifetime. Low rise building. Values are general estimations for the U.S. All roof assempblies include R-20 continuous insulation, polyethylene membrane, and latex paint. All assemplies are insulated to IECC 2009 minimums for zones 3 and 6. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each material. 2) Includes

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

Interior Wall Type (2)	Embodied Energy (MMBtu/SF) (1)	CO2 Equivalent Emissions (lbs/SF)
2x4 wood stud (16" OC) + gypsum board (3)	0.03	2.84
2x4 wood stud (24" OC) + gypsum board (3)	0.03	2.78
2x4 wood stud (24" OC) + 2 gypsum boards (4)	0.04	4.45
Steel stud (16" OC) + gypsum board (4)	0.04	3.99
Steel stud (24" OC) + gypsum board (4)	0.04	3.64
Steel stud (24" OC) + 2 gypsum boards	0.05	5.31
6" Concrete block + gypsum board	0.21	34.02
6" Concrete block	0.19	32.34
Clay brick (4") unpainted	0.05	6.97

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) All interior walls include two coats of latex paint unless noted otherwise. 3) Rounding obscures difference in embodied energy figures: wood stud with 16" OC is 3.6% higher than wood stud with 24" OC. 4) Rounding obscures difference in embodied energy figure: wood stud wall is 19.9% higher than steel stud wall with 16" OC and 27.6% higher than steel stud wall with 24" OC.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. 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)
Glulam joist and plank decking	0.04	3.06
Precast Hollowcore	0.05	13.43
Wood I-joist	0.02	2.03
Open-web Steel Joist	0.06	7.94
Open-web Steel Joist with concrete topping	0.07	12.30
Precast Double-T	0.04	11.38
Precast Double-T with concrete topping	0.06	16.45
Steel Joist	0.06	8.82
Steel Joist with plywood decking	0.06	9.28
Suspended Concrete Slab	0.12	29.19
Wood Joist	0.02	1.65
Wood Joist with plywood decking	0.03	2.38
Wood Chord and Steel Web truss	0.05	5.91
Wood Truss	0.03	2.71
Floor Structure without Interior Ceiling Finish		
Glulam joist and plank decking	0.05	4.32
Precast Hollowcore	0.06	14.68
Wood I-joist	0.04	3.26
Open-web Steel Joist	0.07	9.19
Open-web Steel Joist with concrete topping	0.09	13.54
Precast Double-T	0.05	12.61
Precast Double-T with concrete topping	0.07	17.70
Steel Joist	0.07	10.08
Steel Joist with plywood decking	0.08	10.54
Suspended Concrete Slab	0.13	30.42
Wood Joist	0.04	2.91
Wood Joist with plywood decking	0.05	3.64
Wood Chord and Steel Web truss	0.06	7.17
Wood Truss	0.04	3.95

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.

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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

Assumes Non-Load-Bearing Exterior Wall:

Column Type	Beam Type	Embodied Energy (MMBtu SF) (1)	CO2 Equivalent Emissions (lbs/SF)
Concrete	Concrete	0.101	17.57
Concrete	Steel I-beam	0.091	11.24
Hollow structural steel	Glulam	0.022	2.07
Hollow structural steel	Laminated veneer lumber	0.019	1.81
Glulam	Glulam	0.019	1.68
Glulam	Laminated veneer lumber	0.016	1.39
Steel I-beam	Steel I-beam	0.054	5.51
Steel I-beam	Laminated veneer lumber	0.018	1.61
Built-up softwood	Glulam	0.019	0.62
Built-up softwood	Laminated veneer lumber	0.016	0.49

Assumes Load-Bearing Exterior Wall:

Column Type	Beam Type		
Concrete	Concrete	0.076	13.49
Concrete	Steel I-beam	0.069	8.31
Hollow structural steel	Glulam	0.017	1.63
Hollow structural steel	Laminated veneer lumber	0.015	1.41
Glulam	Glulam	0.015	1.34
Glulam	Laminated veneer lumber	0.013	1.15
Steel I-beam	Steel I-beam	0.044	4.48
Steel I-beam	Laminated veneer lumber	0.014	1.28
Built-up softwood	Glulam	0.015	1.34
Built-up softwood	Laminated veneer lumber	0.013	1.12

Note(s): Assumptions: Values are general estimations for the U.S. Low rise building. 60 year building lifetime. Bay size: 30 by 30 feet. Column Height: 10 feet. 1) Embodied Energy: Energy use includes extraction, processing, transportation, construction, and disposal of each

Source(s): Athena Institute. Athena EcoCalculator for Assemblies v.3.5.2. 2010. Available at www.athenasmi.org/tools/ecoCalculator/index.html

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 2008-Year
1980	4.86	31%	1.72	11%	0.03	0%	0.85	5%	2.45	5.91	8.35	53%	15.81	100%	-
1985	4.57	28%	1.55	10%	0.04	0%	1.01	6%	2.71	6.24	8.95	56%	16.11	100%	-
1990	4.52	27%	1.37	8%	0.03	0%	0.64	4%	3.15	7.30	10.45	61%	17.01	100%	-
1995	4.98	27%	1.35	7%	0.02	0%	0.58	3%	3.56	8.08	11.64	63%	18.57	100%	-
2000	5.10	25%	1.52	7%	0.01	0%	0.49	2%	4.07	9.26	13.32	65%	20.45	100%	-
2005	4.96	23%	1.42	7%	0.01	0%	0.49	2%	4.64	10.14	14.78	68%	21.66	100%	-
2008	**5.00**	**23%**	**1.20**	**6%**	**0.01**	**0%**	**0.45**	**2%**	**4.71**	**10.17**	**14.88**	**69%**	**21.54**	**100%**	-
2010	4.90	22%	1.15	5%	0.01	0%	0.44	2%	4.97	10.59	15.56	71%	22.05	100%	1.2%
2015	4.93	24%	1.07	5%	0.01	0%	0.47	2%	4.59	9.46	14.05	68%	20.52	100%	-0.7%
2020	4.97	24%	0.99	5%	0.01	0%	0.51	2%	4.75	9.78	14.53	69%	21.01	100%	-0.2%
2025	4.96	23%	0.94	4%	0.01	0%	0.52	2%	4.98	10.24	15.22	70%	21.64	100%	0.0%
2030	4.95	22%	0.90	4%	0.01	0%	0.52	2%	5.25	10.69	15.95	71%	22.32	100%	0.2%
2035	4.89	21%	0.87	4%	0.01	0%	0.53	2%	5.50	11.12	16.62	73%	22.91	100%	0.2%

Note(s): 1) Petroleum includes distillate oil, LPG, and kerosene. 2) Includes site-marketed and non-marketed renewable energy. 3) 2008 site-to-source electricity conversion = 3.16.

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables,Table A2, p. 2-5 for 2006-2035 consumption and Table A17, p. 34-35 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 (quad)
1980	41%	12%	28%	7%	6%	13%	6%	14.91
1985	36%	10%	32%	6%	7%	13%	9%	15.75
1990	34%	8%	34%	6%	5%	11%	13%	16.61
1995	35%	8%	33%	6%	5%	11%	13%	18.36
2000	35%	8%	35%	5%	4%	9%	14%	20.11
2005	34%	7%	36%	5%	4%	9%	14%	21.33
2008	**35%**	**6%**	**35%**	**4%**	**4%**	**8%**	**14%**	**21.31**
2010	36%	6%	34%	4%	5%	9%	15%	21.49
2015	37%	6%	31%	5%	6%	11%	15%	19.57
2020	36%	6%	31%	5%	7%	12%	15%	19.94
2025	35%	5%	33%	5%	7%	12%	15%	20.43
2030	35%	5%	33%	5%	7%	12%	14%	20.91
2035	38%	5%	31%	4%	8%	12%	13%	18.29

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

Source(s): EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 2-5 and Table A17, p. 34-35 for energy consumption; and EIA, State Energy Data Report 2008, Jun. 2010, 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 2008-Year
1980	0.846	0.000	N.A.	0.000	0.846	-
1985	1.010	0.000	N.A.	0.000	1.010	-
1990	0.582	0.056	N.A.	0.006	0.643	-
1995	0.520	0.065	N.A.	0.007	0.591	-
2000	0.430	0.061	N.A.	0.009	0.500	-
2005	0.428	0.061	N.A.	0.016	0.505	-
2008	**0.445**	**0.003**	**0.002**	**0.004**	**0.454**	-
2010	0.418	0.004	0.008	0.008	0.438	-1.8%
2015	0.405	0.004	0.036	0.023	0.468	0.4%
2020	0.419	0.005	0.043	0.031	0.498	0.8%
2025	0.423	0.005	0.044	0.037	0.509	0.7%
2030	0.425	0.005	0.046	0.042	0.517	0.6%
2035	0.421	0.006	0.047	0.046	0.520	0.5%

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

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A17, p. 34-35 for 2008-2035.

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.	9.90	124.3	15.81	198.5
1985	87.9	N.A.	9.87	112.3	16.11	183.3
1990	94.2	N.A.	9.72	103.2	17.02	180.6
1995	98.7	N.A.	10.50	106.4	18.58	188.3
2000	105.7	N.A.	11.20	105.9	20.46	193.5
2005	108.2	9.0%	11.53	106.5	21.68	200.3
2008	**112.8**	**12.9%**	**11.36**	**100.8**	**21.54**	**191.1**
2010	114.7	15.3%	11.44	99.7	22.05	192.2
2015	121.3	22.2%	11.00	90.7	20.52	169.2
2020	128.1	28.2%	11.14	86.9	21.01	164.0
2025	134.8	33.2%	11.31	83.9	21.64	160.5
2030	141.2	37.8%	11.52	81.6	22.32	158.1
2035	146.9	52.4%	11.69	79.6	22.91	156.0

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

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10, and Table A17, p. 34-35 for 2005-2035, and Table A19, p. 37-38 for households; and DOC, Statistical Abstract of the United States 2007, Jan. 2007, Table No. 948, p. 606 for 1980-2005 households.

2.1.5 2008 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)	3.40	0.56	0.26	0.03	0.45	0.43	5.12	45.0%	1.35	6.04	28.1%
Space Cooling	0.00					0.97	0.97	8.5%	3.07	3.07	14.3%
Water Heating	1.33	0.11	0.09		0.00	0.48	2.00	17.6%	1.50	3.03	14.1%
Lighting						0.74	0.74	6.5%	2.34	2.34	10.9%
Electronics (5)						0.54	0.54	4.7%	1.70	1.70	7.9%
Refrigeration (6)						0.45	0.45	4.0%	1.43	1.43	6.7%
Wet Cleaning (7)	0.05					0.31	0.37	3.2%	0.99	1.04	4.8%
Cooking	0.22		0.03			0.23	0.48	4.2%	0.73	0.98	4.5%
Computers						0.17	0.17	1.5%	0.55	0.55	2.5%
Other (8)	0.00		0.14		0.00	0.19	0.34	3.0%	0.61	0.76	3.5%
Adjust to SEDS (9)						0.19	0.19	1.7%	0.60	0.60	2.8%
Total	**5.00**	**0.66**	**0.52**	**0.03**	**0.45**	**4.71**	**11.37**	100%	**14.88**	**21.54**	100%

Note(s): 1) Kerosene and coal are assumed attributable to space heating. 2) Comprised of wood space heating (0.44 quad), solar water heating (less than 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) = 3.16. 4) Includes furnace fans (0.14 quad). 5) Includes color television (0.33 quad). 6) Includes refrigerators (1.32 quad) and freezers (0.42 quad). 7) Includes clothes washers (0.03 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.19 quad), and dishwashers (0.09 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 2011 Early Release, Dec. 2010, Table A2, p. 2-5, Table A4, p. 9-12 and Table A17, p. 34-35; and BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A, for residential electric end-uses.

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)	3.29	0.50	0.26	0.03	0.43	0.43	4.93	43.0%	1.34	5.84	26.5%
Space Cooling	0.00					1.11	1.11	9.7%	3.49	3.49	15.8%
Water Heating	1.34	0.10	0.08		0.00	0.44	1.96	17.1%	1.38	2.90	13.2%
Lighting						0.71	0.71	6.2%	2.22	2.22	10.0%
Refrigeration (5)						0.44	0.44	3.9%	1.39	1.39	6.3%
Electronics (6)						0.34	0.34	3.0%	1.07	1.07	4.8%
Wet Cleaning (7)	0.05					0.31	0.36	3.2%	0.97	1.02	4.6%
Cooking	0.22		0.03			0.11	0.35	3.1%	0.34	0.58	2.6%
Computers						0.18	0.18	1.6%	0.56	0.56	2.5%
Other (8)	0.00		0.16		0.01	0.90	1.07	9.3%	2.82	2.99	13.5%
Total	**4.90**	**0.60**	**0.52**	**0.03**	**0.44**	**4.97**	**11.46**	100%	**15.56**	**22.05**	100%

Note(s): 1) Kerosene and coal are assumed attributable to space heating. 2) Comprised of wood space heating (0.42 quad), solar water heating (less than 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) = 3.13. 4) Includes furnace fans (0.14 quad). 5) Includes refrigerators (0.36 quad) and freezers (0.08 quad). 6) Includes color television (0.34 quad). 7) Includes clothes washers (0.03 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.03 quad), and dishwashers (0.09 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 2011 Early Release, Dec. 2010, Table A2, p. 2-5, Table A4, p. 9-12 and Table A17, p. 34-35.

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)	3.29	0.43	0.22	0.03	0.45	0.46	4.88	43.5%	1.41	5.83	27.8%
Water Heating	1.40	0.06	0.05		0.00	0.49	2.00	17.9%	1.50	3.01	14.3%
Space Cooling	0.00					0.85	0.85	7.6%	2.61	2.61	12.4%
Lighting						0.54	0.54	4.8%	1.64	1.64	7.8%
Refrigeration (5)						0.43	0.43	3.8%	1.31	1.31	6.2%
Electronics (6)						0.34	0.34	3.0%	1.03	1.03	4.9%
Wet Cleaning (7)	0.05					0.30	0.35	3.1%	0.92	0.97	4.6%
Cooking	0.23		0.03			0.12	0.38	3.4%	0.38	0.63	3.0%
Computers						0.17	0.17	1.5%	0.53	0.53	2.5%
Other (8)	0.00		0.18		0.04	1.05	1.28	11.4%	3.21	3.43	16.4%
Total	**4.97**	**0.50**	**0.48**	**0.03**	**0.50**	**4.75**	**11.21**	100%	**14.53**	**21.00**	100%

Note(s): 1) Kerosene and coal are assumed attributable to space heating. 2) Comprised of wood space heating (0.42 quad), solar water heating (less than 0.01 quad), geothermal space heating (0.03 quad), and solar PV (0.04 quad). 3) Site-to-source electricity conversion (due to generation and transmission losses) = 3.06. 4) Includes furnace fans (0.17 quad). 5) Includes refrigerators (0.35 quad) and freezers (0.08 quad). 6) Includes color television (0.34 quad). 7) Includes clothes washers (0.03 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.18 quad), and dishwashers (0.09 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 2011 Early Release, Dec. 2010, Table A2, p. 2-5, Table A4, p. 9-12 and Table A17, p. 34-35.

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)	3.29	0.36	0.20	0.02	0.47	0.50	4.83	41.6%	1.51	5.84	26.2%
Water Heating	1.37	0.05	0.04		0.01	0.49	1.95	16.7%	1.49	2.95	13.2%
Space Cooling	0.00					0.95	0.95	8.2%	2.88	2.88	12.9%
Lighting						0.53	0.53	4.5%	1.60	1.60	7.2%
Refrigeration (5)						0.45	0.45	3.9%	1.36	1.36	6.1%
Electronics (6)						0.39	0.39	3.3%	1.17	1.17	5.3%
Wet Cleaning (7)	0.05					0.32	0.38	3.3%	0.99	1.04	4.7%
Cooking	0.24		0.03			0.14	0.40	3.5%	0.42	0.69	3.1%
Computers						0.19	0.19	1.6%	0.56	0.56	2.5%
Other (8)	0.00		0.21		0.05	1.30	1.56	13.4%	3.95	4.21	18.9%
Total	**4.95**	**0.40**	**0.48**	**0.02**	**0.52**	**5.25**	**11.61**	100%	**15.95**	**22.31**	100%

Note(s): 1) Kerosene and coal are assumed attributable to space heating. 2) Comprised of wood space heating (0.42 quad), solar water heating (less than 0.01 quad), geothermal space heating (0.04 quad), solar PV (0.05 quad), and wind (less than 0.01 quad). 3) Site-to-source electricity conversion (due to generation and transmission losses) = 3.04. 4) Includes furnace fans (0.19 quad). 5) Includes refrigerators (0.36 quad) and freezers (0.08 quad). 6) Includes color television (0.39 quad). 7) Includes clothes washers (0.03 quad), natural gas clothes dryers (0.05 quad), electric clothes dryers (0.19 quad), and dishwashers (0.11 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 2011 Early Release, Dec. 2010, Table A2, p. 2-5, Table A4, p. 9-12 and Table A17, p. 34-35.

2.1.9 2005 Delivered Energy End-Uses for an Average Household, by Region (Million Btu per Household)

	Northeast	Midwest	South	West	National
Space Heating	70.3	56.6	20.4	23.8	38.7
Space Cooling	3.6	5.6	13.9	4.0	7.9
Water Heating	21.1	20.4	15.8	21.2	19.0
Refrigerator	5.4	7.0	6.6	5.7	6.3
Other Appliances & Lighting	23.0	25.9	25.0	24.1	24.7
Total (1)	**122.2**	**113.5**	**79.9**	**77.4**	**95.0**

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.

2.1.10 2005 Residential Delivered Energy Consumption Intensities, by Census Region

Region	Per Square Foot (thousand Btu) (1)	Per Household (million Btu)	Per Household Members (million Btu)	Percent of Total Consumption
Northeast	**73.5**	**122.2**	**47.7**	**24%**
New England	77.0	129.4	55.3	7%
Middle Atlantic	72.2	119.7	45.3	17%
Midwest	**58.9**	**113.5**	**46.0**	**28%**
East North Central	61.1	117.7	47.3	20%
West North Central	54.0	104.1	42.9	8%
South	**51.5**	**79.8**	**31.6**	**31%**
South Atlantic	47.4	76.1	30.4	16%
East South Central	56.6	87.3	36.1	6%
West South Central	56.6	82.4	31.4	9%
West	**56.6**	**77.4**	**28.1**	**18%**
Mountain	54.4	89.8	33.7	6%
Pacific	58.0	71.8	25.7	11%
U.S. Average	**58.7**	**94.9**	**37.0**	**100%**

Note(s): 1) Energy consumption per square foot was calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008.

2.1.11 2005 Residential Delivered Energy Consumption Intensities, by Housing Type

Type	Per Square Foot (thousand Btu) (1)	Per Household (million Btu)	Per Household Members (million Btu)	Percent of Total Consumption
Single-Family:	**55.4**	**106.6**	**39.4**	**80.5%**
Detached	55.0	108.4	39.8	73.9%
Attached	60.5	89.3	36.1	6.6%
Multi-Family:	**78.3**	**64.1**	**29.7**	**14.9%**
2 to 4 units	94.3	85.0	35.2	6.3%
5 or more units	69.8	54.4	26.7	8.6%
Mobile Homes	**74.6**	**70.4**	**28.5**	**4.6%**
All Housing Types	**58.7**	**95.0**	**37.0**	**100%**

Note(s): 1) Energy consumption per square foot was calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008.

2.1.12 2005 Residential Delivered Energy Consumption Intensities, by Vintage

Year Built	Per Square Foot (thousand Btu) (1)	Per Household (million Btu)	Per Household Member (million Btu)	Percent of Total Consumption
Prior to 1950	74.5	114.9	46.8	24%
1950 to 1969	66.0	96.6	38.1	23%
1970 to 1979	59.4	83.4	33.5	15%
1980 to 1989	51.9	81.4	32.3	14%
1990 to 1999	48.2	94.4	33.7	16%
2000 to 2005	44.7	94.7	34.3	8%
Average	58.7	95.0	40.0	

Note(s): 1) Energy consumption per square foot was calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008.

2.1.13 2005 Residential Delivered Energy Consumption Intensities, by Principal Building Type and Vintage

	Per Square Foot (thousand Btu) (1)		Per Household (million Btu)		Per Household Member (million Btu)	
Building Type	Pre-1995	1995-2005	Pre-1995	1995-2005	Pre-1995	1995-2005
Single-Family	**38.4**	**44.9**	**102.7**	**106.2**	**38.5**	**35.5**
Detached	37.9	44.7	104.5	107.8	38.8	35.4
Attached	43.8	55.5	86.9	85.1	34.2	37.6
Multi-Family	**63.8**	**58.7**	**58.3**	**49.2**	**27.2**	**24.3**
2 to 4 units	69.0	55.1	70.7	59.4	29.5	25.0
5 or more units	61.5	59.6	53.6	47.2	26.3	24.2
Mobile Homes	**82.4**	**57.1**	**69.6**	**74.5**	**29.7**	**25.2**

Note(s): 1) Energy consumption per square foot was calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, 2005 Residential Energy Consumption Survey,

2.1.14 2005 Residential Delivered Energy Consumption Intensities, by Ownership of Unit

Ownership	Per Square Foot (thousand Btu) (1)	Per Household (million Btu)	Per Household Members (million Btu)	Percent of Total Consumption
Owned	**54.9**	**104.5**	**40.3**	**78%**
Rented	**77.4**	**71.7**	**28.4**	**22%**
Public Housing	75.7	62.7	28.7	2%
Not Public Housing	77.7	73.0	28.4	19%
				100%

Note(s): 1) Energy consumption per square foot was calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, 2005 Residential Energy Consumption Survey.

2.1.15 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. 1999, Figure P-1 and Appendix C: Component Loads Data

2.1.16 Operating Characteristics of Electric Appliances in the Residential Sector

	Power Draw (W) (1)			Annual Usage (hours/year)			Annual Consumption	Annual Cost
	Active	Idle	Off	Active	Idle	Off	(kWh/year)	($) (2)
Kitchen								
Coffee Maker	1,000	70	0	38	229	8,493	58	5.6
Dishwasher (3)				365 (4)			120	11.6
Microwave Oven	1,500		3	70		8,690	131	12.6
Toaster Oven	1,051			37			54	5.2
Refrigerator-Freezer							660	63.1
Freezer							470	45.0
Lighting								
18-W Compact Fluorescent	18			1,189			20	2.1
60-W Incandescent Lamp	60			672			40	3.9
100-W Incandescent Lamp	100			672			70	6.4
Torchiere Lamp-Halogen	300			1,460			440	42.0
Bedroom and Bathroom								
Hair Dryer	710			50			40	3.4
Waterbed Heater	350			3,051			1,070	102.7
Laundry Room								
Clothes Dryer				359 (4)			1,000	96.0
Clothes Washer (3)				392 (4)			110 (3)	10.4
Home Electronics								
Desktop PCs	75	4	2	2,990	330	5,440	237	22.8
Notebook PCs	25	2	2	2,368	935	5,457	72	6.9
Desktop Computer Monitors	42	1	1	1,865	875	6,020	85	8.2
Stereo Systems	33	30	3	1,510	1,810	5,440	119	11.4
Televisions	97		4	1,860		6,900	222 (7)	21.3
Analog, <40"	86			1,095 (5)			184	17.7
Analog, >40"	156			1,825 (5)			312	30.0
Digital, ED/HD TV, <40"	150			1,095 (5)			301	28.9
Digital, ED/HD TV, >40"	234			1,825 (5)			455	43.7
Set-top Boxes	20	0	20	6,450	0	2,310	178	17.1
DVD/VCR	17	13	3	170	5,150	3,430	78	7.5
Video Game Systems	36	36	1	405	560	7,795	41	3.9
Heating and Cooling								
Dehumidifier	600			1,620			970	93.3
Furnace Fan	295			1,350			400	38.2
Ceiling Fan (only fan motor)	35			2,310			81	7.8
Space Heater	1,320	1		584			314	30.1
Water Heating								
Water Heater-Family of 4	4,500			64 (6)			4,770	458.3
Water Heater-Family of 2	4,500			32 (6)			2,340	224.3
Portable Spa	4,350	275		25	8,735		2,525	242.4
Miscellaneous								
Rechargeable Power Tool	13	4		73			38	3.6
Vacuum	542			37			55	5.3
Pool Pump	1,000			792			790	76.0
Well Pump	725			115			80	8.0
Lawn Sprinkler	11			0			32	3.1
Aquarium Equipment	24			6,534			153	14.6

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. 7) Power, usage and annual consumption values for televisions are weighted averages of multiple usage types and screen sizes.

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, DVD/VCR, ceiling fan, and portable spa; TIAX, Energy Consumption by Consumer Electronics in U.S. Residences, Final Report to the Consumer Electronics Association, Jan. 2007, p. 69-72 for desktop and notebook PCs, p. 62-63 for monitors, p. 85-90 for TVs, p. 76-81 for set-top boxes, and p. 103-105 for video game systems; and Energy Center of Wisconsin, Electricitiy Savings Opportunities for Home Electronics and Other Plug-In Devices in Minnesota Homes, May 2010, pp. 52-57 for toaster ovens, spaceheaters, power tools, vacuums, lawn sprinklers, and acquarium equipment.

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 American Gas Association, Gas Facts 1998, December 1999, www.aga.org for range and clothes dryer consumption.

2.1.18 2009 Annual Natural Gas Consumption per Appliance by Census Division

Census Division	**Furnaces** million Btu	**Water Heaters** million Btu	**Ranges** million Btu	**Clothes Dryers** million Btu	**Fireplaces** million Btu
New England	72,095	24,853	6,367	4,930	8,216
Middle Atlantic	85,241	24,032	5,238	4,930	9,448
East North Central	72,506	22,902	8,832	8,216	13,248
West North Central	46,831	24,443	4,416	4,622	3,903
South Atlantic	54,226	20,232	4,108	5,135	5,957
East South Central	47,858	20,129	4,416	5,135	9,038
West South Central	33,891	24,648	3,595	3,081	5,135
Mountain	58,334	26,702	3,389	3,389	6,162
Pacific	44,675	20,232	3,286	3,286	29,064
United States					
Average	**61,928**	**23,005**	**5,238**	**5,135**	**10,270**
Total	**515,657**	**208,173**	**43,648**	**42,723**	**90,171**

Source(s): American Gas Association, Residential Natural Gas Market Survey, Table 10-1, January 2011

2.1.19 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
1985	**26%**	40%	18%	3%		**32%**	46%	3%	17.84
1990	**23%**	43%	17%	3%		**29%**	49%	3%	19.75
1995	**22%**	42%	19%	3%		**28%**	49%	3%	22.83
2000	**21%**	40%	22%	3%		**29%**	47%	3%	23.80
2005	**22%**	35%	27%	3%		**32%**	42%	3%	22.63
2008	**21%**	**34%**	**29%**	**3%**		**32%**	**42%**	**3%**	**23.85**
2010	**20%**	33%	31%	3%		**32%**	41%	3%	24.52
2015	**19%**	37%	27%	3%		**29%**	45%	3%	25.53
2020	**19%**	37%	27%	3%		**29%**	44%	3%	25.81
2025	**19%**	37%	26%	3%		**29%**	44%	3%	25.61
2030	**19%**	36%	28%	3%		**29%**	43%	3%	26.37
2035	**18%**	35%	29%	3%		**29%**	41%	3%	27.15

Note(s): 1) Residential sector accounted for 35% (or $91.5 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, 2-5 for 2008-2035 consumption, Table A3, p. 6-8 for 2008 expenditures.

2.1.20 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
1985	**5%**	25%	4%	63%		**6%**	26%	63%	30.9
1990	**4%**	25%	4%	64%		**5%**	26%	64%	33.6
1995	**4%**	25%	2%	67%		**5%**	26%	67%	34.6
2000	**4%**	24%	3%	67%		**5%**	25%	67%	38.4
2005	**3%**	24%	3%	68%		**5%**	25%	68%	40.7
2008	**3%**	**23%**	**1%**	**71%**		**4%**	**23%**	**71%**	**38.5**
2010	**3%**	22%	1%	72%		**4%**	22%	72%	37.0
2015	**3%**	24%	1%	71%		**3%**	24%	71%	39.1
2020	**3%**	23%	1%	72%		**3%**	24%	72%	39.4
2025	**2%**	23%	1%	72%		**3%**	23%	72%	39.9
2030	**2%**	22%	1%	73%		**3%**	22%	73%	40.6
2035	**2%**	22%	1%	74%		**2%**	22%	74%	41.8

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2000; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 2-5 for 2008-2035 consumption, Table A3, p. 6-8 for 2008 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
1985	88	N.A.	N.A.	238	2.7
1990	94	N.A.	169	250	2.6
1995	99	N.A.	N.A.	266	2.7
2000	106	N.A.	N.A.	282	2.7
2005	108	9%	256	297	2.7
2008	113	13%	N.A.	304	2.7
2010	115	13%	N.A.	309	2.7
2015	121	20%	N.A.	322	2.7
2020	128	26%	N.A.	336	2.6
2025	135	32%	N.A.	349	2.6
2030	141	37%	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 2011 Early Release, Dec. 2010, Table A4, p. 9-10 for 2005-2030 households and Table A19, p. 37-38 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, 1997 Residential Energy Consumption Survey for 1997 buildings and floorspace; EIA, 2001 Residential Energy Consumption Survey for 2001 households and floorspace; and EIA, 2005 Residential Energy Consuption Survey for 2005 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%**	**71.7%**
Detached	57.7%	7.2%	64.9%
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	**70.3%**	**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 Total U.S. Households, by Census Region, Division, and Vintage, as of 2005

Region	Prior to 1950	1950 to 1969	1970 to 1979	1980 to 1989	1990 to 1999	2000 to 2005	All Vintages
Northeast	**6.7%**	**5.2%**	**2.4%**	**2.1%**	**1.3%**	**0.8%**	**18.5%**
New England	2.1%	1.2%	0.5%	0.5%	0.3%	0.3%	4.9%
Middle Atlantic	4.6%	4.0%	1.9%	1.6%	1.0%	0.5%	13.6%
Midwest	**5.7%**	**5.8%**	**3.6%**	**2.5%**	**3.7%**	**1.7%**	**23.0%**
East North Central	4.3%	3.9%	2.7%	1.8%	2.1%	1.1%	16.0%
West North Central	1.4%	1.9%	0.9%	0.7%	1.6%	0.6%	7.1%
South	**4.0%**	**6.9%**	**6.4%**	**7.5%**	**7.5%**	**4.3%**	**36.6%**
South Atlantic	2.0%	3.4%	3.5%	4.2%	4.3%	2.2%	17.4%
East South Central	0.9%	1.3%	0.9%	1.0%	1.3%	0.7%	6.2%
West South Central	1.2%	2.3%	4.7%	2.2%	1.8%	1.4%	13.6%
West	**3.4%**	**4.6%**	**4.5%**	**4.6%**	**3.1%**	**1.5%**	**21.8%**
Mountain	0.7%	1.2%	1.3%	1.5%	1.3%	0.9%	6.8%
Pacific	2.8%	3.4%	3.3%	3.1%	1.8%	0.6%	15.0%
United States	**19.9%**	**22.5%**	**17.0%**	**16.7%**	**15.6%**	**8.3%**	**100%**

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

2.2.4 Characteristics of U.S. Housing by Census Division and Region, as of 2005

Census Division	Share of U.S. Housing Stock	Average Home Size (1) (total square feet)	Average Home Size (heated square feet)
Northeast	**19%**	**2,423**	**1,664**
New England	5%	2,552	1,680
Middle Atlantic	14%	2,376	1,658
Midwest	**23%**	**2,566**	**1,927**
East North Central	16%	2,628	1,926
West North Central	7%	2,424	1,930
South	**37%**	**2,295**	**1,551**
South Atlantic	20%	2,370	1,607
East South Central	6%	2,254	1,544
West South Central	11%	2,184	1,455
West	**22%**	**1,963**	**1,366**
Mountain	7%	2,149	1,649
Pacific	15%	1,878	1,238
Total	**100%**	**2,309**	**1,618**

Note(s): 1) Total Square footage includes attic, garage, and basement square footage.
Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008.

2.2.5 Characteristics of U.S. Housing by Vintage, as of 2005

Vintage	Share of US Housing Stock	Average Home Size (square feet) (1) Single Family	Multi-Family	Mobile Home
Prior to 1950	20%	2,677	1,021	775
1950 to 1969	23%	2,433	927	775
1970 to 1979	17%	2,666	869	948
1980 to 1989	17%	2,853	909	1,008
1990 to 1999	16%	3,366	940	1,245
2000 to 2005	8%	3,680	1,047	1,425
Total U.S. Homes (millions)	111.1	**U.S. Average** 2,838	941	1,062

Note(s): 1) Average home sizes include both heated and unheated floor space, including garages.
Source(s): EIA, A Look at Residential Energy Consumption in 2005, July 2008.

2.2.6 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.

2.2.7 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,

2.2.8 Presence of Air-Conditioning and Type of Heating System in New Single-Family Homes

		Type of Primary Heating System					
Year	Total Homes (thousands)	Warm-Air furnace	Heat pump	Hot Water or steam (1)	Other or none (2)		Air-Conditioning
1980	957	57%	24%	4%	15%		62%
1981	819	56%	25%	3%	16%		65%
1982	632	53%	26%	4%	17%		66%
1983	924	56%	29%	4%	12%		69%
1984	1,025	55%	30%	4%	11%		71%
1985	1,072	54%	30%	5%	11%		70%
1986	1,120	54%	29%	7%	10%		69%
1987	1,123	57%	27%	7%	9%		71%
1988	1,085	60%	26%	7%	8%		75%
1989	1,026	63%	24%	6%	7%		77%
1990	966	64%	23%	6%	6%		76%
1991	838	65%	22%	6%	7%		75%
1992	964	66%	24%	6%	5%		77%
1993	1,039	67%	24%	5%	5%		78%
1994	1,160	67%	24%	5%	4%		79%
1995	1,066	66%	25%	5%	4%		79%
1996	1,129	70%	23%	5%	2%		81%
1997	1,116	70%	23%	5%	2%		82%
1998	1,160	72%	21%	4%	3%		83%
1999	1,270	72%	22%	4%	2%		84%
2000	1,242	71%	23%	4%	2%		85%
2001	1,256	71%	23%	4%	1%		86%
2002	1,325	71%	23%	4%	2%		87%
2003	1,386	71%	24%	3%	2%		88%
2004	1,532	70%	26%	3%	1%		90%
2005	1,636	67%	29%	3%	1%		89%
2006	1,654	63%	33%	3%	2%		89%
2007	1,218	62%	34%	2%	2%		90%
2008	819	60%	34%	3%	3%		89%
2009	520	56%	37%	3%	4%		88%

Note(s) 1) Includes both air source and geothermal (ground source) versions. 2) Includes electric baseboard, panel, radiant heat, space heater, floor or wall furnace, solar, and other types.

Source(s): DOC, 2009 Characteristics of New Housing, June 2010, "Type of Heating System Used in New Single-Family Houses Completed" and "Presence of Air-Conditioning in New Single-Family Houses Completed"

2.3.1 Residential Energy Prices, by Year and Major Fuel Type ($2009 per Million Btu)

	Electricity	Natural Gas	Petroleum (1)	Avg.
1980	36.11	8.28	16.63	17.43
1985	38.61	10.59	14.49	19.88
1990	34.90	8.56	13.17	18.44
1995	33.16	7.93	10.25	17.32
2000	29.89	9.46	14.07	17.89
2005	30.39	13.55	18.77	21.31
2008	**33.16**	**13.62**	**26.75**	**23.50**
2010	33.59	11.14	23.23	22.52
2015	32.00	10.31	25.07	21.21
2020	31.43	10.95	28.08	21.62
2025	31.22	11.91	29.95	22.31
2030	31.18	12.63	31.09	22.90
2035	31.67	13.51	31.66	23.78

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

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, Jun. 2010, Tables 2-3, p. 24-25 for 1980-2007 and prices for note, Tables 8-9, p. 18-19 for 1980-2007 consumption; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 Table A3, p. 6-8, Table A12, p. 25-26, and Table A13, p. 27-28 for 2008-2035 consumption and prices; and EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price deflators.

2.3.2 Residential Energy Prices, by Year and Fuel Type ($2009)

	Electricity (cents/kWh)	Natural Gas (cents/therm)	Distillate Oil ($/gal)	LPG ($/gal)
1980	12.32	82.84	1.54	2.24
1985	13.17	105.94	1.37	1.96
1990	11.91	85.58	1.41	1.69
1995	11.31	79.32	1.23	1.22
2000	10.20	94.60	1.51	1.70
2005	10.37	135.50	1.91	2.36
2008	**11.31**	**136.20**	**2.53**	**3.43**
2010	11.46	111.44	2.27	2.87
2015	10.92	103.13	2.56	2.93
2020	10.72	109.52	2.76	3.37
2025	10.65	119.08	2.91	3.60
2030	10.64	126.28	2.99	3.73

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, Jun. 2010, p. Tables 2-3, p. 24-25 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A3, p. 6-8 for 2006-2035 and Table G1, p. 215 for fuels' heat content; and EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price deflators.

2.3.3 Residential Aggregate Energy Expenditures, by Year and Major Fuel Type ($2009 Billion) (1)

	Electricity	Natural Gas	Petroleum (2)	Total
1980	38.5	17.5	12.5	68.4
1985	58.7	27.1	12.6	98.4
1990	72.4	25.4	11.9	109.7
1995	87.6	29.4	10.3	127.3
2000	98.2	39.0	17.3	154.5
2005	128.4	61.2	24.3	213.9
2008	156.1	68.1	32.2	**256.4**
2010	166.8	54.6	26.6	248.0
2015	147.0	50.8	26.8	224.6
2020	149.3	54.4	27.9	231.6
2025	155.6	59.0	28.1	242.7
2030	163.7	62.4	27.9	254.0
2035	174.3	66.1	27.4	267.8

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

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, Jun. 2010, p. 24-25 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A3, p. 6-8 for 2008-2035; and EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price deflators.

2.3.4 Cost of a Generic Quad Used in the Residential Sector ($2009 Billion) (1)

	Residential
1980	10.51
1985	11.61
1990	10.17
1995	9.49
2000	9.60
2005	11.17
2008	**11.78**
2010	10.36
2015	10.12
2020	10.21
2025	10.44
2030	10.57
2035	10.85

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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A17, p. 34-35 for energy consumption and Table A3, p. 6-8 for energy prices (2008-2035). EIA, State Energy Data Report 2008, Jun. 2010, Tables 8-12 pages 22-24 and EIA, State Energy Prices and Expenditures 2008, Tables 2 and 3(1980-2005); EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price inflators.

2.3.5 2008 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	46.3	13.7	7.6	0.5	21.9	0.0	14.2	82.4	32.1%
Water Heating (3)	18.1	2.7	2.5		5.2		14.0	37.3	14.6%
Space Cooling (4)	0.0						32.2	32.2	12.6%
Lighting							24.5	24.5	9.6%
Refrigeration (5)							19.4	19.4	7.6%
Electronics (6)							17.9	17.9	7.0%
Cooking	2.9		0.9		0.9		7.7	11.6	4.5%
Wet Cleaning (7)	0.7						10.4	11.1	4.3%
Computers							5.7	5.7	2.2%
Other (8)	0.0		4.2		4.2		6.5	10.7	4.2%
Adjust to SEDS (9)							1.7	1.7	0.7%
Total	**68.1**	**16.4**	**15.3**	**0.5**	**32.2**	**0.0**	**156.1**	**256.4**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($4.6 billion). 3) Includes residential recreational water heating ($1.4 billion). 4) Fan energy use included. 5) Includes refrigerators ($15.2 billion) and freezers ($4.4 billion). 6) Includes color televisions ($11.2 billion) and other electronics ($6.9 billion). 7) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($0.7 billion), electric clothes dryers ($6.3 billion), and dishwashers ($3.1 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A4, p. 9-10 for energy, Table A3, p. 6-8 for prices; EIA, State Energy Data 2008, Prices and Expenditures, Jun. 2010, p. 24 for coal price; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 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.

2.3.6 2010 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	36.7	10.3	6.8	0.4	17.5	0.0	14.3	68.5	27.6%
Space Cooling (3)	0.0						37.4	37.4	15.1%
Water Heating	15.0	2.1	2.1		4.1		14.8	33.8	13.6%
Lighting							23.8	23.8	9.6%
Refrigeration (4)							14.9	14.9	6.0%
Electronics (5)							11.4	11.4	4.6%
Wet Cleaning (6)	0.6						10.4	11.0	4.4%
Cooking	2.4		0.8		0.8		3.6	6.8	2.7%
Computers							6.0	6.0	2.4%
Other (7)	0.0		4.2		4.2		30.2	34.4	13.9%
Total	**54.6**	**12.4**	**13.9**	**0.4**	**26.6**	**0.0**	**166.8**	**248.0**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($4.7 billion). 3) Fan energy use included. 4) Includes refrigerators ($12.4 billion) and freezers ($2.7 billion). 5) Includes color televisions ($11.6 billion). 6) Includes clothes washers ($1.1 billion), natural gas clothes dryers ($0.6 billion), electric clothes dryers ($6.3 billion), and dishwashers ($3.1 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A4, p. 9-10 for energy, Table A3, p. 6-8 for prices; EIA, State Energy Data 2008, Prices and Expenditures, Jun. 2010, p. 24 for coal price; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 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.

2.3.7 2020 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	36.0	10.5	7.1	0.4	18.0	0.0	14.5	68.6	29.6%
Water Heating	15.3	1.6	1.6		3.1		15.4	33.8	14.6%
Space Cooling (3)	0.0						26.8	26.8	11.6%
Lighting							16.9	16.9	7.3%
Refrigeration (4)							13.4	13.4	5.8%
Electronics (5)							10.6	10.6	4.6%
Wet Cleaning (6)	0.6						9.4	10.0	4.3%
Cooking	2.5		0.9		0.9		3.9	7.3	3.1%
Computers							5.4	5.4	2.3%
Other (7)	0.0		5.9		5.9		33.0	38.9	16.8%
Total	**54.4**	**12.0**	**15.5**	**0.4**	**28.0**	**0.0**	**149.3**	**231.6**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($5.3 billion). 3) Fan energy use included. 4) Includes refrigerators ($11.0 billion) and freezers ($2.5 billion). 5) Includes color televisions ($10.7 billion). 6) Includes clothes washers ($0.9 billion), natural gas clothes dryers ($0.6 billion), electric clothes dryers ($5.7 billion), and dishwashers ($0.9 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A4, p. 9-10 for energy, Table A3, p. 6-8 for prices; EIA, State Energy Data 2008, Prices and Expenditures, Jun. 2010, p. 24 for coal price; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 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.

2.3.8 2030 Residential Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum							
	Gas	Distil.	LPG	Kerosene	Total	Coal	Electricity	Total	Percent
Space Heating (2)	41.5	9.6	7.0	0.5	17.1	0.0	15.5	74.1	29.2%
Water Heating	17.2	1.3	1.3		2.5		15.3	35.1	13.8%
Space Cooling (3)	0.0						29.6	29.6	11.6%
Lighting							16.4	16.4	6.5%
Refrigeration (4)							14.0	14.0	5.5%
Electronics (5)							12.1	12.1	4.7%
Wet Cleaning (6)	0.7						10.1	10.8	4.3%
Cooking	3.0		0.9		0.9		4.4	8.2	3.2%
Computers							5.8	5.8	2.3%
Other (7)	0.0		7.4		7.4		40.6	48.0	18.9%
Total	**62.4**	**10.8**	**16.6**	**0.5**	**27.9**	**0.0**	**163.7**	**254.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes furnace fans ($6.0 billion). 3) Fan energy use included. 4) Includes refrigerators ($11.5 billion) and freezers ($2.7 billion). 5) Includes color televisions ($12.2 billion). 6) Includes clothes washers ($0.9 billion), natural gas clothes dryers ($0.7 billion), electric clothes dryers ($6.0 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A4, p. 9-10 for energy, Table A3, p. 6-8 for prices; EIA, State Energy Data 2008, Prices and Expenditures, Jun. 2010, p. 24 for coal price; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 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.

2.3.9 Average Annual Energy Expenditures per Household, by Year ($2009)

Year	Average Expenditure
1980	2,032
1985	1,955
1990	1,788
1995	1,789
2000	1,894
2005	2,156
2008	**2,269**
2010	2,158
2015	1,848
2020	1,804
2025	1,797
2030	1,796
2035	1,820

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, Jun. 2010, p. 24 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10 for consumption, Table A3, p. 6-8 for prices 2008-2035; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price deflators; and DOC, Statistical Abstract of the United States Historical Data for 1980-2007 occupied units.

2.3.10 2005 Energy End-Use Expenditures for an Average Household, by Region ($2009)

	Northeast	Midwest	South	West	National
Space Heating	1,042	716	368	349	571
Air-Conditioning	198	173	452	260	308
Water Heating	370	292	311	315	317
Refrigerators	192	144	145	153	156
Other Appliances and Lighting	820	660	709	710	719
Total (1)	**2,533**	**1,959**	**1,954**	**1,642**	**1,987**

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 2009, August 2010, Appendix D, p. 383 for price deflators.

2.3.11 2005 Energy Expenditures per Household, by Housing Type and Square Footage ($2009)

	Per Household	Per Square Foot (1)
Single-Family	**2,212**	**1.15**
Detached	2,261	1.15
Attached	1,754	1.19
Multi-Family	**1,348**	**1.65**
2 to 4 units	1,708	1.89
5 or more units	1,182	1.51
Mobile Home	**1,648**	**1.75**
All Homes	**1,987**	**1.12**

Note(s): 1) Energy expenditures per square foot were calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Table US-1 part1; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

2.3.12 2005 Household Energy Expenditures, by Vintage ($2009)

Year	Per Square Foot (1)	Per Household	Per Household Member	Percent of Residential Sector Expenditures
Prior to 1950	1.41	2,160	880	22%
1950 to 1969	1.33	1,940	765	22%
1970 to 1979	1.30	1,816	730	16%
1980 to 1989	1.17	1,850	735	16%
1990 to 1999	1.06	2,093	746	16%
2000 to 2005	1.01	2,129	771	9%
			Total	100%
Average	**1.23**	**1,987**	**774**	

Note(s): 1) Energy expenditures per square foot were calculated using estimates of average heated floor space per household. According to the 2005 Residential Energy Consumption Survey (RECS), the average heated floor space per household in the U.S. was 1,618 square feet. Average total floor space, which includes garages, attics and unfinished basements, equaled 2,309 square feet.

Source(s): EIA, A Look at Residential Energy Consumption in 2005, October 2008 for 2005 expenditures; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

2.3.13 2005 Average Household Expenditures, by Census Region ($2009)

Item	Northeast	Midwest	South	West	United States
Energy (1)	2,533	1,959	1,954	1,642	1,987
Shelter (2)	11,055	8,656	7,867	12,445	9,665
Food	7,130	6,316	6,027	6,958	6,510
Telephone, water and other public services	1,423	1,463	1,614	1,653	1,552
Household supplies, furnishings and equipment (3)	2,389	2,577	2,436	3,121	2,610
Transportation (4)	8,487	8,510	8,771	11,052	9,159
Healthcare	2,833	3,119	2,861	2,906	2,924
Education	1,523	1,096	740	1,016	1,032
Personal taxes (5)	2,371	2,553	2,486	3,225	2,643
Other expenditures	13,073	13,132	11,912	14,127	12,903
Average Annual Income	**69,230**	**62,136**	**58,519**	**72,380**	**64,448**

Note(s): 1) Average household energy expenditures are calculated from the Residential Energy Consumption Survey (RECS), while average expenditures for other categories are calculated from the Consumer Expenditure Survey (CE). RECS assumed total US households to be 111,090,617 in 2005, while the CE data is based on 117,356,000 "consumer units," which the Bureau of Labor Statistics defines to be financially independent persons or groups of people that use their incomes to make joint expenditure decisions, including all members of a particular household who are related by blood, marriage, or other legal arrangements. CE calculated average annual energy expenditures for the United States to be $1,943. 2) Shelter includes both owned and rented dwellings, including any expenses for mortgage interest, property taxes, maintenance, repairs, insurance, and other expenses. 3) Household supplies, furnishings and equipments includes the following: laundry and cleaning supplies, postage and stationary, household textiles, furniture, floor coverings, appliances, and other household equipment. 4) Transportation expenditures include public transportation as well as the following vehicle-related expenses: net outlay of vehical purchases, gasoline and motor oil, vehicle finance, maintenance and repairs, insurance, licenses, rental fees, and other charges. CE estimated public transportation to comprise 5.4% of total transportation spending. 5) Personal taxes include federal, state and local income taxes, as well as $177 per year for "other taxes."

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Tables US-1 part 1 for energy expenditures; Bureau of Labor Statistics, Consumer Expenditure Survey 2005, Table 8, Oct. 2010; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

2.3.14 2005 Average Household Expenditures as Percent of Annual Income, by Census Region ($2009)

Item	Northeast	Midwest	South	West	United States
Energy (1)	3.7%	3.2%	3.3%	2.3%	3.1%
Shelter (2)	16.0%	13.9%	13.4%	17.2%	15.0%
Food	10.3%	10.2%	10.3%	9.6%	10.1%
Telephone, water and other public services	2.1%	2.4%	2.8%	2.3%	2.4%
Household supplies, furnishings and equipment (3)	3.5%	4.1%	4.2%	4.3%	4.1%
Transportation (4)	12.3%	13.7%	15.0%	15.3%	14.2%
Healthcare	4.1%	5.0%	4.9%	4.0%	4.5%
Education	2.2%	1.8%	1.3%	1.4%	1.6%
Personal taxes (5)	3.4%	4.1%	4.2%	4.5%	4.1%
Average Annual Expenditures	76.0%	79.5%	79.7%	80.2%	79.0%
Average Annual Income	**69,230**	**62,136**	**58,519**	**72,380**	**64,448**

Note(s): 1) Average household energy expenditures are calculated from the Residential Energy Consumption Survey (RECS), while average expenditures for other categories are calculated from the Consumer Expenditure Survey (CE). RECS assumed total US households to be 111,090,617 in 2005, while the CE data is based on 117,356,000 "consumer units," which the Bureau of Labor Statistics defines to be financially independent persons or groups of people that use their incomes to make joint expenditure decisions, including all members of a particular household who are related by blood, marriage, or other legal arrangements. CE calculated average annual energy expenditures for the United States to be $1,943 while RECS calculated it to be $1,987. 2) Shelter includes both owned and rented dwellings, including any expenses for mortgage interest, property taxes, maintenance, repairs, insurance, and other expenses. 3) Household supplies, furnishings and equipments includes the following: laundry and cleaning supplies, postage and stationary, household textiles, furniture, floor coverings, appliances, and other household equipment. 4) Transportation expenditures include public transportation as well as the following vehicle-related expenses: net outlay of vehical purchases, gasoline and motor oil, vehicle finance, maintenance and repairs, insurance, licenses, rental fees, and other charges. CE estimated public transportation to comprise 5.4% of total transportation spending. 5) Personal taxes include federal, state and local income taxes, as well as $177 per year for "other taxes."

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Oct. 2008, Tables US-1 part 1 for energy expenditures; Bureau of Labor Statistics, Consumer Expenditure Survey 2005, Table 8, Oct. 2010; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

2.3.15 2005 Households and Energy Expenditures, by Income Level ($2009)

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 Table 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, Table US-1 part 2; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

2.3.16 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 2.7.1 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.

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

	Residential					U.S.				
	Site Fossil	Electricity	Total	Growth Rate 2008-Year		Total	Growth Rate 2008-Year		Res.% of Total U.S.	Res.% of Total Global
1980	385	525	909	-		4723	-		19%	4.9%
1985	351	549	901	-		4559	-		20%	4.6%
1990	340	618	959	-		5020	-		19%	4.4%
1995	362	674	1035	-		5302	-		20%	4.7%
2000	380	799	1180	-		5850	-		20%	5.0%
2005	365	890	1255	-		5974	-		21%	4.4%
2008	**349**	**872**	**1220**	-	**(2)**	**5820**	-	**(3)**	21%	**4.0%**
2010	339	892	1231	0.9%		5639	-1.1%		22%	4.0%
2015	335	757	1092	-0.9%		5679	-0.4%		19%	3.5%
2020	332	778	1110	-0.5%		5774	-0.1%		19%	3.3%
2025	327	833	1161	-0.1%		5931	0.0%		20%	3.2%
2030	324	878	1202	0.1%		6110	0.2%		20%	3.1%
2035	319	916	1234	0.1%		6315	0.2%		20%	2.9%

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 2011 Early Release, Table A18. Residential buildings sector total varies by 0.2% for year 2008 from EIA, AEO 2011 Early Release. 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. 2008, Dec. 2009, Tables 7-10 for 1980-2007 greenhouse gas emissions; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 2, p. 9 for carbon coefficients; EIA, AEO 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for 2008-2030 energy consumption and Table A18, p. 36 for 2008-2035 emissions; EIA, International Energy Outlook 2010, May 2009, Table A10, p. 93 for 2008-2035 global emissions; and EIA, International Energy Annual 2007, July 2008, Table H1, www.eia.doe.gov for 1980-2000 global emission.

2.4.2 2005 End-Use Carbon Dioxide Emissions Splits for an Average Household, by Region (Pounds of CO2)

	Northeast	Midwest	South	West	National
Space Heating	9,992	7,544	3,893	3,759	5,862
Space Cooling	2,113	2,916	6,799	3,326	4,472
Water Heating	3,520	3,489	3,964	3,429	3,676
Refrigerator	2,544	3,335	3,154	2,723	2,989
Other Appliances & Lighting	8,854	10,645	10,958	9,413	10,159
Total	**27,024**	**27,929**	**28,768**	**22,650**	**27,158**

Source(s): EIA, A Look at Residential Energy Consumption in 2005, Jul. 2008, Tables CE(2-5)-(9-12)c; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2011, Table A2, p. 3-4, Table A17, p. 34-35 for consumption data, and Table A18, p. 36 for emissions data; and EIA, Assumptions to the AEO 2010, May 2010, Table 2, p. 12 for coefficients.

2.4.3 2008 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)	180.4	40.6		16.3	1.5	58.5	0.8	79.1	318.8	26.1%
Space Cooling	0.0							179.8	179.8	14.7%
Water Heating	70.5	7.9		5.4		13.4		88.7	172.6	14.1%
Lighting								137.0	137.0	11.2%
Electronics (5)								99.6	99.6	8.2%
Refrigeration (6)								84.0	84.0	6.9%
Wet Cleaning (7)	2.8							58.1	60.8	5.0%
Cooking	11.5			1.9		1.9		42.9	56.3	4.6%
Computers								31.9	31.9	2.6%
Other (8)				9.0		9.0		36.0	45.0	3.7%
Adjust to SEDS (9)								34.3	34.3	2.8%
Total	**265.2**	**48.5**		**32.7**	**1.5**	**82.8**	**0.8**	**871.5**	**1,220.2**	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. Carbon emissions calculated from EIA, Assumptions to the AEO 2010 and differs from AEO 2011 Early Release, Table A18. Residential buildings sector total varies by 0.2% from AEO 2011 Early Release. 2) Includes kerosene space heating (1.5 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (25.4 MMT). 5) Includes color television (61.6 MMT) and other office equipment(11.8 MMT). 6) Includes refrigerators (69.3 MMT) and freezers (14.7 MMT). 7) Includes clothes washers (6.3 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (34.8 MMT), and dishwashers (17.1 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, Assumptions to the AEO 2010, May 2010, 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.

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)	174.5	36.5		16.2	1.7	54.5	0.7	76.6	306.3	24.9%
Space Cooling	0.0							200.2	200.2	16.3%
Water Heating	71.2	7.3		4.9		12.1		79.0	162.4	13.2%
Lighting								127.1	127.1	10.3%
Refrigeration (5)								79.5	79.5	6.5%
Electronics (6)								61.1	61.1	5.0%
Wet Cleaning (7)	2.8							55.5	58.3	4.7%
Cooking	11.5			1.9		1.9		19.2	32.6	2.7%
Computers								32.2	32.2	2.6%
Other (8)				10.0		10.0		161.8	171.7	13.9%
Total	**260.0**	**43.8**		**33.0**	**1.7**	**78.5**	**0.7**	**892.2**	**1,231.4**	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 (1.7 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (25.0 MMT). 5) Includes refrigerators (65.5 MMT) and freezers (14.1 MMT). 6) Includes color television (61.1 MMT). 7) Includes clothes washers (5.8 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (33.4 MMT), and dishwashers (16.3 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption,and Table A18, p. 36 for emissions; EIA, Assumptions to the AEO 2010, May 2010, Table 2, p. 12 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)	174.6	31.5		13.9	1.4	46.8	0.6	75.6	297.6	26.8%
Water Heating	74.1	4.7		3.1		7.8		80.1	161.9	14.6%
Space Cooling	0.0							139.9	139.9	12.6%
Lighting								87.9	87.9	7.9%
Refrigeration (5)								70.0	70.0	6.3%
Electronics (6)								55.3	55.3	5.0%
Wet Cleaning (8)	2.8							49.1	51.9	4.7%
Cooking	12.0			1.7		1.7		20.3	34.1	3.1%
Computers								28.3	28.3	2.6%
Other (9)				11.6		11.6		171.8	183.3	16.5%
Total	**263.5**	**36.2**		**30.3**	**1.4**	**67.9**	**0.6**	**778.2**	**1,110.1**	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 (1.4 MMT). 3) Excludes electric imports by utilities. 4) Includesresidential furnace fans (27.3 MMT). 5) Includes refrigerators (56.8 MMT) and freezers (13.1 MMT). 6) Includes color television (55.3 MMT). 8) Includes clothes washers (4.4 MMT), natural gas clothes dryers (2.8 MMT), electric clothes dryers (29.5 MMT), and dishwashers (15.2 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption,and Table A18, p. 36 for emissions; EIA, Assumptions to the AEO 2010, May 2010, Table 2, p. 12 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)	174.4	26.0		12.7	1.3	40.0	0.5	83.2	298.2	24.8%
Water Heating	72.5	3.4		2.3		5.7		82.1	160.3	13.3%
Space Cooling	0.0							158.7	158.7	13.2%
Electronics (5)								64.6	64.6	5.4%
Refrigeration (6)								75.0	75.0	6.2%
Lighting								88.2	88.2	7.3%
Wet Cleaning (7)	2.9							54.3	57.2	4.8%
Cooking	12.6			1.6		1.6		23.4	37.6	3.1%
Computers								31.1	31.1	2.6%
Other (8)				13.4		13.4		217.7	231.1	19.2%
Total	**262.4**	**29.5**		**30.0**	**1.3**	**60.7**	**0.5**	**878.3**	**1,201.9**	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 (1.3 MMT). 3) Excludes electric imports by utilities. 4) Includes residential furnace fans (31.7 MMT). 5) Includes color television (64.6 MMT). 6) Includes refrigerators (60.8 MMT) and freezers (14.2 MMT). 7) Includes clothes washers (4.7 MMT), natural gas clothes dryers (2.9 MMT), electric clothes dryers (31.9 MMT), and dishwashers (17.7 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption,and Table A18, p. 36 for emissions; EIA, Assumptions to the AEO 2010, May 2010, Table 2, p. 12 for emission coefficients.

2.4.7 2006 Methane Emissions for U.S. Residential Buildings Energy Production, by Fuel Type

Fuel Type	MMT CO2 Equivalent (1)
Petroleum	0.9
Natural Gas	34.2
Coal	0.0
Wood	2.3
Electricity (2)	38.2
Total	**75.7**

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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for energy consumption.

2.5.1 Construction Statistics of New Homes Completed/Placed

	Single-Family		Multi-Family		Mobile Homes	Total
Year	Thousand Units	Average SF	Thousand Units	Average SF	Thousand Units	Thousand Units
1980	957	1,700	545	979	234	1,736
1981	819	1,710	447	980	229	1,495
1982	632	1,690	374	N.A.	234	1,240
1983	924	1,740	467	N.A.	278	1,669
1984	1,025	1,790	627	N.A.	288	1,940
1985	1,072	1,760	631	922	283	1,986
1986	1,120	1,810	636	911	256	2,012
1987	1,123	1,900	546	N.A.	239	1,908
1988	1,085	1,960	445	990	224	1,754
1989	1,026	2,000	397	1,000	203	1,626
1990	966	2,050	342	1,005	195	1,503
1991	838	2,050	253	1,020	174	1,265
1992	964	2,060	194	1,040	212	1,370
1993	1,039	2,060	153	1,065	243	1,435
1994	1,160	2,050	187	1,035	291	1,638
1995	1,066	2,050	247	1,080	319	1,632
1996	1,129	2,090	284	1,070	338	1,751
1997	1,116	2,140	284	1,095	336	1,736
1998	1,160	2,170	314	1,065	374	1,848
1999	1,270	2,221	334	1,104	338	1,942
2000	1,242	2,265	332	1,114	281	1,855
2001	1,256	2,282	315	1,171	196	1,767
2002	1,325	2,301	323	1,166	174	1,822
2003	1,386	2,315	292	1,173	140	1,818
2004	1,532	2,366	310	1,173	124	1,966
2005	1,636	2,414	296	1,247	123	2,055
2006	1,654	2,456	325	1,277	112	2,091
2007	1,218	2,521	284	1,300	95	1,597
2008	819	2,519	301	1,250	81	1,201
2009	520	2,438	274	N.A.	52	846

Source(s): DOC, 2009 Characteristics of New Housing, June 2010, "Median and Average Square Feet of Floor Area in New Single-Family Houses Completed by Location" for average SF of single-family homes and "Presence of Air-Conditioning in New Single Family Houses" for total new single-family homes completed; 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, 1980-2009.

2.5.2 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.

2.5.3 Value of New Building Construction, by Year ($2009 Billion)

	Residential	GDP
1980	164.6	6,409
1985	211.7	7,518
1990	206.7	8,819
1995	236.0	9,982
2000	331.9	12,323
2005	521.3	13,873
2006	384.2	14,244
2007	245.6	14,549
2008	240.4	14,613
2009	141.5	14,256

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 1995-2000; DOC, Annual Value of Private Construction Put in Place, August 2010 for 2002-2009; DOC, Annual Value of Public Construction Put in Place, August 2008 for 1995-2000; DOC, Annual Value of Public Construction Put in Place, August 2010 for 2002-2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.5.4 2009 New Homes Completed/Placed, by Census Region (Thousand Units and Percent of Total Units)

Region	Single-Family Units		Multi-Family Units		Mobile Homes Units		Total	
Northeast	54	10%	40	15%	4	7%	98	12%
Midwest	89	17%	30	11%	5	10%	125	15%
South	259	50%	135	49%	36	69%	430	51%
West	118	23%	69	25%	7	13%	195	23%
Total	**520**	100%	**274**	100%	**52**	100%	**847**	100%

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, Oct. 2010 for mobile home placements.

2.5.5 2009 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	49	10%	3	30%	1	9%	53
Midwest	83	17%	3	30%	3	27%	89
South	248	50%	4	40%	6	55%	259
West	117	24%	0	0%	1	9%	118
Total	**497**	100%	**10**	100%	**11**	100%	**519**

Source(s): DOC, Manufacturing, Mining and Construction Statistics, New Residential Construction: Type of Construction Method of New One-Family Houses Completed, June 2010.

2.5.6 2009 Mobile Home Placements, by Census Region and Top Five States (Percent of National Total)

Region		Top Five States	
Northeast	7%	Texas	15%
Midwest	10%	Louisiana	8%
South	69%	North Carolina	6%
West	13%	Florida	5%
Total	100%	Mississippi	5%

Source(s): DOC, Manufactured Housing Statistics, "New Manufactured Homes Placed by State - 2009" and "Placements of New Manufactured Homes by Region and Size of Home: 1980-2009".

2.5.7 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.

2.5.8 1998 Cost Breakdown of a 2,150-Square-Foot, New Single-Family Home ($2009) (1)

	Cost	
Finished Lot	**64,622**	**24%**
Construction Cost		
Inspection/Fees	4,223	2%
Shell/Frame		
Framing	30,925	11%
Windows/Doors	10,271	4%
Exterior Finish	11,304	4%
Foundation	16,130	6%
Wall/Finish Trim	28,210	10%
Flooring	7,210	3%
Equipment		
Plumbing	8,837	3%
Electrical Wiring	5,638	2%
Lighting Fixtures	1,560	1%
HVAC	6,170	2%
Appliances	2,165	1%
Property Features	17,566	6%
Financing	**5,151**	**2%**
Overhead & General Expenses	**15,644**	**6%**
Marketing	**3,840**	**1%**
Sales Commission	**9,238**	**3%**
Profit	**25,161**	**9%**
Total	**273,865**	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 2009, August, Appendix D, p. 383 for price inflators.

2.5.9 Annual Sales of Existing Homes, by Region

	Existing Home Sales (in thousands)				
	North-east	Mid-west	South	West	United States
1970	251	501	568	292	1,612
1971	311	583	735	389	2,018
1972	361	630	788	473	2,252
1973	367	674	847	446	2,334
1974	354	645	839	434	2,272
1975	370	701	862	543	2,476
1976	439	881	1,033	712	3,065
1977	515	1,101	1,231	803	3,650
1978	516	1,144	1,416	911	3,987
1979	526	1,061	1,353	887	3,827
1980	403	806	1,092	671	2,972
1981	353	632	917	516	2,418
1982	354	490	780	366	1,990
1983	493	709	1,035	481	2,718
1984	511	755	1,073	529	2,868
1985	622	866	1,172	554	3,214
1986	703	991	1,261	610	3,565
1987	685	959	1,282	600	3,526
1988	673	929	1,350	642	3,594
1989	635	886	1,075	694	3,290
1990	583	861	1,090	651	3,185
1991	591	863	1,067	624	3,145
1992	666	967	1,126	674	3,433
1993	709	1,027	1,262	740	3,738
1994	723	1,031	1,321	812	3,887
1995	717	1,010	1,315	810	3,852
1996	772	1,060	1,394	941	4,167
1997	812	1,088	1,474	997	4,371
1998	898	1,228	1,724	1,115	4,965
1999	910	1,246	1,850	1,177	5,183
2000	911	1,222	1,866	1,174	5,173
2001	912	1,271	1,967	1,184	5,334
2002	952	1,346	2,064	1,269	5,631
2003	1,019	1,468	2,283	1,405	6,175
2004	1,113	1,550	2,540	1,575	6,778
2005	1,169	1,588	2,702	1,617	7,076
2006	1,086	1,483	2,563	1,346	6,478
2007	1,006	1,327	2,235	1,084	5,652
2008	849	1,129	1,865	1,070	4,913
2009	868	1,163	1,914	1,211	5,156

Source(s): HUD, US Housing Market Conditions: 3rd Quarter 2010, November 2010, Exhibit 7. Existing Home Sales 1970-Present, p. 68.

2.5.10 Home Price Index (HPI), All-Transactions, by Region (1)

	North-east	Mid-west	South	West	United States	
1975	69.13	64.37	65.54	50.54	63.62	
1976	71.15	68.44	68.07	56.86	69.52	
1977	76.03	76.53	73.46	67.64	78.47	
1978	83.99	87.75	82.57	80.01	89.40	
1979	97.60	97.69	93.65	93.09	99.00	
1980	104.34	102.14	101.27	103.31	105.55	(2)
1981	110.08	103.04	107.78	111.85	109.83	
1982	115.18	101.41	113.77	115.90	113.31	
1983	124.97	105.22	117.83	117.87	117.81	
1984	144.24	108.32	120.21	120.09	123.62	
1985	169.55	112.71	124.21	124.02	131.38	
1986	202.56	118.57	130.10	129.83	140.49	
1987	238.94	125.61	135.04	135.71	149.28	
1988	258.91	131.53	138.15	145.04	157.66	
1989	262.75	137.18	142.05	162.03	164.13	
1990	256.35	141.75	145.39	172.32	167.72	
1991	248.36	146.24	147.59	175.89	171.25	
1992	249.01	151.63	152.34	178.97	175.23	
1993	249.81	156.90	156.40	181.23	179.11	
1994	247.00	165.05	161.56	186.00	183.85	
1995	248.39	173.28	166.16	192.24	189.93	
1996	254.18	182.08	173.39	198.88	196.78	
1997	260.25	190.70	178.90	206.53	205.35	
1998	273.62	199.77	187.72	218.89	215.56	
1999	291.18	210.25	195.38	229.83	227.84	
2000	319.54	223.09	203.84	248.21	244.06	
2001	351.81	237.43	217.46	270.75	261.25	
2002	389.41	250.13	227.71	289.70	277.93	
2003	425.79	261.45	239.44	311.93	299.95	
2004	477.41	277.34	255.81	356.65	331.26	
2005	534.36	294.20	282.38	420.81	361.54	
2006	562.61	302.53	308.11	467.33	377.18	
2007	563.07	305.50	320.33	471.96	374.21	
2008	545.89	301.14	318.00	432.54	360.69	
2009	524.21	293.17	311.67	396.74	311.33	

Note(s): (1) The HPI is a broad measure of the movement of single-family house prices. It serves as a timely, accurate indicator of house price trends at various geographic levels (Federal Housing Finance Agency, "Frequently Asked Questions"). The Federal Housing Finance Agency (FHFA) calculated quarterly HPI for each census division using sales prices and appraisal data that were not seasonally adjusted; DOE estimated the average annual HPI for each census region using publicly-available data from FHFA. (2) HPI was indexed to the first quarter of 1980 separately for each region, i.e. the HPI=100 for 1980 Q1 in all regions. As a result, the values for each region are only comparable to one another with regard to the magnitude of the change in home prices over time.

Source(s): Federal Housing Finance Agency, Housing Price Indexes, data for 'All-Transactions Indexes, U.S. and Census Divisions (Not Seasonally Adjusted)'. Accessed January 20, 2011 at <http://www.fhfa.gov/weblink/hpi_reg.txt>

2.5.11 Yearly Average Historic Mortgage Rates

	30-Year Fixed	15-Year Fixed	1-Year ARM (1)
1973	8.04	N/A	N/A
1974	9.19	N/A	N/A
1975	9.05	N/A	N/A
1976	8.87	N/A	N/A
1977	8.85	N/A	N/A
1978	9.64	N/A	N/A
1979	11.20	N/A	N/A
1980	13.74	N/A	N/A
1981	16.63	N/A	N/A
1982	16.04	N/A	N/A
1983	13.24	N/A	N/A
1984	13.88	N/A	11.51
1985	12.43	N/A	10.05
1986	10.19	N/A	8.43
1987	10.21	N/A	7.83
1988	10.34	N/A	7.90
1989	10.32	N/A	8.80
1990	10.13	N/A	8.36
1991	9.25	N/A	7.09
1992	8.39	7.96	5.62
1993	7.31	6.83	4.58
1994	8.38	7.86	5.36
1995	7.93	7.48	6.06
1996	7.81	7.32	5.67
1997	7.60	7.13	5.61
1998	9.64	6.59	5.58
1999	7.44	7.06	5.99
2000	8.05	7.72	7.04
2001	6.97	6.50	5.82
2002	6.54	5.98	4.62
2003	5.83	5.17	3.76
2004	5.84	5.21	3.90
2005	5.87	5.42	4.49
2006	6.41	6.07	5.54
2007	6.34	6.03	5.56
2008	6.03	5.62	5.17
2009	5.04	4.57	4.70

Note(s): 1) To calculate adjustable-rate mortgage (ARM) rates, Freddie Mac indexes the products to US Treasury yields and asks lenders for both the initial coupon rate as well as the margin on the ARM products.

Source(s): US Department of Housing and Urban Development, US Housing Market Conditions: 3rd Quarter 2010, November 2010, Exhibit 14. Mortgage Interest Rates, Average Commitment Rates, and Points 1973-Present.

2.5.12 Annual Home Improvement Loan Origination Volumes and Values, by Housing Vintage of Loan Applicant

	Volume (thousands)										
Housing Vintage	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1990-2000	N/A	N/A	N/A	N/A	49	74	93	95	74	36	23
1980-1989	105	103	95	86	117	190	224	235	196	113	75
1970-1979	242	231	214	186	144	270	306	320	277	173	123
1960-1969	178	165	153	134	97	172	191	200	168	102	70
1950-1959	135	123	113	96	147	249	268	279	234	139	93
1949 or earlier	126	113	100	84	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Total Volume	**660**	**622**	**575**	**502**	**553**	**955**	**1,083**	**1,128**	**949**	**563**	**383**

	Value (in $2009 billion)										
Housing Vintage	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
1990-2000	N/A	N/A	N/A	N/A	2.5	7.5	11.7	10.5	7.3	3.1	2.3
1980-1989	3.5	3.7	3.7	4.0	5.5	16.0	23.0	21.9	16.2	8.0	6.4
1970-1979	7.0	7.2	7.5	7.6	6.6	21.2	28.7	27.7	21.0	11.2	9.2
1960-1969	5.2	5.3	5.6	5.9	4.7	15.3	20.2	19.4	14.4	7.3	5.9
1950-1959	3.9	4.0	4.2	4.3	6.8	22.1	27.8	26.9	20.6	10.1	7.9
1949 or earlier	3.5	3.5	3.6	3.5	(1)	(1)	(1)	(1)	(1)	(1)	(1)
Total Value	**23.1**	**23.7**	**24.7**	**25.3**	**26.1**	**82.2**	**111.4**	**106.5**	**79.5**	**39.6**	**31.8**

Note(s): 1) After 2002, category represent 1959 and earlier vintage homes.

Source(s): The Federal Financial Institution Examination Council, Home Mortgage Disclosure Act, National Aggregate Report, Years: 1999-2009.

2.6.1 Value of Residential Building Improvements and Repairs, by Sector ($2009 Billion) (1)

		Improvements	Maintenance and Repairs	Total
1980		71.6	34.9	106.5
1985		81.6	64.8	146.4
1990		90.7	84.8	175.5
1995		104.9	63.3	168.2
2000		137.1	52.3	189.4
2003		154.9	51.4	206.4
2004		167.8	57.4	225.2
2005		177.5	59.2	236.7
2006		185.8	56.8	242.6
2007	(2)	177.4	56.6	233.9

Note(s): 1) Improvements includes additions, alterations, reconstruction, and major replacements. Repairs include maintenance. 2) The US Census Bureau discontinued the Survey of Residential Alterations and Repairs (SORAR) after 2007.

Source(s): DOC, Historic Expenditures for Residential Properties by Property Type: Quarterly 1962-2003 (Old structural purposes) for 1980-2000; DOC, 1997 Census of Construction Industries: Industry Summary, Jan. 2000, Table 7, p. 15; DOC, Historic Expenditures for residential Proerties by Property Type: Quarterly 2003-2007 (New structural purposes) for 2003-2007; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.6.2 2007 Professional and Do-It-Yourself Improvements, by Project ($2009)

	Professional Installation			Do-It-Yourself Installation		
Repair/Improvement	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)
Room Additions, Alterations, and Remodelings	**3,957**	**65,158**	**16,466**	**3,986**	**21,643**	**5,430**
Kitchen	1,349	21,426	15,883	1,110	7,550	6,801
Bathroom	1,602	14,514	9,060	1,611	4,979	3,091
Bedroom	276	10,551	38,228	415	3,316	7,991
Other	730	18,667	25,571	850	5,798	6,821
Systems and Equipment	**11,708**	**23,384**	**1,997**	**7,156**	**4,918**	**687**
Plumbing (Pipes and Fixtures	2,885	4,599	1,594	2,888	1,786	618
Electrical System	1,602	2,834	1,769	936	684	731
HVAC	2,936	12,313	4,194	556	1,289	2,318
Appliance/Major Equipment	4,285	3,638	849	2,776	1,160	418
Exterior Additions and Replacements	**6,216**	**32,340**	**5,203**	**2,986**	**5,749**	**1,925**
Roof	2,707	16,255	6,005	677	1,880	2,777
Siding	776	5,350	6,895	428	1,298	3,033
Windows/Doors	2,733	10,735	3,928	1,881	2,571	1,367
Interior Additions and Replacements	**6,207**	**21,959**	**3,538**	**4,721**	**6,728**	**1,425**
Insulation	727	1,683	2,314	918	794	865
Flooring/Paneling/Ceiling	4,836	16,415	3,394	3,467	4,707	1,358
Other Interior	644	3,862	5,997	336	1,227	3,651
Disaster Repair	**728**	**10,157**	**13,952**	**187**	**3,278**	**17,530**
Other Additions and Replacements (1)	**4,447**	**32,303**	**7,264**	**3,580**	**8,323**	**2,325**
Total (2)	**33,263**	**185,301**		**22,616**	**50,639**	

Note(s): 1) Other additions and replacements include porches, carports, swimming pools and other major improvements or repairs to lot or yard. 2)Total expenditures (professional installation plus do-it-yourself installation) are $1.8 billion higher compared to 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. Individual households may report projects in multiple categories.

Source(s): Joint Center for Housing Studies of Harvard University, The Remodeling Market in Transition: Improving America's Housing 2009, 2009, Table A-2, p. 30; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.6.3 2007 and 2009 Professional Home Improvements, by Project ($2009)

	2007 Professional Installation			2009 Professional Installation		
Repair/Improvement	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)
Room Additions, Alterations, and Remodelings	**3,957**	**65,158**	**16,466**	**3,322**	**38,182**	**11,494**
Kitchen	1,349	21,426	15,883	1,109	16,081	14,500
Bathroom	1,602	14,514	9,060	1,401	12,085	8,626
Bedroom	276	10,551	38,228	255	8,712	34,165
Other	730	18,667	25,571	557	1,304	2,341
Systems and Equipment	**11,708**	**23,365**	**1,996**	**11,262**	**20,666**	**1,835**
Plumbing (Pipes and Fixtures	2,885	4,599	1,594	2,700	3,743	1,386
Electrical System	1,602	2,815	1,757	1,523	2,055	1,349
HVAC	2,936	12,313	4,194	2,824	11,752	4,161
Appliance/Major Equipment	4,285	3,638	849	4,215	3,116	739
Exterior Additions and Replacements	**6,216**	**32,340**	**5,203**	**6,163**	**28,684**	**4,654**
Roof	2,707	16,255	6,005	2,698	15,122	5,605
Siding	776	5,350	6,895	780	4,181	5,360
Windows/Doors	2,733	10,735	3,928	2,685	9,381	3,494
Interior Additions and Replacements	**6,207**	**15,029**	**2,421**	**5,479**	**14,542**	**2,654**
Insulation	727	1,286	1,768	861	1,244	1,445
Flooring/Paneling/Ceiling	4,836	11,811	2,442	4,081	11,428	2,800
Other Interior	644	1,933	3,001	537	1,870	3,482
Disaster Repair	728	9,847	13,526	806	9,063	11,244
Other Additions and Replacements (1)	**4,447**	**32,303**	**7,264**	**3,732**	**24,262**	**6,501**
Total	**33,263**	**178,042**		**30,764**	**135,399**	

Note(s): 1) Other additions and replacements include porches, carports, swimming pools and other major improvements or repairs to lot or yard.

Source(s): Joint Center for Housing Studies of Harvard University, The Remodeling market in Transition, 2009, Table A.2, p. 30 for 2007; Joint Center for Housing Studies of Harvard University, A New Decade of Growth for Remodeling: Improving America's Housing, 2011, Table A-2, p. 28 for 2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.6.4 2007 and 2009 Do-It-Yourself Home Improvements, by Project ($2009)

	2007 DIY Installation			2009 DIY Installation		
Repair/Improvement	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)	Projects (thousand)	Total Expenditures ($million)	Mean Expenditures ($)
Room Additions, Alterations, and Remodelings	**3,986**	**21,643**	**5,430**	**3,372**	**15,563**	**4,615**
Kitchen	1,110	7,550	6,801	898	5,354	5,962
Bathroom	1,611	4,979	3,091	1,465	3,847	2,626
Bedroom	415	3,316	7,991	299	2,636	8,816
Other	850	5,798	6,821	710	3,726	5,248
Systems and Equipment	**7,156**	**4,918**	**687**	**6,994**	**4,198**	**600**
Plumbing (Pipes and Fixtures	2,888	1,786	618	2,890	1,335	462
Electrical System	936	684	731	843	385	457
HVAC	556	1,289	2,318	532	1,400	2,632
Appliance/Major Equipment	2,776	1,160	418	2,729	1,078	395
Exterior Additions and Replacements	**2,986**	**5,749**	**1,925**	**2,714**	**4,418**	**1,628**
Roof	677	1,880	2,777	671	1,686	2,513
Siding	428	1,298	3,033	357	666	1,866
Windows/Doors	1,881	2,571	1,367	1,686	2,066	1,225
Interior Additions and Replacements	**4,721**	**6,728**	**1,425**	**4,411**	**4,777**	**1,083**
Insulation	918	794	865	922	564	612
Flooring/Paneling/Ceiling	3,467	4,707	1,358	3,174	3,611	1,138
Other Interior	336	1,227	3,651	315	602	1,911
Disaster Repair	**187**	**3,278**	**17,530**	**257**	**1,445**	**5,623**
Other Additions and Replacements (1)	**3,580**	**8,323**	**2,325**	**3,313**	**7,419**	**2,239**
Total	**22,616**	**50,639**		**21,061**	**37,820**	

Note(s): 1) Other additions and replacements include porches, carports, swimming pools and other major improvements or repairs to lot or yard.

Source(s): Joint Center for Housing Studies of Harvard University, The Remodeling market in Transition, 2009, Table A.2, p. 30 for 2007; Joint Center for Housing Studies of Harvard University, A New Decade of Growth for Remodeling: Improving America's Housing, 2011, Table A-2, p. 28 for 2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.6.5 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.

2.6.6 2007 National Professional Remodeling Cost and Amount Recouped in Resale Value ($2009)

Envelope	Job Cost ($ thousand)	Resale Value ($ thousand)	Cost Recouped
Siding Replacement - Vinyl	10.2	8.5	83%
Siding Replacement - Foam-backed vinyl	12.5	10.0	80%
Siding Replacement - Fiber-cement	13.7	12.0	88%
Window Replacement - Vinyl	10.8	8.6	79%
Window Replacement - Wood	11.8	9.6	81%
Roofing Replacement - Asphalt	18.6	12.6	67%
Roofing Replacement - Steel	34.3	22.5	66%
Remodel			
Minor Kitchen Remodel	21.9	18.2	83%
Major Kitchen Remodel	57.4	44.8	78%
Bathroom Remodel	16.3	12.8	78%
Attic Bedroom Remodel	48.3	37.0	77%
Basement Remodel	61.4	46.2	75%
Home Office Remodel	28.1	16.0	57%
Additions			
Deck Addition - Wood	10.7	9.1	85%
Deck Addition - Composite	15.5	12.1	78%
Bathroom Addition	38.4	25.4	66%
Garage Addition	55.7	38.7	70%
Sunroom Addition	72.2	42.6	59%
Family Room Addition	81.6	56.0	69%
Master Suite Addition	102.2	70.5	69%
Two-Story Addition	144.0	106.5	74%
Back-Up Power Generator	13.8	8.0	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. Costs and resale values inflated from $2007 to $2009.

Source(s): © 2007 Hanley Wood, LLC. Reproduced by permission. Complete regional and city data from the Remodeling 2007 Cost vs. Value Report can be downloaded for free at costvalue.remodelingmagazine.com; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

2.6.7 Home Improvement Spending by Household Income

Income (2009 dollars)	Number of Homeowners (000s)	Homeowners Reporting Projects (000s)	Average Expenditure ($)	Total Expenditures (Millions of $)
Under $40,000	24,675	6,113	5,643	34,496
$40-79,999	23,178	6,545	6,776	44,350
$80-119,999	14,051	2,499	9,102	39,132
120,000 and Over	13,005	4,097	16,375	67,092

Note(s): Home improvements include room additions, remodeling, replacements of household systems and appliances, porches and garages, additions and replacements of roofing, siding, window/doors, insulation, flooring/paneling/ceiling, and disaster repairs.

Source(s): Joint Center for Housing Studies, A New Decade of Growth for Remodeling, Table A-3, pg. 29.

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.

2.8.6 Manufactured Home Shipments, Estimated Retail Sales and Average Sales Prices (1980-2008)

Year	Manufactured Home Shipments	Estimated Retail Sales (2009$ Million)	Average Sales Price (2009$) Single Section	Average Sales Price (2009$) Multi-Section
1980	221,091	10,064	$36,781	$65,516
1981	240,313	10,051	$35,101	$61,375
1982	238,808	9,321	$34,073	$56,260
1983	295,079	11,809	$33,539	$58,122
1984	294,993	11,648	$32,509	$55,835
1985	283,489	11,017	$31,732	$53,659
1986	244,660	9,558	$31,045	$53,719
1987	232,598	9,344	$31,187	$54,916
1988	218,429	8,985	$30,479	$55,059
1989	198,254	8,516	$30,949	$56,371
1990	188,172	7,953	$30,103	$55,644
1991	170,713	6,944	$29,219	$54,180
1992	210,787	8,586	$29,546	$53,355
1993	254,276	10,882	$30,732	$55,570
1994	303,932	13,114	$32,297	$57,722
1995	339,601	15,179	$34,734	$60,044
1996	363,411	16,596	$35,670	$61,036
1997	353,377	17,377	$36,220	$62,444
1998	372,843	19,956	$36,970	$63,928
1999	348,671	18,531	$37,067	$64,646
2000	250,550	16,140	$37,396	$66,372
2001	193,229	11,618	$36,812	$66,843
2002	168,491	10,655	$36,821	$66,850
2003	130,937	8,953	$37,212	$69,642
2004	130,802	8,213	$37,320	$71,917
2005	146,744	8,446	$37,432	$75,412
2006	117,373	7,608	$38,377	$75,797
2007	95,769	6,408	$38,549	$76,684
2008	81,889	5,208	$38,552	$77,003

Note(s): Manufactured Housing Institute compiled data from the Institute for Building Technology and Safety (IBTS) and the US Census Bureau.

Source(s): Manufactured Housing Institute, "Manfuctured Home Shipments, Estimated Retail Sales amd Average Sales Prices (1980-2008). Accessed January 20, 2011 at <http://www.factorybuilthousing.com/admin/template/subbrochures/399temp.pdf>; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

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% of State median income, whichever is higher.

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

Source(s): ORNL, Scope of the Weatherization Assistance Program: Profile of the Population in Need, Mar. 1994, p. 1.2 for Weatherization eligible, Weatherization recipient, and LIHEAP eligible households; EIA, Housing Characteristics 1993, June 1995, p. 336 for Federally eligible for weatherization; 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)

	DOE	Federally Eligible (2)	Federally Ineligible	Below 125% Poverty Line	Below 150% Poverty Line	Total Households
1977	0.03	N.A.	N.A.	N.A.	N.A.	74.8
1980	0.18	N.A.	N.A.	N.A.	N.A.	79.6
1985	0.13	N.A.	N.A.	N.A.	N.A.	87.9
1987	0.10	N.A.	N.A.	N.A.	N.A.	90.5
1990	0.09	27.9	66.1	18.2	N.A.	94.2
1991	0.11	N.A.	N.A.	N.A.	N.A.	95.3
1992	0.11	N.A.	N.A.	N.A.	N.A.	96.4
1993	0.09	30.7	65.9	19.4	N.A.	96.6
1994	0.10	N.A.	N.A.	N.A.	N.A.	98.7
1995	0.10	N.A.	N.A.	N.A.	N.A.	100.0
1996	0.06	N.A.	N.A.	N.A.	N.A.	101.0
1997	0.07	34.1	67.4	19.7	N.A.	101.0
1998	0.07	N.A.	N.A.	N.A.	N.A.	102.5
1999	0.07	N.A.	73.2	N.A.	N.A.	103.9
2000	0.08	N.A.	N.A.	N.A.	N.A.	104.7
2001	0.08	33.8	73.2	20.1	26.5	108.2
2002	0.10	N.A.	N.A.	N.A.	N.A.	109.3
2003	0.10	N.A.	N.A.	N.A.	N.A.	111.3
2004	0.10	N.A.	N.A.	N.A.	N.A.	112.0
2005	0.09	29.6	81.5	19.4	26.6	113.3
2006	0.10	N.A.	N.A.	N.A.	N.A.	114.4
2007	0.10	N.A.	N.A.	N.A.	N.A.	116.0
1977-2007	**3.21**	**N.A.**	**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, A Look at Residential Energy Consumption in 1997, Nov. 1999, Table HC1-3a, p. 38-39; EIA, 1997 Residential Energy Consumption Survey for eligible households; EIA, 2001 Residential Energy Consumption Survey, 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, 2001 Residential Energy Consumption Survey for eligible households; and DOC, Income, Poverty, and Valuation of Noncash Benefits: 1994, Apr. 1996, Table B-1, for 1991 households; DOC, The 2011 Statistical Abstract, Table 62, p. 55 for 1990-2007 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 3.2 million households have received DOE funded weatherization services.
- In PY 2007, the energy burden on Federally eligible households was more than four and a quater times the burden on Federally ineligible households (17% versus 4%).
- DOE weatherization saves an average of 32% on natural gas bills. This equates to $1.65 in energy benefits being produced for every $1.00 invested. These services reduce average annual energy costs by $413 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; Weatherization Assistance Program Briefing Book, August 2008.

2.9.5 Weatherization Program Facts

- PY 2009 weatherization funding breakdown: DOE 40.1%, LIHEAP 43.4%, others 16.5%.(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 2009 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 $6,572 per household in PY 2011. All States are using energy audits or priority lists to determine the most cost-effective weatherization measures.
- For PR 2007, DOE weatherization created an average energy savings of $413 per household, reduced household annual gas heating consumption 32% with a benefit-cost ratio of 1.65.

Source(s): ORNL, Weatherization Plus Progress Report: Poised to Move Forward, June 2001;
EERE/OWIP, Weatherization Assistance Program Briefing Book, August 2008; EERE/OWIP, Weatherization Program Notice 11-1, page 6, December,

2.9.7 Residential Energy Burdens, by Weatherization Eligibility and Year

	1987	1990		FY 2000 (1)			FY 2007 (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%	7.0%	4.2%	3.0%
Federally Eligible	**13.0%**	**14.4%**	**10.1%**	**12.1%**	**7.9%**	**7.7%**	**3.6%**	**3.1%**	**2.5%**
Federally Ineligible	4.0%	3.5%	N.A.	3.0%	2.6%	2.0%	13.5%	9.3%	9.9%
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 2005, adjusted to reflect FY 2007 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 2007, June 2009, Tables A-3a, A-3b, and A-3c, p. 69-71.

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	8.8%	5.3%	3.4%	7.5%	4.6%	3.2%	7.0%	4.3%	3.0%	4.8%	3.0%	2.3%
Federally Eligible	**15.7%**	**10.5%**	**11.4%**	**14.7%**	**9.9%**	**10.8%**	**12.9%**	**9.8%**	**9.9%**	**9.6%**	**6.1%**	**6.9%**
Federally Ineligible	4.3%	3.8%	2.8%	3.8%	3.3%	2.6%	3.4%	3.0%	2.5%	2.7%	2.3%	1.9%

Note(s): 1) Data are derived from RECS 2005, adjusted to reflect FY 2007 HDD, CDD, and fuel prices.

Source(s): HHS, LIHEAP Home Energy Notebook for FY 2007, June 2009, Tables A-3a, A-3b, and A-3c, p. 69-71.

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	68.2	10.7	4.2	20.1	5.7	1.0
Federally Eligible	**10.9**	**4.5**	**1.1**	**9.4**	**2.5**	**0.6**
Federally Ineligible	57.3	6.2	3.1	10.7	3.2	0.4
Below 100% Poverty Line	5.3	2.4	0.7	6.1	1.5	0.3

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 ($2009)

	$ Per Household Member	Members/ Hhold	$ Per Square Foot	Square Feet/ Hhold
Total U.S. Households	774	2.6	0.86	2,309
Federally Eligible	**612**	**2.7**	**1.09**	**1,532**
Federally Ineligible	837	2.5	0.81	2,590
Below 100% Poverty Line	598	2.7	1.13	1,442

Source(s): EIA, 2005 Residential Energy Consumption Survey: Household Energy Consumption and Expenditures Tables, Oct. 2008, Table US1 part2; EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, p. 383 for price deflators.

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 2008-Year
1980	2.67	25.1%	1.31	12.4%	0.12	1.1%	0.02	0.2%	1.91	4.60	6.50	61.2%	10.62	-
1985	2.50	21.7%	1.08	9.4%	0.14	1.2%	0.02	0.2%	2.35	5.42	7.77	67.5%	11.51	-
1990	2.70	20.2%	0.99	7.4%	0.12	0.9%	0.10	0.7%	2.86	6.62	9.48	70.8%	13.39	-
1995	3.12	21.1%	0.76	5.2%	0.12	0.8%	0.12	0.8%	3.25	7.39	10.64	72.1%	14.75	-
2000	3.25	18.9%	0.80	4.6%	0.09	0.5%	0.13	0.7%	3.96	9.00	12.95	75.2%	17.22	-
2005	3.08	17.2%	0.75	4.2%	0.10	0.5%	0.12	0.7%	4.35	9.52	13.87	77.4%	17.92	-
2008	**3.22**	**17.5%**	**0.64**	**3.5%**	**0.07**	**0.4%**	**0.12**	**0.7%**	**4.56**	**9.82**	**14.37**	**78.0%**	**18.43**	**-**
2010	3.18	17.3%	0.56	3.0%	0.06	0.3%	0.14	0.8%	4.60	9.82	14.42	78.6%	18.35	-0.2%
2015	3.44	18.2%	0.55	2.9%	0.06	0.3%	0.14	0.8%	4.82	9.93	14.75	77.9%	18.94	0.4%
2020	3.57	17.7%	0.54	2.6%	0.06	0.3%	0.15	0.7%	5.20	10.71	15.90	78.7%	20.22	0.8%
2025	3.65	17.0%	0.53	2.5%	0.06	0.3%	0.15	0.7%	5.58	11.46	17.04	79.5%	21.43	0.9%
2030	3.76	16.5%	0.53	2.3%	0.06	0.3%	0.15	0.7%	6.01	12.24	18.25	80.2%	22.75	1.0%
2035	3.90	16.2%	0.53	2.2%	0.06	0.3%	0.15	0.6%	6.43	12.99	19.42	80.7%	24.06	1.0%

Note(s): 1) Petroleum includes distillate and residual fuels, liquefied petroleum gas, kerosene, and motor gasoline. 2) Includessite-marketed and non-marketed renewable energy. 3) 2008 site-to-source electricity conversion = 3.16.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2008; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2009-2035 and Table A17, p. 34-35 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 2008-Year
1980	0.021	N.A	N.A.	0.000	0.021	-
1985	0.024	N.A	N.A.	0.000	0.024	-
1990	0.094	N.A	N.A.	0.003	0.097	-
1995	0.113	N.A	N.A.	0.005	0.117	-
2000	0.119	N.A	N.A.	0.008	0.127	-
2005	0.105	N.A	N.A.	0.014	0.118	-
2008	**0.107**	**0.025**	**0.003**	**N.A.**	**0.135**	**-**
2010	0.111	0.026	0.004	N.A.	0.140	2.1%
2015	0.111	0.028	0.005	N.A.	0.144	1.0%
2020	0.111	0.029	0.005	N.A.	0.145	0.6%
2025	0.111	0.029	0.006	N.A.	0.146	0.5%
2030	0.111	0.029	0.008	N.A.	0.148	0.4%
2035	0.111	0.030	0.010	N.A.	0.151	0.4%

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 2008: Consumption, June 2010, Tables 8-9, p. 24-25 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables,Table A17, p. 34-35 for 2008-2030.

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* Consumption per SF (thousand Btu/SF)	Primary Energy Consumption Total (10^15 Btu)	Primary Energy Consumption Consumption per SF (thousand Btu/SF)
1980		50.9	N.A.	6.02	118.3	10.62	208.7
1990		64.3	N.A.	6.76	105.2	13.39	208.3
2000	(2)	68.5	N.A.	8.22	120.0	17.22	251.4
2008	**(2)**	**78.8**	**18%**	**8.62**	**109.5**	**18.47**	**234.4**
2010	(2)	81.2	26%	8.54	105.1	18.35	226.0
2015	(2)	85.5	35%	9.02	105.5	18.94	221.7
2020	(2)	91.5	45%	9.51	104.0	20.22	221.0
2025	(2)	97.4	54%	9.96	102.3	21.43	220.1
2030	(2)	103.5	62%	10.51	101.5	22.75	219.7
2035	(2)	109.8	70%	11.07	100.8	24.02	218.8

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 2008: Consumption, June 2010, Tables 8-12, p. 24-28 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, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A5, p. 11-12, and Table A17, p. 34-35 for 2008-2035.

3.1.4 2008 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						1.27	1.27	14.7%	I	4.00	4.00	21.7%
Space Heating	1.56	0.23		0.08	0.11	0.28	2.25	26.1%	I	0.89	2.86	15.5%
Space Cooling	0.03					0.77	0.80	9.3%	I	2.44	2.47	13.4%
Ventilation						0.53	0.53	6.2%	I	1.68	1.68	9.1%
Refrigeration						0.40	0.40	4.7%	I	1.28	1.28	6.9%
Water Heating	0.44	0.02			0.02	0.09	0.58	6.7%	I	0.30	0.78	4.2%
Electronics						0.24	0.24	2.8%	I	0.75	0.75	4.1%
Computers						0.22	0.22	2.6%	I	0.70	0.70	3.8%
Cooking	0.17					0.02	0.19	2.2%	I	0.07	0.24	1.3%
Other (5)	0.29	0.01	0.15	0.05	0.00	0.59	1.09	12.6%	I	1.86	2.36	12.8%
Adjust to SEDS (6)	0.73	0.18				0.14	1.05	12.2%	I	0.43	1.35	7.3%
Total	**3.22**	**0.44**	**0.15**	**0.12**	**0.13**	**4.56**	**8.62**	100%	**I**	**14.41**	**18.47**	100%

Note(s): 1) Includes (0.37 quad) distillate fuel oil and (0.07 quad) residual fuel oil. 2) Kerosene (0.01 quad) and coal (0.07 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.11 quad) biomass, (0.02 quad) solar water heating, (less than 0.01 quad) solar PV, and (less than 0.01 quad) wind. 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.16. 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; 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 2011 Early Release, Dec. 2010, Table 32.

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						1.02	1.02	12.0%	I	3.20	3.20	17.4%
Space Heating	1.61	0.18		0.06	0.11	0.18	2.14	25.1%	I	0.55	2.52	13.7%
Space Cooling	0.04					0.58	0.62	7.3%	I	1.82	1.86	10.1%
Ventilation						0.51	0.51	6.0%	I	1.60	1.60	8.7%
Refrigeration						0.39	0.39	4.6%	I	1.23	1.23	6.7%
Electronics						0.26	0.26	3.1%	I	0.82	0.82	4.5%
Water Heating	0.46	0.02			0.03	0.09	0.59	6.9%	I	0.29	0.79	4.3%
Computers						0.21	0.21	2.5%	I	0.66	0.66	3.6%
Cooking	0.18					0.02	0.20	2.4%	I	0.07	0.25	1.4%
Other (5)	0.30	0.01	0.15	0.04	0.00	0.65	1.15	13.5%	I	2.03	2.53	13.8%
Adjust to SEDS (6)	0.58	0.15				0.69	1.42	16.7%	I	2.15	2.89	15.7%
Total	**3.11**	**0.36**	**0.15**	**0.11**	**0.14**	**4.60**	**8.54**	100%	**I**	**14.42**	**18.35**	100%

Note(s): 1) Includes (0.32 quad) distillate fuel oil and (0.04 quad) residual fuel oil. 2) Kerosene (0.01 quad) and coal (0.06 quad) are assumed attributable to space heating. Motor gasoline (0.04 quad) assumed attributable to other end-uses. 3) Comprised of (0.11 quad) biomass, (0.03 quad) solar water heating, (less than 0.01 quad) solar PV, and (less than 0.01 quad) wind. 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.13. 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

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						1.09	1.09	11.4%	I	3.33	3.33	16.5%
Space Heating	1.75	0.18		0.07	0.11	0.17	2.29	24.1%	I	0.52	2.64	13.1%
Ventilation						0.60	0.60	6.3%	I	1.83	1.83	9.0%
Space Cooling	0.04					0.54	0.58	6.1%	I	1.66	1.70	8.4%
Electronics						0.37	0.37	3.9%	I	1.12	1.12	5.5%
Refrigeration						0.36	0.36	3.7%	I	1.09	1.09	5.4%
Water Heating	0.55	0.02			0.03	0.09	0.69	7.3%	I	0.29	0.89	4.4%
Computers						0.19	0.19	2.0%	I	0.58	0.58	2.9%
Cooking	0.21					0.02	0.23	2.5%	I	0.07	0.28	1.4%
Other (5)	0.39	0.01	0.15	0.05	0.01	0.97	1.58	16.6%	I	2.96	3.57	17.7%
Adjust to SEDS (6)	0.63	0.11				0.80	1.54	16.2%	I	2.44	3.18	15.7%
Total	**3.57**	**0.33**	**0.15**	**0.12**	**0.15**	**5.20**	**9.51**	100%	**I**	**15.90**	**20.22**	100%

Note(s): 1) Includes (0.27 quad) distillate fuel oil and (0. quad) residual fuel oil. 2) Kerosene (0.01 quad) and coal (0.06 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.11 quad) biomass, (0.03 quad) solar water heating, (0.01 quad) solar PV, and (less than 0.01 quad) wind. 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.06. 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

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						1.20	1.20	11.4%	3.63	3.63	16.0%
Space Heating	1.76	0.17		0.07	0.11	0.18	2.29	21.8%	0.53	2.65	11.7%
Ventilation						0.68	0.68	6.5%	2.06	2.06	9.1%
Space Cooling	0.04					0.59	0.62	5.9%	1.78	1.82	8.0%
Electronics						0.44	0.44	4.2%	1.34	1.34	5.9%
Refrigeration						0.37	0.37	3.6%	1.13	1.13	5.0%
Water Heating	0.61	0.02			0.03	0.10	0.75	7.2%	0.29	0.95	4.2%
Computers						0.21	0.21	2.0%	0.62	0.62	2.7%
Cooking	0.23					0.02	0.26	2.4%	0.07	0.30	1.3%
Other (5)	0.63	0.02	0.15	0.05	0.01	1.36	2.21	21.0%	4.12	4.97	21.8%
Adjust to SEDS (6)	0.49	0.11				0.88	1.48	14.1%	2.67	3.27	14.4%
Total	**3.76**	**0.32**	**0.15**	**0.12**	**0.15**	**6.01**	**10.51**	100%	**18.25**	**22.75**	100%

Note(s): 1) Includes (0.25 quad) distillate fuel oil and (0.07 quad) residual fuel oil. 2) Kerosene (0.01 quad) and coal (0.06 quad) are assumed attributable to space heating. Motor gasoline (0.05 quad) assumed attributable to other end-uses. 3) Comprised of (0.11 quad) biomass, (0.03 quad) solar water heating, (0.01 quad) solar PV, and (less than 0.01 quad) wind. 4) Site-to-source electricity conversion (due to generation and transmission losses) = 3.04. 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Tables A2, p. 3-5, Table A5, p. 11-12, and Table A17, p. 34-35; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

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)

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

Note(s): 1) See Table 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
1985	**14%**	40%	18%	3%		**19%**	46%	3%	17.84
1990	**14%**	43%	17%	3%		**19%**	49%	3%	19.75
1995	**14%**	42%	19%	3%		**20%**	49%	3%	22.83
2000	**14%**	40%	22%	3%		**21%**	47%	3%	23.80
2005	**14%**	35%	27%	3%		**23%**	42%	3%	22.63
2008(1)	**13%**	**34%**	**29%**	**3%**		**24%**	**42%**	**3%**	**23.85**
2010	**13%**	33%	31%	3%		**24%**	41%	3%	24.52
2015	**13%**	37%	27%	3%		**24%**	45%	3%	25.53
2020	**14%**	37%	27%	3%		**24%**	44%	3%	25.81
2025	**14%**	37%	26%	3%		**25%**	44%	3%	25.61
2030	**14%**	36%	28%	3%		**26%**	43%	3%	26.37
2035	**14%**	35%	29%	3%		**27%**	41%	3%	27.15

Note(s): 1) Commercial buildings accounted for 15% (or $38.6 billion) of total U.S. natural gas expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2030 consumption, Table A3, p. 4-6 for 2008 expenditures.

3.1.15 Commercial Buildings Share of U.S. Petroleum Consumption (Percent)

	Site Consumption					Primary Consumption			U.S. Petroleum Total
	Commercial	Industry	Electric Gen.	Transportation		**Commercial**	Industry	Transportation	(quads)
1980	**4%**	28%	8%	56%		**6%**	31%	56%	34.2
1985	**3%**	25%	4%	63%		**5%**	26%	63%	30.9
1990	**3%**	25%	4%	64%		**4%**	26%	64%	33.6
1995	**2%**	25%	2%	67%		**3%**	26%	67%	34.6
2000	**2%**	24%	3%	67%		**3%**	25%	67%	38.4
2005	**2%**	24%	3%	68%		**3%**	25%	68%	40.7
2008	**2%**	**22%**	**1%**	**71%**		**2%**	**23%**	**72%**	**37.6**
2010	**2%**	22%	1%	72%		**2%**	22%	72%	37.0
2015	**1%**	24%	1%	71%		**2%**	24%	71%	39.1
2020	**1%**	23%	1%	72%		**2%**	24%	72%	39.4
2025	**1%**	23%	1%	72%		**2%**	23%	72%	39.9
2030	**1%**	22%	1%	73%		**2%**	22%	73%	40.6
2035	**1%**	22%	1%	74%		**2%**	22%	74%	41.8

Note(s): 1) Commercial buildings accounted for an estimated 1.6% (or $14.9 billion) of total U.S. petroleum expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, June 2010, Tables 8-12, p. 24-28 for 1980-2008; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2009-2035 consumption; and EIA, State Energy Data 2008: Price and Expenditure, June 2010, Tables 2-6 for 2008 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)
2008 (4)	**78.8**	**15%**	N.A.
2010 (4)	81.2	26%	N.A.
2015 (4)	85.5	35%	N.A.
2020 (4)	91.5	45%	N.A.
2025 (4)	97.4	54%	N.A.
2030 (4)	103.5	62%	N.A.
2035 (4)	109.8	70%	

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, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A5, p. 11-12 for 2008-2035 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		Ownership	
One	40%	**Nongovernment Owned**	**76%**
Two	25%	Owner-Occupied	36%
Three	12%	Nonowner-Occupied	37%
Four to Nine	16%	Unoccupied	3%
Ten or More	8%	**Government Owned**	**24%**
Total	100%	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 (1)	74	14%
200,001 to 500,000 (1)	26	10%
Over 500,000 (1)	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)
Assembly	55	40	75
Education	62	45	86
Food Sales	55	41	74
Food Service	50	35	71
Health Care	55	42	73
Large Office	65	46	92
Mercantile & Service	50	36	69
Small Office	58	41	82
Warehouse	58	41	82
Lodging	53	38	74
Other	60	44	81

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 2010, April 2010, Table 5.2, 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 ($2009 per Million Btu)

	Electricity	Natural Gas	Petroleum (1)	Average
1980	36.92	7.64	12.96	17.12
1985	37.98	9.52	11.58	19.76
1990	32.23	7.15	9.24	17.23
1995	30.01	6.65	6.98	16.23
2000	26.65	8.12	10.35	16.38
2005	27.89	12.05	15.02	19.40
2008 (2)	**30.74**	**12.03**	**23.58**	**22.72**
2010	28.49	9.04	18.13	20.39
2015	27.01	8.59	19.78	19.37
2020	26.62	9.05	22.42	19.63
2025	26.70	9.84	24.08	20.25
2030	26.59	10.41	24.96	20.60
2035	27.03	11.10	25.41	21.24

Note(s): 1) Commercial petroleum products include distillate fuel, LPG, kerosene, motor gasoline, and residual fuel. 2) In 2008, buildings average electricity price was $30.23/10^6 Btu or ($0.10/kWh), average natural gas price was $12.11/10^6 Btu ($12.47/1000 CF), and petroleum was $19.65/10^6 Btu ($1.94/gal.). Averages do not include wood or coal prices.

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, Tables 2-3, p. 24-25 for 1980-2008 and prices for note, Tables 8-9, p. 24-25 for 1980-2007 consumption; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8, Table A12, p. 25-26, and Table A13, p. 27-28 for 2009-2035 consumption and prices; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

3.3.2 Commercial Energy Prices, by Year and Fuel Type ($2009)

	Electricity (cents/kWh)	Natural Gas (cents/therm)	Distillate Oil ($/gal)	Residual Oil ($/gal)
1980	12.60	76.39	1.42	2.04
1985	12.96	95.19	1.20	1.55
1990	11.00	71.46	0.78	1.25
1995	10.24	66.45	0.63	0.87
2000	9.09	81.20	0.83	1.27
2005	9.51	120.48	1.23	2.06
2008	**10.49**	**120.29**	**2.00**	**3.32**
2010	9.72	90.41	2.07	2.51
2015	9.22	85.88	1.98	2.65
2020	9.08	90.46	2.27	3.08
2025	9.11	98.41	2.55	3.31
2030	9.07	104.08	2.65	3.44
2035	9.22	111.04	2.72	3.51

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, p. Tables 2-3, p. 24-25 for 1980-2008; EIA, Annual Energy Outlook 2010, May 2010, Table G1, p. 221 for fuels' heat content; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A3, p. 6-8 for 2009-2035; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

3.3.3 Commercial Buildings Aggregate Energy Expenditures, by Year and Major Fuel Type ($2009 Billion) (1)

	Electricity	Natural Gas	Petroleum (2)	Total
1980	70.4	20.4	17.0	107.8
1985	89.3	23.8	12.5	125.6
1990	92.2	19.3	9.1	120.6
1995	97.6	20.7	5.3	123.6
2000	105.4	26.4	8.3	140.1
2005	121.3	37.1	11.3	169.8
2008	**140.1**	**38.7**	**15.1**	**193.9**
2010	131.2	28.7	10.1	170.0
2015	130.3	29.6	10.8	170.7
2020	138.4	32.3	12.0	182.7
2025	148.9	35.9	12.8	197.6
2030	159.7	39.2	13.2	212.1
2035	173.9	43.3	13.5	230.6

Note(s): 1) Expenditures exclude wood and coal. 2008 U.S. energy expenditures were 1.51 trillion. 2) Commercial petroleum products include distillate fuel oil, LPG, kerosene, motor gasoline, and residual fuel.

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, Tables 2-3, p. 24-25 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A3, p. 6-8 for 2008-2035; and EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators.

3.3.4 2008 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								38.6	38.6	20.1%
Space Heating	18.7	3.3	1.2		0.1	4.6	0.2	8.6	32.1	16.7%
Space Cooling	0.4							23.5	23.9	12.4%
Ventilation								16.2	16.2	8.4%
Refrigeration								12.3	12.3	6.4%
Water Heating	5.2	0.4				0.4		2.9	8.5	4.4%
Electronics								7.2	7.2	3.8%
Computers								6.8	6.8	3.5%
Cooking	2.0							0.7	2.7	1.4%
Other (4)	3.4	0.3		4.0	1.2	5.5		18.0	26.9	14.0%
Adjust to SEDS (5)	8.8	4.0				4.0		4.2	17.0	8.8%
Total	**38.6**	**8.0**	**1.2**	**4.0**	**1.3**	**14.5**	**0.2**	**139.0**	**192.3**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.1 billion) and motor gasoline other uses ($1.2 billion). 3) Coal average price is from AEO 2011 Early Release, 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, and Table A5, p. 11-12 for energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 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 2011 Early Release, Dec. 2010, Table 32.

3.3.5 2010 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								29.1	29.1	17.1%
Space Heating	14.6	2.5	0.6		0.1	3.2	0.1	5.0	22.9	13.5%
Space Cooling	0.4							16.5	16.9	10.0%
Ventilation								14.6	14.6	8.6%
Refrigeration								11.2	11.2	6.6%
Electronics								7.5	7.5	4.4%
Water Heating	4.1	0.3				0.3		2.6	7.1	4.2%
Computers								6.0	6.0	3.5%
Cooking	1.6							0.7	2.3	1.3%
Other (4)	2.7	0.2		2.6	1.0	3.8		18.4	25.0	14.7%
Adjust to SEDS (5)	5.3	2.8				2.8		19.6	27.6	16.2%
Total	**28.7**	**5.8**	**0.6**	**2.6**	**1.0**	**10.0**	**0.1**	**131.2**	**170.1**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.1 billion) and motor gasoline other uses ($1.0 billion). 3) Coal average price is from AEO 2011 Early Release, 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, and Table A5, p. 11-12 for energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators; and EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

3.3.6 2020 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								29.0	29.0	15.9%
Space Heating	15.9	2.7	1.0		0.2	3.9	0.2	4.5	24.4	13.4%
Electronics								9.8	9.8	5.3%
Space Cooling	0.3							14.4	14.8	8.1%
Water Heating	5.0	0.4				0.4		2.5	7.9	4.3%
Computers								5.1	5.1	2.8%
Refrigeration								9.5	9.5	5.2%
Ventilation								15.9	15.9	8.7%
Cooking	1.9							0.6	2.5	1.4%
Other (4)	3.5	0.3		3.6	1.3	5.2		25.8	34.5	18.9%
Adjust to SEDS (5)	5.7	2.6				2.6		21.2	29.5	16.1%
Total	**32.3**	**5.9**	**1.0**	**3.6**	**1.5**	**12.0**	**0.2**	**138.4**	**182.8**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.2 billion) and motor gasoline other uses ($1.3 billion). 3) Coal average price is from AEO 2011 Early Release, 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, and Table A5, p. 11-12 for energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators; and EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

3.3.7 2030 Commercial Energy End-Use Expenditure Splits, by Fuel Type ($2009 Billion) (1)

	Natural	Petroleum								
	Gas	Distil.	Resid.	LPG	Oth(2)	Total	Coal (3)	Electricity	Total	Percent
Lighting								31.8	31.8	15.0%
Space Heating	18.3	2.7	1.2		0.2	4.1	0.2	4.7	27.3	12.9%
Water Heating	6.4	0.4				0.4		18.0	24.9	11.7%
Space Cooling	0.4							15.6	16.0	7.5%
Electronics								11.7	11.7	5.5%
Refrigeration								9.9	9.9	4.7%
Computers								5.5	5.5	2.6%
Cooking	2.4							0.6	3.1	1.4%
Ventilation								2.5	2.5	1.2%
Other (4)	6.5	0.4		4.1	1.5	5.9		36.0	48.4	22.8%
Adjust to SEDS (5)	5.1	2.8				2.8		23.4	31.2	14.7%
Total	**39.2**	**6.2**	**1.2**	**4.1**	**1.7**	**13.2**	**0.2**	**159.7**	**212.3**	100%

Note(s): 1) Expenditures include coal and exclude wood. 2) Includes kerosene space heating ($0.2 billion) and motor gasoline other uses ($1.5 billion). 3) Coal average price is from AEO 2011 Early Release, 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A3, p. 6-8 for prices, and Table A5, p. 11-12 for energy consumption; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators; and EIA, Supplement to the AEO 2011 Early Release, Dec. 2010, Table 32.

3.3.8 Average Annual Energy Expenditures per Square Foot of Commercial Floorspace, by Year ($2009)

Year	($/SF) (2)
1980(1)	2.11
1985	2.05
1990	1.85
1995	1.98
2000	1.93
2005	2.15
2008	**2.51**
2010	2.16
2015	2.06
2020	2.06
2025	2.10
2030	2.12
2035	2.17

Note(s): 1) End of year 1979. 2) Square footage estimated for years in gray.

Source(s): EIA, State Energy Data 2008: Prices and Expenditures, June 2010, Table 3, p. 25 for 1980-2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 and Table A5, p. 11-12 for consumption, Table A3, p. 6-8 for prices for 2008-2030; EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators. 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

	Per Square Foot ($2009)	Per Building ($2009 thousand)		Per Square Foot ($2009)	Per Building ($2009 thousand)
Food Service	4.84	26.9	Mercantile	2.22	37.8
Food Sales	4.64	25.8	Education	1.42	36.3
Health Care	2.74	67.4	Service	1.38	9.0
Public Order and Safety	2.05	31.7	Warehouse and Storage	0.79	13.4
Office	1.99	29.5	Religious Worship	0.76	7.7
Public Assembly	1.71	24.4	Vacant	0.34	4.8
Lodging	1.70	61.0	Other	2.96	65.0

Note(s): 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, August 2010, Appendix D, p. 383 for price deflators.

3.3.10 2003 Energy Expenditures per Square Foot of Commercial Floorspace, by Vintage ($2009)

Vintage	($/SF)
Prior to 1960	1.43
1960 to 1969	1.69
1970 to 1979	1.86
1980 to 1989	2.07
1990 to 1999	1.87
2000 to 2003	1.71
Average	**1.76**

Source(s): EIA, 2003 Commercial Buildings Energy Consumption and Expenditures: Consumption and Expenditures Tables, Table C4; and EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators.

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	1,876	2,186
2001	-	-
2002	-	-
2003	-	-
2004	2,447	2,507
2005	2,949	3,004
2006	3,579	3,627
2007	-	-
2008	4,087	4,171

2008 Revenue Sources

Market Segment	Share
MUSH (2)	69%
Federal	15%
Commercial & Industrial	7%
Residential	6%
Public Housing	3%

2008 Revenues by Project/Technology Type

Market Segment	Share
Energy Efficiency	75%
Onsite Renewables	14%
Engine/Turbine Generators	6%
Consulting/Master Planning	3%
Other	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; LBNL, A Survey of the U.S. ESCO Industry: Market Growth and Development from 2000 to 2006, LBNL-62679, May 2007 for 2004-2006; and LBNL, A Survey of the U.S. ESCO Industry: Market Growth and Development from 2008 to 2011, LBNL-3479E, June 2010 for 2008.

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 2008-Year	Total	Growth Rate 2008-Year	Com.% of Total U.S.	Com.% of Total Global
1980	245	409	653	-	4,723	-	14%	3.5%
1985	217	477	695	-	4,559	-	15%	3.6%
1990	224	561	785	-	5,020	-	16%	3.6%
1995	229	616	845	-	5,302	-	16%	3.8%
2000	236	777	1,013	-	5,850	-	17%	4.3%
2005	225	835	1,060	-	5,974	-	18%	3.7%
2008 (2)	**223**	**844**	**1,067**	-	**5,820**	-	**18%**	**(3) 3.5%**
2010	213	827	1,041	0.3%	5,639	-2.2%	18%	3.4%
2015	227	795	1,022	-0.2%	5,679	-0.5%	18%	3.2%
2020	233	851	1,085	0.4%	5,774	-0.2%	19%	3.2%
2025	237	933	1,170	0.7%	5,931	0.0%	20%	3.2%
2030	243	1,005	1,248	0.9%	6,110	0.2%	20%	3.2%
2035	250	1,070	1,320	0.9%	6,315	0.3%	21%	3.1%

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 2010 and differs from EIA, AEO 2011 Early Release, Table A18. Commercial sector total varies by 0.1% from EIA, AEO 2011 Early Release. 3) U.S. commercial buildings emissions approximately equal the combined carbon emissions of Canada and Mexico.

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. 2008, Dec. 2009, Tables 7-11, p. 20-24 for 1990-2007; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for 2008-2035 energy consumption and Table A18, p. 36 for 2008-2035 emissions; EIA, International Energy Outlook 2010, July 2010, Table A10, p. 155 for 2004-2030 global emissions; and EIA, Country Energy Profiles for global emissions (1980-2007), available at http://www.eia.gov/country/index.cfm, accessed 2/3/2011.

3.4.2 2008 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								259.7	259.7	24.3%
Space Heating	82.8	11.1	5.8		0.3	17.2	6.9	52.2	159.2	14.9%
Space Cooling	1.8							142.7	144.4	13.5%
Ventilation								98.3	98.3	9.2%
Refrigeration								74.9	74.9	7.0%
Electronics								44.0	44.0	4.1%
Water Heating	23.2	1.4				1.4		17.4	42.0	3.9%
Computers								41.0	41.0	3.8%
Cooking	8.8							4.3	13.1	1.2%
Other (4)	15.3	1.0		9.3	3.2	13.6		109.1	137.9	12.9%
Adjust to SEDS (5)	38.9	13.5				13.5		0.0	52.4	4.9%
Total	**170.8**	**27.0**	**5.8**	**9.3**	**3.6**	**45.6**	**6.9**	**843.7**	**1,067.0**	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 2010 and differs from EIA, AEO 2011 Early Release, Table A18. Commercial sector total varies by 0.1% from EIA, AEO 2008. 2) Includes kerosene space heating (0.3 MMT) and motor gasoline other uses (3.2 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients; BTS/A.D. Little, Electricity Consumption by Small End-Uses in Residential Buildings, Aug. 1998, Appendix A for residential electric end-uses; BTS/A.D. Little, Energy Consumption Characteristics of Commercial Building HVAC Systems, Volume II: Thermal Distribution, Auxiliary Equipment, and Ventilation, Oct. 1999, p. 1-2; BTP/Navigant Consulting, U.S. Lighting Market Characterization, Volume I, Sept. 2002, Table 8-2, p.63; and EIA, AEO 1999, Dec. 1998, Table A4, p. 118-119 and Table A5, p. 120-121 for 1996 data.

3.4.3 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								183.6	183.6	17.7%
Space Heating	85.6	10.1	3.2		0.3	13.7	5.6	31.5	136.4	13.1%
Space Cooling	2.3							104.2	106.6	10.2%
Ventilation								91.7	91.7	8.8%
Refrigeration								70.3	70.3	6.8%
Electronics								47.0	47.0	4.5%
Water Heating	24.2	1.3				1.3		16.5	42.0	4.0%
Computers								38.0	38.0	3.7%
Cooking	9.5							4.2	13.7	1.3%
Other (4)	16.0	0.9		9.2	3.1	13.2		116.1	145.3	14.0%
Adjust to SEDS (5)	31.0	11.0				11.0		123.5	165.6	15.9%
Total	**168.7**	**23.4**	**3.2**	**9.2**	**3.4**	**39.2**	**5.6**	**826.8**	**1,040.2**	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 (0.3 MMT) and motor gasoline other uses (3.1 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; and EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon 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								178.4	178.4	16.4%
Space Heating	93.0	8.8	5.1		0.7	14.5	5.9	27.9	141.3	13.0%
Ventilation								98.0	98.0	9.0%
Space Cooling	1.9							88.9	90.8	8.4%
Electronics								60.1	60.1	5.5%
Refrigeration								58.3	58.3	5.4%
Computers								31.3	31.3	2.9%
Water Heating	29.3	1.3				1.3		15.4	46.0	4.2%
Cooking	11.2							3.8	15.0	1.4%
Other (4)	20.7	1.0		9.4	3.3	13.7		158.7	193.1	17.8%
Adjust to SEDS (5)	33.2	8.4				8.4		130.7	172.3	15.9%
Total	**189.5**	**19.4**	**5.1**	**9.4**	**3.9**	**37.8**	**5.9**	**851.6**	**1,084.7**	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. 2) Includes kerosene space heating (0.7 MMT) and motor gasoline other uses (3.3 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; and EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients.

3.4.5 2030 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								200.2	200.2	16.0%
Space Heating	93.5	7.8	5.3		0.7	13.7	5.9	29.4	142.5	11.4%
Ventilation								113.5	113.5	9.1%
Space Cooling	1.9							98.1	99.9	8.0%
Electronics								73.7	73.7	5.9%
Refrigeration								62.4	62.4	5.0%
Water Heating	32.5	1.3				1.3		15.9	49.7	4.0%
Computers								34.4	34.4	2.8%
Cooking	12.4							3.9	16.3	1.3%
Other (4)	33.2	1.0		9.7	3.4	14.2		226.8	274.2	22.0%
Adjust to SEDS (5)	26.1	8.1				8.1		146.9	181.1	14.5%
Total	**199.6**	**18.2**	**5.3**	**9.7**	**4.1**	**37.3**	**5.9**	**1,005.1**	**1,247.8**	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 (0.7 MMT) and motor gasoline other uses (3.4 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 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5, Table A4, p. 9-10 and Table A5, p. 11-12 for energy consumption, and Table A18, p. 36 for emissions; EIA, National Energy Modeling System (NEMS) for AEO 2011 Early Release, Dec. 2010; and EIA, Assumptions to the Annual Energy Outlook 2010, May 2010, Table 1.2, p. 12 for carbon coefficients.

3.4.6 2008 Methane Emissions for U.S. Commercial Buildings Energy Production, by Fuel Type (1)

Fuel Type	MMT CO2 Equivalent
Petroleum	0.6
Natural Gas	24.4
Coal	0.3
Wood	0.4
Electricity (2)	41.7
Total	**67.4**

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. 2008, Dec. 2009, Table 17, p. 30 for energy production emissions; EPA, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008, April 2010, Table 3-10, p. 3-9 for stationary combustion emissions; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Summary Reference Case Tables, Table A2, p. 3-5 for energy consumption.

3.5.1 Value of New Commercial Building Construction, by Year ($2009 Billion)

	Value of New Construction Put in Place	U.S. GDP	Comm. Bldgs Percent of Total U.S. GDP
1980	158.5	6,409	2.5%
1985	224.5	7,518	3.0%
1990	225.4	8,819	2.6%
1995	202.2	9,982	2.0%
2000	310.2	12,323	2.5%
2005	299.7	13,873	2.2%
2006	332.0	14,244	2.3%
2007	380.5	14,549	2.6%
2008	396.9	14,613	2.7%
2009	327.5	14,256	2.3%

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 1995-2000; DOC, Annual Value of Private Construction Put in Place, August 2010 for 2002-2009; DOC, Annual Value of Public Construction Put in Place, August 2008 for 1995-2000; DOC, Annual Value of Public Construction Put in Place, August 2010 for 2002-2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

3.5.2 Value of Building Improvements and Repairs, by Sector ($2009 Billion) (1)

	Improvements	Maintenance and Repairs	Total	Percent of GDP
1980	N.A.	N.A.	N.A.	N.A.
1985	88.1	51.0	139.1 (2)	2.0%
1990	88.2	53.0	141.2 (3)	1.8%
1995	112.6	37.1	149.7	1.6%
2000	151.6	46.8	198.4	1.8%
2003	126.9	39.1	166.0	1.4%
2004	128.2	39.5	167.7	1.4%
2005	134.3	41.4	175.8	1.4%
2006	141.4	43.6	196.6	1.5%
2007	181.3	55.9	237.3	1.8%
2008	196.0	60.5	256.5	1.9%
2009	164.4	50.7	215.1	1.7%

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 1995-2000; DOC, Annual Value of Private Construction Put in Place, March 2011 for 2003-2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for GDP and price deflators.

3.6.1 2009 Energy Consumption per Square Foot of Office Floorspace by Vintage (Thousand Btu/SF) (1)

Vintage	Energy Intensity
2000-2009	81.4
1990-1999	74.1
1980-1989	73.1
1970-1979	102.8
1960-1969	71.4
Pre-1959	75.5

Buildings providing consumption data: 436

Note(s): 1) Commercial office buildings sampled include the following: Class A, B, C.

Source(s): BOMA International, Experience Exchange Report 2010, 2010.

3.6.2 Energy Expenditures per Square Foot of Office Floorspace by Building Age ($2009) (1)

Age (years)	2009	Number of Responses	2006	Number of Responses	2004	Number of Responses
0-9	**2.1**	451	2.1	483	1.8	564
10-19	**1.9**	582	2.3	503	2.0	848
20-29	**2.1**	1,161	2.4	939	2.0	786
30-39	**2.4**	416	2.7	314	2.3	290
40-49	**2.5**	150	3.0	68	2.9	57
50+	**2.5**	187	2.5	128	2.1	164
All Buildings	**2.2**	3,494	**2.4**	2,619	**1.8**	2,939

Note(s): 1) Energy includes electric, gas, fuel oil, purchased steam, purchased chilled water, and water/sewage expenditures. BOMA cautions that any data based on fewer than 25 responses may not be a reliable estimate.

Source(s): BOMA International, The Experience Exchange Report 2010, 2010; BOMA International, The Experience Exchange Report 2007, August 2007; BOMA International, The Experience Exchange Report 2005, August 2005; and EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators.

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 ($2009/SF)	Energy Intensity (thousand Btu/SF)	Energy Expenditures ($2009/SF)
Medical Offices	90.79	2.54	N.A.	2.34
Financial Offices	N.A.	3.09	N.A.	3.29
Corporate Facilities(2)	96.78	2.72	89.38	2.70
Class A	81.88	2.42	78.84	2.06
Class B	74.87	2.29	N.A.	2.02
Class C	N.A.	2.42	N.A.	1.83
All Buildings	81.1	2.40	77.83	2.08

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; and EIA, Annual Energy Review 2007, August 2010, Appendix D, p. 383 for price deflators.

3.6.4 2009 Energy Consumption Expenditures by Selected City ($2009/SF) (1)

	Urban	Number of Responses	Suburban	Number of Responses
New York, NY	4.32	33	N.A.	N.A.
Los Angeles, CA	2.84	22	2.47	78
Chicago, IL	1.72	58	N.A.	N.A.
Houston, TX	2.16	27	2.29	149
Phoenix, AZ	2.23	13	1.81	42
Philadelphia, PA	2.81	14	2.87	33
San Antonio, TX	N.A.	N.A.	N.A.	15
San Diego, CA	2.67	14	1.69	75
Dallas, TX	2.27	23	2.19	131
San Jose, CA	N.A.	N.A.	1.88	76
San Francisco, CA	2.55	64	2.19	46
Miami, FL	N.A.	N.A.	2.77	29
Washington, DC	3.29	78	N.A.	N.A.
Seattle, WA	1.51	24	1.75	29
Boston, MA	3.19	32	2.99	47
National Average (2)	**2.33**		**2.08**	

Note(s): 1) Energy includes electric, gas, fuel oil, purchased steam, purchased chilled water, and water/sewage expenditures. "N/A" indicates that the sample size was not large enough to be assumed representative of a given city. BOMA cautions that any data based on fewer than 25 responses may not be a reliable estimate. 2) Averages based on 1,246 urban respondents and 2,942 suburban respondents across 92 US

Source(s): BOMA International, The Experience Exchange Report 2010, 2010.

3.6.5 Top 10 Office Building Owners Globally as of Year End, 2009 (million SF)

Owner	Floorspace Owned
1. RREEF Americas	80.7
2. The Blackstone Group	68.0
3. Brookfield Properties Corp.	61.5
4. Vornado Realty Trust	60.0
5. Hines	58.8
6. CB Richard Ellis Investors	58.3
7. TIAA-CREF	46.4
8. LaSalleInvestment Management	41.4
9. Duke Realty Corp.	38.1
10. Boston Properties	35.4
Total for Top 10:	**548.6**

Source(s): National Real Estate Investor, The 2010 Best of The Best Rankings: 2010 Top 25 Office Owners, June 1, 2010.
http://nreionline.com/research/2010_top_real_estate_top_office_owners/

3.6.6 Top 10 Property Managers Globally as of Year End, 2009 (million SF)

Managing Company	Floorspace Managed
1. CB Richard Ellis Group	2,500
2. Colliers International	1,650
3. Jones Lang LaSalle	1,600
4. Cushman & Wakefield	593
5. ProLogis	479
6. Cassidy Turley	420
7. Grubb & Ellis Co.	305
8. Lincoln Property Co.	272
9. NAI Global	265
10. Simon Property Group	259
Total for Top 10:	**8,343**

Source(s): National Real Estate Investor, The 2010 Best of The Best Rankings: 2010 Top 25 Property Managers, June 1, 2010.
http://nreionline.com/research/2010_top_real_estate_top_property_managers/

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	Packaged Single-Zone
	VAV w/ Economizer	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

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 (1)
Miami	1A	0.2	18.7	0.2	2.8
Houston	2A	3.2	15.2	0.3	2.5
Phoenix	2B	2.2	13.9	0.3	2.9
Atlanta	3A	3.1	11.1	0.4	2.1
Los Angeles	3B	0.5	8.6	0.4	1.9
Las Vegas	3B	1.4	8.4	0.3	2.2
San Francisco	3C	4.2	5.0	0.4	1.7
Baltimore	4A	6.2	9.8	0.4	2.1
Albuquerque	4B	3.0	5.4	0.4	1.9
Seattle	4C	5.7	3.8	0.4	1.5
Chicago	5A	9.5	6.4	0.5	1.7
Boulder	5B	5.4	4.1	0.5	1.7
Minneapolis	6A	14.4	5.8	0.5	1.7
Helena	6B	10.0	3.1	0.5	1.5
Duluth	7	17.6	3.3	0.6	1.6
Fairbanks	8	31.7	1.7	0.6	1.3

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 498,588 square feet and 12 floors. Benchmark interior lighting energy = 10.7 thousand Btu/SF. Interior equipment energy consumption = 15.94 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

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 (1)
Miami	1A	0.3	14.9	0.4	1.5
Houston	2A	3.2	11.8	0.5	1.3
Phoenix	2B	2.6	12.8	0.4	1.6
Atlanta	3A	4.5	7.5	0.5	1.2
Los Angeles	3B	0.9	4.8	0.5	1.0
Las Vegas	3B	2.4	9.3	0.5	1.4
San Francisco	3C	5.2	2.5	0.6	1.1
Baltimore	4A	8.5	6.5	0.6	1.2
Albuquerque	4B	4.7	5.3	0.6	1.4
Seattle	4C	7.8	2.0	0.6	1.1
Chicago	5A	12.0	4.4	0.6	1.2
Boulder	5B	7.5	3.6	0.6	1.3
Minneapolis	6A	17.7	3.9	0.7	1.2
Helena	6B	13.3	2.4	0.7	1.2
Duluth	7	21.0	2.0	0.7	1.3
Fairbanks	8	38.6	0.9	0.8	1.1

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 53,628 square feet and 3 floors. Benchmark interior lighting energy = 10.7 thousand Btu/SF. Interior equipment energy consumption = 18.85 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

3.7.1 2009 Top Retail Companies, by Sales

Chain	2009 Revenues ($billion)	% Change over 2008 Revenues	# Stores 2009	% Change over 2008 Stores
Wal-Mart Stores, Inc.	405.0	1.0%	8,416	7.0%
The Kroger Co.	76.7	0.8%	3,619	1.9%
Costco	69.9	-1.5%	566	10.5%
The Home Depot	66.2	-7.2%	2,244	-1.3%
Target Corp.	65.4	0.6%	1,740	3.4%
Walgreen Co.	63.3	7.3%	7,496	8.1%
CVS Caremark	55.4	13.0%	7,025	1.5%
Best Buy	49.7	10.4%	4,027	2.2%
Lowes Cos.	47.2	-2.1%	1,710	3.7%
Sears Holdings	44.0	-5.8%	3,921	0.1%

Source(s): Chain Store Age. Chain Store Age Top 100: The Nation's Largest Retailers, August/September, 2010.

3.7.2 2009 Top Chain Restaurants, by Sales

Chain	2009 Sales ($billion)	% Change over 2005 Sales	Franchised Stores	Company-owned Stores	Total Stores
McDonald's	31.0	3.2%	12,402	1,578	13,980
Subway (1)	10.0	4.2%	23,034	0	23,034
Burger King	9.0	-3.7%	6,333	917	7,250
Wendy's (1)	8.4	4.7%	4,622	1,255	5,877
Starbucks Coffee (1)	8.3	-4.6%	4,364	6,764	11,128
Taco Bell (2)	6.8	1.5%	4,308	1,296	5,604
Dunkin' Donuts (1)	5.7	3.6%	6,566	0	6,566
Pizza Hut (2)	5.0	-9.1%	6,917	649	7,566
KFC (2)	4.9	-5.8%	4,307	855	5,162
Sonic	3.8	0.7%	3,069	475	3,544

Note(s): 1) Includes figures estimated by Technomic, Inc. 2) Systemwide figure from franchised stores only.
Source(s): QSR Magazine, 2010 QSR 50 - December, 2010, Available at http://www.qsrmagazine.com/reports/2010-qsr-50.

3.7.3 2009 Top Supermarkets, by Sales

Supermarket	2009 All Commodity Volume ($millions)	No. of Stores (> $2 million in sales)	Square Feet Selling Area (thousands)
Wal-Mart Stores	154.2	2,906	179,999
Kroger Co.	62.6	2,470	105,777
Safeway, Inc.	35.0	1,486	54,399
Supervalu, Inc.	31.5	1,516	51,921
Ahold USA, Inc. (Stop and Shop, Giant)	24.1	708	29,772
Publix Super Markets, Inc.	21.6	1,012	37,353
Delhaize America, Inc. (Food Lion)	18.8	1,604	47,760
H.E. Butt Grocery Co. (HEB)	11.6	280	13,997
Great Atlantic & Pacific Tea Co. (Pathmark)	9.2	408	13,619
Meijer, Inc.	8.6	191	12,289

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): Progressive Grocer, Progressive Grocer Super 50, May 2010, Volume 89, Number 4, p. 15.

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

Shell	
Percent Glass	**0.4**
Window (U-Factor	**0.38-0.69**
SHGC	**0.40-0.44**
Wall R-Value (2)	**7.6-15.2 c.i.**
Roof R-Value	
Attic	**30-60**
Insulation Above Deck	**15-25 c.i.**
Lighting	
Average Power Density (W/ft.^2)	**1.3**
System and Plant	
Heating Plant	
Gas Furnace(>225 kBtuh)	**80% Combustion Efficiency**
Cooling Plant	
Air conditioner (>135-240 kBtuh)	**10.8 EER/11.2 IPLV - 11.0 EER/11.5 IPLV**
Service Hot Water	
Gas Storage Water Heater (>75kBtuh)	**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 due to climate zone dependencies. 2) Assumes a wall with heat content greaater than 7 Btu/ft^2.

Source(s): ASHRAE, Advanced Energy Design Guide for Small Retail Buildings, 2008.

3.7.5 Typical Mercantile & Service (Retail) Building (1)

	Retail (>= 25,000 SF)	Retail (<25,000 SF)
Stock Floor Area (billion SF)	5.878	6.528
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)	0.4	0.5
Full Equipment Hours (hrs/year)	4,750 - 5,850	3480
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	Packaged Single-Zone
	VAV w/ Economizer	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

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	Ventilation
Miami	1A	0.2	17.0	11.2
Houston	2A	8.1	11.9	10.7
Phoenix	2B	6.4	13.1	10.2
Atlanta	3A	15.3	5.8	9.6
Los Angeles	3B	4.3	1.8	8.0
Las Vegas	3B	11.0	7.5	7.8
San Francisco	3C	16.1	0.4	4.3
Baltimore	4A	28.4	4.3	9.1
Albuquerque	4B	20.2	3.5	8.5
Seattle	4C	28.8	0.6	7.0
Chicago	5A	39.8	2.9	8.9
Boulder	5B	29.7	2.0	8.4
Minneapolis	6A	52.3	2.4	9.0
Helena	6B	45.2	1.1	8.4
Duluth	7	68.9	0.6	5.6
Fairbanks	8	108.9	0.1	9.4

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 24,962 square feet and 1 floor. Benchmark interior lighting energy = 19.2 thousand Btu/SF. Interior equipment energy consumption = 7.63 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

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	7.9	0.4	11.2
Houston	2A	19.1	6.2	0.4	10.7
Phoenix	2B	19.7	8.2	0.4	10.2
Atlanta	3A	34.9	3.0	0.5	9.6
Los Angeles	3B	23.0	0.6	0.5	8.0
Las Vegas	3B	30.7	4.7	0.4	7.8
San Francisco	3C	43.6	0.2	0.5	4.3
Baltimore	4A	53.5	2.4	0.5	9.1
Albuquerque	4B	44.9	1.8	0.5	8.5
Seattle	4C	59.5	0.3	0.5	7.0
Chicago	5A	67.6	1.5	0.5	8.9
Boulder	5B	57.7	1.1	0.5	8.4
Minneapolis	6A	81.4	1.3	0.6	9.0
Helena	6B	74.1	0.7	0.6	8.4
Duluth	7	99.8	0.6	0.6	5.6
Fairbanks	8	145.6	0.3	0.6	9.4

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 45,000 square feet and 1 floor. Benchmark interior lighting energy = 19.7 thousand Btu/SF. Interior equipment energy consumption = 20.7 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

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(s): DOE/EERE/Navigant Consulting, Energy Savings Potential and R&D Opportunities for Commercial Refrigeration, Sept. 2009, Table 3-2, p. 27.

3.8.1 Medical Offices, Utilities Cost Per Square Foot ($2009)

Expense	Downtown	Suburban	All
HVAC Electricity	2.37	1.79	1.82
Non-HVAC Electricity	N/A	1.50	1.52
Natural Gas	0.52	0.41	0.41
Water/Sewer	0.15	0.22	0.21
Overall Utilities (1)	**2.51**	**2.57**	**2.55**

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 2010, 2010.

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	1.87	0.43	229.0
2003	1.91	0.48	249.3
2008	**2.15**	**0.45**	**210.1**
2010	2.24	0.48	213.7
2015	2.45	0.52	213.6
2020	2.66	0.57	212.4
2025	2.88	0.60	209.6
2030	3.09	0.64	207.3
2035			

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 2011 Early Release, Table 32, Dec. 2010.

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)	2.2	2.2
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

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 (1)
Miami	1A	40.6	67.5	1.8	17.4
Houston	2A	47.2	68.1	2.1	17.1
Phoenix	2B	42.5	62.3	1.9	17.4
Atlanta	3A	48.6	62.5	2.5	16.4
Los Angeles	3B	47.6	55.5	2.4	15.7
Las Vegas	3B	41.8	52.0	2.2	16.2
San Francisco	3C	56.6	51.5	2.7	16.1
Baltimore	4A	55.4	60.5	2.7	16.1
Albuquerque	4B	37.9	41.7	2.7	15.5
Seattle	4C	55.1	49.7	2.9	15.2
Chicago	5A	58.2	51.0	3.0	15.6
Boulder	5B	42.3	39.3	3.0	15.1
Minneapolis	6A	62.8	45.5	3.2	15.1
Helena	6B	50.8	36.6	3.2	14.7
Duluth	7	67.0	38.5	3.5	14.7
Fairbanks	8	89.1	25.2	3.9	13.5

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 241,351 square feet and 5 floors. Benchmark interior lighting energy = 16.36 thousand Btu/SF. Interior equipment energy consumption = 15.15 thousand Btu/SF. Ventilation includes energy used by fans and heat rejection systems.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>. Version 1.3_5.0, November 2010.

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	49.4	49.3	0.7	19.5
Houston	2A	58.9	41.4	0.8	19.4
Phoenix	2B	60.3	40.6	0.7	19.9
Atlanta	3A	66.0	31.9	0.9	19.3
Los Angeles	3B	63.8	26.4	0.9	18.3
Las Vegas	3B	57.7	32.1	0.8	19.6
San Francisco	3C	72.1	19.8	1.0	18.5
Baltimore	4A	72.1	27.4	1.0	19.0
Albuquerque	4B	63.5	23.7	1.0	21.7
Seattle	4C	74.7	17.7	1.0	18.5
Chicago	5A	75.3	21.3	1.1	18.8
Boulder	5B	65.9	19.3	1.1	21.0
Minneapolis	6A	81.3	19.0	1.1	18.9
Helena	6B	74.3	15.6	1.2	20.0
Duluth	7	84.2	13.2	1.3	18.7
Fairbanks	8	99.7	8.8	1.4	17.7

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 40,946 square feet and 3 floors. Benchmark interior lighting energy = 13.02 thousand Btu/SF. Interior equipment energy consumption = 46.01 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>. Version 1.3_5.0, November 2010.

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%	3.4
Other	39	5%	4.0
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 Number of Elementary and Secondary Schools in the United States, Enrollment, and Students per School, 2007-2008

	Number of Schools (thousands)	Enrollment (millions)	Average Students per School
Public Schools	98.9	49.9	505
Elementary	67.0		
Secondary	24.4		
Combined	6.2		
Other (1)	1.2		
Private Schools	33.7	5.9	175
Elementary	21.9		
Secondary	2.9		
Combined	8.9		

Note(s): 1) Includes special education, alternative, and other schools not classified by grade span.
Source(s): U.S. Department of Education/National Center for Educational Statistics (NCES), Digest of Education Statistics: 2009, April 2010, Table 2 for enrollment, Table 5 for number of educational institutions.

3.9.3 National Enrollment and Expenditures for Public K-12 Facilities ($2009)

School Year Beginning	Enrollment (millions)	Expenditures ($billion)	Expenditures per Pupil
1986	39.4	239.3	6,071
1990	41.2	327.6	7,946
1995	44.8	358.3	7,989
2000	47.2	431.7	9,147
2005	49.1	490.3	9,982
2010	50.0	527.4	10,540
2015	52.3	611.5	11,682
2018	53.9	665.1	12,331

Source(s): NCES, Projections of Educational Statistics to 2018, Sept. 2009, Table 34, p. 80 for 1995-2018; NCES, Projections of Educational Statistics to 2015, Sept. 2006, Table 34, p. 78 for 1990; NCES, Projections of Educational Statistics to 2011, Oct. 2001, Table 33, p. 88 for 1986; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

3.9.4 Total Expenditures for K-12 School Plant Operations and Maintenance, by Function ($2009 Billion)

	1990-91		1995-96		2000-01		2005-06		2006-07	
Salaries and Benefits	17.5	54%	18.3	53%	21.3	51%	24.0	49%	24.6	51%
Purchased Services	8.7	27%	10.4	30%	11.9	28%	13.1	27%	13.4	28%
Supplies	5.7	18%	5.7	16%	8.5	20%	11.1	23%	11.3	23%
Other	0.5	2%	0.3	1%	0.3	1%	0.4	1%	0.4	1%
Total	**32.4**	100%	**34.6**	100%	**42.1**	100%	**48.6**	100%	**49.8**	100%

Note(s): 1) Operation and maintenance services include salaries, benefits, supplies, and contractual fees for supervision of operations and maintenance, operating buildings (heating, lighting, ventilating, repair and replacement), care and upkeep of grounds and equipment, vehicle operation and maintenance (other than student transportation), security and other operations and maintenance services.

Source(s): NCES, Digest of Educational Statistics 2009, April 2010, Table 180, p. 258-259; EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

3.9.5 New Construction and Renovations Expenditures for Public K-12 Schools ($2009 Billion)

	New Schools	Additions	Renovations	Total
2000	11.63	7.59	6.98	26.20
2001	12.60	6.49	5.54	24.63
2002	14.79	6.26	4.72	25.77
2003	13.12	5.90	4.26	23.29
2004	13.87	4.87	4.17	22.90
2005	14.05	5.44	4.26	23.74
2006	13.60	5.26	4.12	22.99
2007	13.23	5.12	4.01	22.35
2008	13.12	3.28	3.34	19.73
2009	11.94	2.12	2.32	16.38

Note(s): Data includes public school districts only and is presented in calendar years, rather than school years.

Source(s): School Planning & Management, 6th Annual School Construction Report, February 2001 Table 1, p. 28 for 2000; School Planning & Management, 2002 Construction Report, February 2002 Table 1, p. 3 for 2001; School Planning & Management, 2003 Construction Report, February 2003 Table 1, p. 3 for 2002; School Planning & Management, 9th Annual Construction Report, February 2004, Table 1, p. 3 for 2003; School Planning & Management, 10th Annual School Construction Report, February 2005, Table 1, p. C3 for 2004; School Planning & Management, 11th Annual Construction Report, February 2006, Table 1, p. C3 for 2005; School Planning & Management, The 2007 Construction Report, February 2007, Table 1, p. C3 for 2006; School Planning & Management, The 2008 Annual School Construction Report, February 2008, Table 1, p. CR3 for 2007; School Planning & Management, The 2009 Annual School Construction Report, February 2009, Table 1, p. CR3 for 2008; School Planning & Management, 15th Annual School Construction Report, February 2010, Table 1, p. CR3 for 2009; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

3.9.6 2009 Regional New Construction and Renovations Expenditures for Public K-12 Schools ($Million)

Region	New Schools	Additions	Renovation	Total
Region 1 (CT, MA, ME, NH, RI, VT)	498.4	133.2	87.2	**718.8**
Region 2 (NJ, NY, PA)	783.9	335.0	687.4	**1,806.4**
Region 3 (DE, MD, VA, WV)	636.8	221.0	252.8	**1,110.6**
Region 4 (KY, NC, SC, TN)	1,424.6	138.5	90.6	**1,653.7**
Region 5 (AL, FL, GA, MS)	1,943.5	550.6	173.8	**2,667.8**
Region 6 (IN, MI, OH)	1,009.1	108.1	203.1	**1,320.3**
Region 7 (IL, MN, WI)	661.4	71.8	99.0	**832.3**
Region 8 (IA, KS, MO, NE)	421.0	137.8	96.6	**655.4**
Region 9 (AR, LA, OK, TX)	1,688.0	264.7	337.9	**2,290.6**
Region 10 (CO, MT, ND, NM, SD, UT, WY)	707.8	70.3	71.8	**849.9**
Region 11 (AZ, CA, HI, NV)	1,490.7	41.4	68.3	**1,600.4**
Region 12 (AK, ID, OR, WA)	678.5	46.5	152.7	**877.7**
Total	**11,943.8**	**2,118.9**	**2,321.2**	**16,384.0**

Source(s): School Planning & Management, 15th Annual School Construction Report, February 2010, p. CR3

3.9.7 Percentage of Public K-12 Schools with Environmental Factors that Interfere with Classroom Instruction (1)

	Permanent Buildings (2)			Temporary Buildings (3)		
	Small	Medium	Large	Small	Medium	Large
Lighting, artificial	5%	6%	6%	11%	3%	10%
Lighting, natural	6%	6%	4%	11%	5%	12%
Heating	14%	11%	12%	11%	6%	12%
Air conditioning	16%	16%	17%	15%	6%	14%
Ventilation	11%	12%	12%	20%	8%	16%
Indoor air quality	8%	11%	9%	12%	9%	14%
Acoustincs or noise control	12%	13%	12%	23%	14%	19%
Physical condition of buildings	10%	11%	10%	15%	12%	15%
Size or configuration of rooms	14%	12%	13%	15%	16%	18%

Note(s): 1) Small school is defined as having 1-349 students, medium 350-699 students, and a large school has 700 or more students. 2) Based on the 99% of public schools with classrooms in permanent buildings. 3) Based on the 33% of public schools with classrooms in temporary

Source(s): National Center for Education Statistics, Digest of Educational Statistics 2009, April 2010, Table 101, for 2005 data.

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

Shell		
Percent Glass		Maximum 35%
Window U-Factor		0.33 - 0.56
Wall R-Value		5.7 - 15.2
Roof R-Value		
Attic		30.0 - 60.0
Insulation Above Deck		25.0
Wall Material		Mass: Heat Capacity > 7 Btu/SF*F
Lighting		
Average Power Density(Watts/ft.^2)		
With Daylighting		1.2
Without Daylighting		0.9 - 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:	Water-Cooled Chiller	Comply with ASHRAE 90.1
Service Hot Water:	Gas Boiler	90 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, 2008.

3.9.9 Typical School Building (1)

	Pre-1980	Post-1980
Stock Floor Area (billion SF)	7.482	0.595
Floor-Area Weighted Averages		
Building Area (thousand SF)	22 - 47	16 - 26
Floors	2	2
Shell		
Percent Glass	27	18
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	8
Weekend Hours (hrs/day)	2	2
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

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

3.9.10 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	0.3	15.9	1.4	2.7
Houston	2A	4.7	11.5	1.7	2.2
Phoenix	2B	3.3	12.4	1.5	2.5
Atlanta	3A	8.3	6.2	2.0	1.8
Los Angeles	3B	2.0	3.6	1.9	1.5
Las Vegas	3B	4.7	8.5	1.7	2.2
San Francisco	3C	8.8	2.0	2.1	1.7
Baltimore	4A	15.8	5.0	2.2	1.7
Albuquerque	4B	10.3	4.2	2.1	2.0
Seattle	4C	12.9	1.1	2.3	1.3
Chicago	5A	21.4	3.6	2.4	1.7
Boulder	5B	15.2	2.6	2.3	1.6
Minneapolis	6A	30.9	2.9	2.5	1.7
Helena	6B	24.0	1.5	2.5	1.4
Duluth	7	37.0	1.2	2.8	1.5
Fairbanks	8	59.6	0.5	3.1	1.4

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 73,960 square feet and 1 floor. Benchmark interior lighting energy = 15.80 thousand Btu/SF. Interior equipment energy consumption = 18.77 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

3.9.11 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	54.0	1.1	5.5
Houston	2A	8.1	41.0	1.4	5.2
Phoenix	2B	5.8	44.4	1.3	5.6
Atlanta	3A	15.3	25.3	1.7	4.9
Los Angeles	3B	4.1	15.9	1.6	4.7
Las Vegas	3B	8.6	28.2	1.5	5.2
San Francisco	3C	13.9	9.6	1.8	4.7
Baltimore	4A	27.5	20.9	1.9	4.9
Albuquerque	4B	17.9	13.8	1.9	5.1
Seattle	4C	25.8	5.9	2.0	4.5
Chicago	5A	36.7	15.9	2.1	4.9
Boulder	5B	26.3	9.5	2.1	4.9
Minneapolis	6A	50.4	13.4	2.3	5.0
Helena	6B	40.4	6.0	2.3	5.0
Duluth	7	61.0	6.1	2.5	5.3
Fairbanks	8	96.7	2.2	2.8	5.5

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 210,887 square feet and 2 floors. Benchmark interior lighting energy = 15.20 thousand Btu/SF. Interior equipment energy consumption = 11.83 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

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

	Hotels	Motels/Inns
Average Electricity Consumption(kBtus/SF):	61.3	40.5
Average Natural Gas Consumption(kBtus/SF):	50.7	42.2
Average Fuel Oil Consumption(kBtus/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 (1)	Guestrooms (thousand)	Sales ($2009 billion)	Avg. Occupancy Rate	Avg. Room Rate ($2009)
2001	41,393	4,200	125.45	60.3%	106.89
2002	47,040	4,398	122.26	59.1%	99.55
2003	47,584	4,416	122.84	61.1%	96.26
2004	47,598	4,412	128.97	61.3%	97.81
2005	47,590	4,402	134.69	63.1%	99.76
2006	47,135	4,389	141.81	63.3%	103.95
2007	48,062	4,476	144.07	63.1%	107.35
2008	49,505	4,626	142.27	60.4%	108.11
2009	50,800	4,762	127.20	54.7%	97.85

Note(s): 1) Based on properties with 15 or more rooms

Source(s): The American Hotel & Lodging Association, 2002 Lodging Industy Profile, p. 2-3; The American Hotel & Lodging Association, 2003 Lodging Industy Profile, p. 2-3, 2002; The American Hotel & Lodging Association, 2004 Lodging Industy Profile, p. 2-4, 2004; The American Hotel & Lodging Association, 2005 Lodging Industy Profile, p. 2, 4, 2005; The American Hotel & Lodging Association, 2006 Lodging Industy Profile, p. 2, 4, 2006; The American Hotel & Lodging Association, 2007 Lodging Industy Profile, p. 2, 4, 2007; The American Hotel & Lodging Association, 2008 Lodging Industry Profile p. 2, 4, 2008; The American Hotel & Lodging Association, 2009 Lodging Industry Profile, available at: http://www.ahla.com/content.aspx?id=28832; The American Hotel & Lodging Association, 2010 Lodging Industry Profile, available at: http://www.ahla.com/content.aspx?id=30505

3.10.3 Lodging Industry Profile (Thousands)

	2006		2007		2008		2009	
Location	Properties	Rooms	Properties	Rooms	Properties	Rooms	Properties	Rooms
Suburban	15.9	1,577	16.3	1,610	16.8	1,668	17.3	1,726
Highway	6.8	452	6.9	463	7.1	480	7.3	494
Urban	4.5	691	4.5	699	4.7	721	4.8	742
Airport	2.0	275	2.0	283	2.1	294	2.2	303
Resort	3.6	567	3.6	571	3.7	584	3.8	595
Small Metro	14.4	827	14.7	850	15.1	878	15.4	902
Rate								
Under $30	0.9	58	0.8	55	1.2	54	0.8	56
$30-44.99	7.1	435	6.9	424	7.3	418	7.0	431
$45-59.99	14.8	933	14.7	925	15.0	916	15.3	952
$60-85	14.2	1,295	14.5	1294	14.5	1326	14.0	1195
Over $85	10.1	1,668	11.1	1778	11.4	1913	13.7	2128
Number of Rooms								
Under 75	26.9	1,147	27.2	1159	27.8	1188	28.2	1214
75 - 149	14.5	1,542	15.1	1595	15.8	1668	16.5	1742
150 - 299	4.1	824	4.2	833	4.3	853	4.4	878
300 - 500	1.1	399	1.1	405	1.1	416	1.1	418
Over 500	0.5	478	0.5	484	0.5	502	0.5	510

Source(s): The American Lodging Association, 2007 Lodging Industy Profile, p. 2, 4, 2007; The American Lodging Association, 2008 Profile p. 2, 4, 2008; The American Hotel & Lodging Association, 2009 Lodging Industry Profile, available at: http://www.ahla.com/content.aspx?id=28832; The American Hotel & Lodging Association, 2010 Lodging Industry Profile, available at: http://www.ahla.com/content.aspx?id=30505

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

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	1.3	69.1	29.4	8.7
Houston	2A	5.9	53.7	37.1	8.6
Phoenix	2B	3.8	47.4	32.7	8.8
Atlanta	3A	10.2	43.0	44.6	8.7
Los Angeles	3B	3.1	34.7	43.1	8.5
Las Vegas	3B	6.0	35.4	38.0	8.8
San Francisco	3C	6.6	23.2	49.5	8.9
Baltimore	4A	17.2	37.0	50.5	8.6
Albuquerque	4B	12.3	23.9	49.4	8.8
Seattle	4C	15.0	21.1	53.5	8.5
Chicago	5A	24.2	31.6	55.6	8.6
Boulder	5B	18.4	21.7	55.4	8.8
Minneapolis	6A	31.7	29.0	60.1	8.6
Helena	6B	27.1	18.6	60.9	8.7
Duluth	7	39.6	21.9	67.4	8.7
Fairbanks	8	60.9	13.2	76.3	8.4

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 122,120 square feet and 6 floors. Benchmark interior lighting energy = 11.28 thousand Btu/SF. Interior equipment energy consumption = 24.77 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

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

	IECC Climate Zone	Heating	Cooling	Water Heating	Ventilation
Miami	1A	0.2	17.9	5.4	5.3
Houston	2A	2.5	13.6	6.5	5.0
Phoenix	2B	1.8	14.1	5.9	5.3
Atlanta	3A	4.5	9.7	7.6	4.8
Los Angeles	3B	1.6	7.5	7.4	4.5
Las Vegas	3B	3.0	10.5	6.6	4.9
San Francisco	3C	4.2	5.2	8.3	4.3
Baltimore	4A	8.0	7.8	8.4	4.5
Albuquerque	4B	5.1	7.1	8.2	5.0
Seattle	4C	6.9	4.1	8.8	4.1
Chicago	5A	11.6	6.3	9.1	4.4
Boulder	5B	8.2	5.4	9.1	4.8
Minneapolis	6A	16.3	5.8	9.7	4.4
Helena	6B	12.8	4.0	9.9	4.5
Duluth	7	20.7	3.9	10.8	4.3
Fairbanks	8	36.6	2.7	12.0	3.9

Note(s): Commercial building energy benchmarks are based off of the current stock of commercial buildings and are designed to provide a consistent baseline to compare building performance in energy-use simulations. The benchmark building had 43,200 square feet and 4 floors. Benchmark interior lighting energy = 13.79 thousand Btu/SF. Interior equipment energy consumption = 21.98 thousand Btu/SF.

Source(s): DOE/EERE/BT, Commercial Building Benchmark Models, Version 1.3_5.0, November 2010, accessed at <http://www1.eere.energy.gov/buildings/commercial_initiative/new_construction.html>.

4.1.1 FY 2006 Federal Primary Energy Consumption (Quadrillion Btu)

Buildings and Facilities	**0.86**	
Vehicles/Equipment	0.67	(mostly jet fuel and diesel)
Total Federal Government Consumption	1.53	

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Nov. 2007, Table A-1, p. 71 for total consumption and Table A-7, p. 76 for vehicle and equipment operations.

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 2006 (10^15 Btu)
Electricity	47.8%	76.2%	DOD	57.5%	Total Delivered	
Natural Gas	32.8%	14.9%	DOE	8.8%	Energy Consumption =	0.39
Fuel Oil	8.1%	3.7%	USPS	7.9%	Total Primary	
Coal	6.0%	2.7%	VA	6.5%	Energy Consumption =	0.86
Other	5.2%	2.4%	GSA	5.2%		
Total	100%	100%	Other	14.1%		
			Total	100%		

Note(s): See Table 2.3.1 for floorspace.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Nov. 2008, Table A-4, p. 74 and Table A-6, p. 75 for fuel types, and Table A-1, p. 71 and Table A-7, p. 76 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 1997	111.9
FY 1986	131.3	FY 1998	107.7
FY 1987	136.9	FY 1999	106.7
FY 1988	136.3	FY 2000	104.8
FY 1989	132.6	FY 2001	105.9
FY 1990	128.6	FY 2002	104.6
FY 1991	122.9	FY 2003	105.2
FY 1992	125.5	FY 2004	104.9
FY 1993	122.3	FY 2005	98.2
FY 1994	120.2	FY 2006 (2)	113.9
FY 1995	117.3	FY 2015 (3)	89.5
FY 1996	115.0		

Note(s): 1) See Table 4.3.1 for floorspace. 2) Increase due to change in categorization of Federal buildings. 3) Executive Order 13423 goal.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Sept. 2006, Table A-12, p. 158 for 1985-2005 energy consumption. DOE/FEMP, Annual Report on FEMP, Jan. 2001, Table 7-A, p. 55 for 1999, Dec. 2002, Table 8-A, p. 61 for 2000, Feb. 2004, Table 8-A, p. 66 for 2001, Sep. 2004, Table 8-A, p. 65 for 2002, Aug. 2005, Table 6-A, P. A-10 for 2003, Feb. 2006, Table 6-A, p. A-10 for 2004, Sep. 2006, Table 2, p. 13 for 2005, Nov. 2008, Table 1, p. 12 for 2006 and DOE/FEMP for remaining years for floorspace.

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	5.74	9.63	9%		101.65
EPA	0.55	0.56	123%	(2)	0.46
DOE	0.47	0.49	3%		16.72
GSA	0.44	0.45	5%		9.90
NASA	0.37	0.37	7%		5.41
DOC	0.35	0.35	33%		1.07
Others	0.93	1.05	2%		51.54
All Agencies	**8.86**	**12.89**	7%		**186.74**

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 122.7% 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, Nov. 2008, Table 4, p. 16, and p. 16 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
FY 2006	3.10

Agency	2006 Percent of Total Floorspace
DOD	63%
USPS	11%
GSA	6%
VA	5%
DOE	3%
Other	12%
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, Annual Report to Congress on FEMP, Nov. 2008, Table 1, p. 12 for floorspace by agency. DOE/FEMP, Annual Report on FEMP, Jan. 2001, Table 7-A, p. 55 for 1999, Dec. 2002, Table 8-A, p. 61 for 2000, Feb. 2004, Table 8-A, p. 66 for 2001, Sep. 2004, Table 8-A, p. 65 for 2002, Aug. 2005, Table 6-A, P. A-10 for 2003, Feb. 2006, Table 6-A, p. A-10 for 2004, Sep. 2006, Table 2, p. 13 for 2005, Nov. 2008, Table 1, p. 12 for 2006 and DOE/FEMP for remaining years for floorspace by year.

4.3.1 FY 2006 Federal Buildings Energy Prices and Expenditures, by Fuel Type ($2009)

Fuel Type	Average Fuel Prices ($/million BTU)			Total Expenditures ($ million) (2)
Electricity	$ 24.164	(1)		$ 3,960.631
Natural Gas	$ 14.458			$ 1,326.632
Fuel Oil	$ 11.045			$ 433.977
Coal	$ 16.297			$ 64.855
Purchased Steam	$ 3.381			$ 307.562
LPG/Propane	$ 21.410			$ 38.545
Other	$ 15.702			$ 42.539
Average	$ 17.505		**Total**	$ 6,177.930

Note(s): Prices and expenditures are for Goal-Subject buildings. (1) $0.078/kWh. (2) Energy used in Goal-Subject buildings in FY 2006 accounted for 32.8% of the total Federal energy bill.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP November 2010, Table A-4, p. 74 for prices and expenditures, and Table A-9, p. 78 for total energy expenditures. EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

4.3.2 Annual Energy Expenditures per Gross Square Foot of Federal Floorspace Stock, by Year ($2009)

FY 1985	2.11
FY 2000	1.35
FY 2001	1.57
FY 2002	1.47
FY 2003	1.44
FY 2004	1.53
FY 2005	1.58
FY 2006	1.99 (1)

Note(s): Total Federal buildings and facilities energy expenditures in FY 2006 were $5.81 billion (in $2009).
(1) Increase due to change in FEMP categorization of Federal buildings.

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Nov. 2008, Table A-9, p. 78 for energy costs, and Table 1, p. 12 for floorspace for 2006. DOE/FEMP, Annual Report to Congress on FEMP, Sep. 2006, Table A-12, p. 158 for energy costs for 1985-2005. DOE/FEMP, Annual Report on FEMP, Dec. 2002, Table 8-A, p. 61 for 2000; Feb. 2004, Table 8-A, p. 66 for 2001; Sep. 2004, Table 8-A, p. 65 for 2002; Aug. 2005, Table 6-A, P. A-10 for 2003; Feb. 2006, Table 6-A, p. A-10 for 2004; Sep. 2006, Table 2, p. 13 for 2005 and 1985.

4.3.3 Direct Appropriations on Federal Buildings Energy Conservation Retrofits and Capital Equipment ($2009 Million)

FY 1985	518,620.38	FY 1991	167,703.17	FY 1997	259,224.65	FY 2003	199,540.36
FY 1986	339,899.96	FY 1992	208,286.30	FY 1998	337,341.54	FY 2004	196,992.17
FY 1987	97,914.53	FY 1993	169,453.67	FY 1999	259,681.04	FY 2005	319,101.28
FY 1988	107,831.23	FY 1994	316,178.31	FY 2000	149,687.43	FY 2006	281,073.00
FY 1989	82,670.09	FY 1995	435,416.64	FY 2001	161,182.46		
FY 1990	101,314.30	FY 1996	236,318.06	FY 2002	146,706.56		

Source(s): DOE/FEMP, Annual Report to Congress on FEMP, Nov. 2007, Table 9-B, p. 26 for 1985, 1990, 1995, 2000-2006. DOE/FEMP, Annual Report to Congress on FEMP, Sep. 2004, Table 4-B, p. 38 for 1986-1989, 1991-1994, 1996-1999. EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price deflators.

4.4.1 Energy Policy Act of 2005, Provisions Affecting Energy Consumption in Federal Buildings

Energy Management Requirements - Amended reduction goals set by the National Energy Conservation Policy Act, and requires increasing percentage reductions in energy consumption through FY 2015, with a final energy consumption reduction goal of 20 percent savings in FY 2015, as compared to the baseline energy consumption of Federal buildings in FY 2003. (These goals were superseded by Section 431 of the Energy Independence and Security Act of 2007.) [Section 102]

Energy Use Measurement and Accountability - Requires that all Federal buildings be metered to measure electricity use by 2012. [Section 103]

Procurement of Energy Efficient Products - Requires all Federal agencies to procure ENERGY STAR qualified products, for product categories covered by the ENERGY STAR program, or FEMP designated products, unless such products are not available, or if such products are not cost-effective. [Section 104]

Federal Building Performance Standards - Requires that new Federal buildings be designed to achieve savings of at least 30% below ASHRAE Standard 90.1-2004 or 2004 IECC if cost-effective. [Section 109]

Federal Renewable Energy Purchase Requirement - Requires that the Federal government obtain at least 3 percent of electrical energy consumed in FY 2007, 2008 and 2009 from renewable energy sources. This requirement increases to 5 percent in FY 2010, 2011, and 2012, and to 7.5 percent for FY 2013 and all fiscal years after.

Source(s): Energy Policy Act of 2005, Enacted August 8, 2005

4.4.2 Executive Order 13423, Provisions Affecting Energy Consumption in Federal Buildings

-- Requires Federal agencies to improve energy efficiency and reduce greenhouse gas emissions by either 3 percent annual reductions through FY 2015, or by 30 percent by 2015, as compared to FY 2003.

-- Requires Federal agencies to obtain at least half of required renewable energy from new renewable sources.

Source(s): Executive Order 13423, Strengthening Federal Environmental, Energy, and Transportation Management, Issued January 24, 2007

4.4.3 Energy Independence and Security Act of 2007, Provisions Affecting Energy Consumption in Federal Buildings

Energy Reduction Goals for Federal Buildings - Amended reduction goals set by the National Energy Conservation Policy Act, and requires increasing percentage reductions in energy consumption through FY 2015, with a final energy consumption reduction goal of 30 percent savings in FY 2015, as compared to the baseline energy consumption of Federal buildings in FY 2003. The goals specified in Section 431 of EISA 2007 supersede those from Section 102 of EPACT 2005. [Section 431]

Management of Energy and Water Efficiency in Federal Buildings - Requires each Federal agency to designate an energy manager, requires that energy manager to evaluate all facilities of that agency for energy and water saving measures once every four years, and requires agencies. Authorizes the Office of Management and Budget to evaluate progress by each agency on energy and water savings measures through semiannual scorecards. [Section 432]

Federal Building Energy Efficiency Performance Standards - Requires that new Federal buildings built after 2010, and Federal building undergoing major renovations after 2010, be designed to reduce fossil fuel consumption, as compared to FY 2003. This reduction requirement increases each 5 years. [Section 433]

Management of Federal Building Efficiency - Requires that Federal agencies select the most energy-efficient designs, systems, equipment, and controls that are life-cycle cost effective, when performing any replacement of installed equipment within a Federal building. [Section 434]

Leasing - Requires that Federal agencies lease space in buildings that have earned the ENERGY STAR label in the most recent year, unless no available space exists. [Section 435]

High Performance Green Federal Buildings - Establishes the Office of Federal High-Performance Green Buildings within the General Services Administration. This office is authorized to coordinate all efforts related to green practices within Federal buildings. [Section 436]

Standard Relating to Solar Hot Water - Requires new Federal buildings, or Federal buildings undergoing major renovations, to meet at least 30 percent of hot water demand through the use of solar hot water heaters, if cost-effective. [Section 523]

Federally-Procured Appliances with Standby Power - Requires all Federal agencies to procure appliances with standby power consumption of less than 1 watt, if available and cost-effective. [Section 524]

Source(s): Energy Independence and Security Act of 2007, Enacted December 19, 2007

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/Polyurethane	5.6 - 7.0
Loose-Fill	2.5 - 3.7		Phenolic	4.4 - 8.2
Cellulose			Reflective Insulation	2 - 17
Loose-Fill	3.1 - 3.7		Vacuum Powder Insulation	25 - 30
Spray-Applied	2.9 - 3.5		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 (Thousand SF)

North America

	Extensive	Intensive	Mixed	**Total**
2004	917	406	4.9	1,327
2005	1,785	488	198.7	2,472
2006	1,957	1,033	73.8	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) These data are 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

5.1.5 Properties of Cool Roofing Materials (1)

	Solar Reflectance (2)	Infrared Emittance (3)
Asphalt Shingles		
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	0.5%
2000	0.0	0.1	0.1	0.4%
2001	0.0	0.1	0.1	0.3%
2002	4.4	0.0	4.5	23.6%
2003	1.0	0.1	1.0	5.4%
2004	1.2	0.3	1.4	7.4%
2005	3.5	0.2	3.7	18.7%
2006	4.1	0.5	4.5	22.5%

Note(s): N/A: Year is before date of ENERGY STAR specification.

Source(s): LBNL, Climate Change Action Plan spreadsheet (updated 2007).

5.2.1 Residential Prime Window Sales, by Frame 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**
2009	1.9	2.5	6.3	0.7	**11.4**
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**
2009	1.0	6.1	19.1	1.3	**27.5**
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**
2009	2.9	8.6	25.5	1.9	**38.9**

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; AAMA/WDMA, U.S. Industry Statistical Review and Forecast, May 2010, p. 6 for 2009.

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

	Windows				Doors				Total			
Type	1990	2000	2005	2008	1990	2000	2005	2008	1990	2000	2005	2008
Aluminum	10	8	7	N/A	2	4	4	3	12	12	11	N/A
Wood	0	0	0	N/A	0	0	0	0	0	0	0	N/A
Other (1)	1	2	2	N/A	0	1	2	1	1	4	4	N/A
Total (2)	**11**	**11**	**9**	**N/A**	**2**	**6**	**6**	**4**	**13**	**16**	**15**	**N/A**

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; 2003 AAMA/WDMA Industry Statistical Review and Forecast, June 2004, p. 6 for 2000; AAMA/WDMA, Study of U.S. Market for Windows, Doors, and Skylights, Apr. 2006, p. 101, Exhibit G.2 for 2005; AAMA/WDMA, U.S. Industry Statistical Review and Forecast, May 2010, p. 7 for 2008.

5.2.3 Nonresidential Window Sales, by Type and Census Region (Million Square Feet of Vision Area) (1)

	Northeast		Midwest		South		West		Total	
Type	1995	2009	1995	2009	1995	2009	1995	2009	1995	2009
New Construction										
Commercial Windows (2)	4	15	16	22	21	58	13	25	54	120
Curtain Wall	3	10	6	16	16	41	8	18	33	84
Store Front	7	10	11	16	14	41	11	18	43	85
Total (3)	**14**	**36**	**33**	**53**	**51**	**140**	**32**	**60**	**130**	**289**
Remodeling/Replacement										
Commercial Windows (2)	18	12	25	17	46	45	27	19	116	93
Curtain Wall	4	2	6	3	8	7	10	3	28	15
Store Front	12	5	18	8	24	20	22	9	76	41
Total (3)	**34**	**18**	**49**	**27**	**78**	**72**	**59**	**31**	**220**	**148**
Total										
Commercial Windows (2)	22	27	41	40	67	103	40	45	170	213
Curtain Wall	7	12	12	18	24	48	18	21	61	99
Store Front	19	15	29	23	38	61	33	26	119	125
Total (3)	**48**	**54**	**82**	**80**	**129**	**211**	**91**	**91**	**350**	**437**

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; AAMA/WDMA, U.S. Industry Statistical Review and Forecast, May 2010, p. 17 for 2009.

5.2.4 Insulating Glass Historical Penetration, by Sector (Percent of New Sales) (1)

Sector	1985	1990	1995	2000	2005	2009
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; AAMA/WDMA, 2003 AAMA/WDMA Industry Statistical Review and Forecast, June 2004, p.12 for 2000; AAMA/WDMA, U.S. Industry Statistical Review and Forecast, May 2010, p. 12 for 2005 and 2009.

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

	Single Pane		Double Pane Sealed IG (1)		Other		Total	
1980	8.6	34%	0.0	0%	16.6	66%	25.2	100%
1990	4.9	14%	12.0	34%	18.7	53%	35.6	100%
1993	2.8	14%	17.2	84%	0.4	2%	20.4	100%
1995	5.5	12%	37.8	85%	1.3	3%	44.5	100%
1999	4.8	8%	55.2	89%	2.0	3%	62.0	100%
2001	3.9	7%	50.9	90%	1.5	3%	56.3	100%
2003	4.7	7%	55.9	89%	2.2	4%	62.8	100%
2005	4.2	6%	63.8	91%	2.5	3%	70.5	100%
2007	2.7	5%	55.0	93%	1.4	2%	59.1	100%
2009	1.6	4%	36.2	93%	1.2	3%	38.9	100%

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; 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; AAMA/WDMA/Ducker, Study of the U.S. Market For Windows, Doors, and Skylights, Executive Report, May 2010, Exhibit D.8 Conventional Residential Window Glass Usage, p. 52.

5.2.6 2005 Residential Prime Window Stock (Million Households)

		Double Pane			
Census Division	Single Pane	Without Low-e	With Low-e	Total	Total Households (1)
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
United States	**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) Respondents were shown pictures of different types of window glass and were asked "Which picture best describes the type of glass in the windows of your home/apartment?" 2) An additional 1.3 million households not counted here use other types of windows such as triple-

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

5.2.7 Nonresidential Window Stock and Sales, by Glass Type

Type	Existing U.S. Stock (% of buildings)	Vision Area of New Windows (Million Square Feet) 1995	2001	2003	2005	2007	2009
Single Pane	53%	56	57	48	56	60	48
Insulating Glass (1)	47%	294	415	373	407	476	389
Total	100%	**350**	**472**	**421**	**463**	**536**	**437**
Clear	65%	36%	49%	43%	44%	38%	33%
Tinted	28%	40%	24%	17%	15%	11%	10%
Reflective	7%	7%	8%	6%	4%	3%	3%
Low-e	(2)	17%	19%	34%	37%	48%	54%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note(s): 1) Includes double- and triple-pane sealed units and stock glazing with storm windows. 2) 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; AAMA/WDMA/Ducker, Study of U.S. Market For Windows, Doors, and Skylights, May 2010, Exhibit D.31 and Exhibit D.32, p. 75 for 2009.

5.2.8 Typical Thermal Performance of Residential Windows, by Type

	U-Factor	Solar Heat Gain Coefficient	Visual Transmittance
Single-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	0.55-0.65
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

Source(s): The Efficient Windows Collaborative (http://www.efficientwindows.org)

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)	2007 (1,000s)	2009 (1,000s)	2005 Value of Shipments ($million) (7)
Air-Conditioners (1)	**2,920**	**5,346**	**6,472**	**4,508**	**3,516**	**5,837**
Heat Pumps	**809**	**1,539**	**2,336**	**1,899**	**1,642**	**2,226**
Air-to-Air Heat Pumps	809	1,339	2,114	1,899	1,642	1,869
Water-Source Heat Pumps (2)	N.A.	200	222	N.A.	N.A.	357
Chillers	**N.A.**	**38**	**37**	**N.A.**	**N.A.**	**1,093**
Reciprocating	N.A.	25	24	30	20	462
Centrifugal/Screw	5	8	6	7	5	566
Absorption (3)	N.A.	5	7	N.A.	N.A.	64
Furnaces	**2,369**	**3,681**	**3,624**	**2,866**	**2,231**	**2,144**
Gas-Fired (4)	1,950	3,104	3,512	2,782	2,175	2,081
Electric	280	455	N.A.	N.A.	N.A.	N.A.
Oil-Fired (5)	138	121	111	84	56	63
Boilers (6)	**316**	**368**	**370**	**N.A.**	**N.A.**	**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) DOC did not report absorption chiller shipments for 2007 and 2009. 4) 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. 5) 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. 6) 61% of shipments were gas-fired and 39% were oil-fired. 96% of shipments are cast iron and 4% are steel. 7) 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; AHRI, 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; AHRI, "Historical Statistical Data: Central Air Conditioners and Air-Source Heat Pumps," 2010, accessed March 15, 2011 at <http://www.ahrinet.org/historical+data.aspx> for 2007 and 2009 A/C and heat pump shipments; AHRI, "Historical Statistical Data: Furnaces," 2010, accessed March 15, 2011 at <http://www.ahrinet.org/historical+data.aspx> for 2007 and 2009 furnace shipments; DOC, Current Industrial Reports, MA333M - Refrigeration, Air Conditioning, and Warm Air Heating Equipment, 2008 Annual and 2009 Annual reports for 2007 and 2009 shipments of chillers; and GAMA News Release, Jan. 2007 for note 6.

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%		

Oil-Fired

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

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)

Gas-Fired Boilers

Average shipped in 1985 (2):	74% AFUE
Best Available in 1981:	81% AFUE
Best Available in 2007:	96% AFUE

Oil-Fired Boilers

Average shipped in 1985 (2):	79% AFUE
Best Available in 1981:	86% 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 2008 Unitary Air-Conditioner/Heat Pump Manufacturer Market Shares (Percent of Products Produced)

Total Units Shipped: 5,833,354 (1)

Company	Market Share (%)
UTC/Carrier	27%
Goodman (Amana)	14%
American Standard (Trane)	14%
York	12%
Nordyne	12%
Rheem	9%
Lennox	9%
Others	3%
Total	100%

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

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturaation Levels, January 2010, p. 5.

5.3.7 2008 Gas Furnace Manufacturer Market Shares (Percent of Products Produced)

Total Units Shipped: 2,300,000

Company	Market Share (%)
UTC/Carrier	32%
Goodman (Amana)	15%
Lennox	13%
American Standard (Trane)	13%
Rheem	12%
York	9%
Nordyne	5%
Others	1%
Total	**100%**

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturaation Levels, January 2010, p. 5.

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 2010 (1,000s)
Central Air Conditioners	8 - 14	11	8	5,354
Heat Pumps	9 - 15	12	8	1,260
Furnaces				
Electric	10 - 20	15	11	N.A.
Gas-Fired	12 - 17	15	11	2,601
Oil-Fired	15 - 19	17	N.A.	149
Gas-Fired Boilers (1)	17 - 24	20	17	204

Note(s): Lifetimes based on use by the first owner of the product, and do not necessarily indicate that the product stops working after this period. A replaced unit may be discarded or used elsewhere. 1) 2005 average stock age is for gas- and oil-fired steam and hot water boilers.

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 10 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-CooledPackage	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 2005 (Percent of Total Households)

Heating Fuel	1949 or Before	1950 to 1959	1960 to 1969	1970 to 1979	1980 to 1989	1990 to 1999	2000 to 2005
Natural Gas	56%	57%	55%	46%	45%	45%	45%
Electricity	8%	18%	26%	36%	42%	42%	43%
Fuel Oil	14%	10%	7%	5%	2%	2%	2%
LPG	5%	3%	2%	5%	6%	8%	8%
Other (1)	17%	12%	10%	8%	4%	3%	2%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Note(s): 1) Other includes wood and kerosene.

Source(s): EIA, Residential Energy Consumption Survey 2005 , June 2008, Table HC 5.4.

5.3.11 Main Residential Heating Equipment as of 1987, 1993, 1997, 2001, and 2005 (Percent of Total Households)

Equipment Type	1987	1993	1997	2001	2005
Natural Gas	**55%**	**53%**	**53%**	**55%**	**52%**
Central Warm-Air Furnace	35%	36%	38%	42%	40%
Steam or Hot-Water System	10%	9%	7%	7%	7%
Floor/Wall/Pipeless Furnace	6%	4%	4%	3%	2%
Room Heater/Other	4%	3%	4%	3%	3%
Electricity	**20%**	**26%**	**29%**	**29%**	**30%**
Central Warm-Air Furnace	8%	10%	11%	12%	14%
Heat Pump	5%	8%	10%	10%	8%
Built-In Electric Units	6%	7%	7%	6%	5%
Other	1%	1%	2%	2%	1%
Fuel Oil	**12%**	**11%**	**9%**	**7%**	**7%**
Steam or Hot-Water System	7%	6%	5%	4%	4%
Central Warm-Air Furnace	4%	5%	4%	3%	3%
Other	1%	0%	0%	0%	0%
Other	**13%**	**11%**	**9%**	**8%**	**10%**
Total	100%	100%	100%	100%	100%

Note(s): Other equipment includes wood, LPG, kerosene, other fuels, and none.

Source(s): EIA, A Look at Residential Consumption in 2005, June 2008, Table HC2-4; 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)	Cooling Equipment	1995	1999	2003 (2)
Packaged Heating Units	29%	38%	28%	Packaged Air Conditioning Units	45%	54%	46%
Boilers	29%	29%	32%	Individual Air Conditioners	21%	21%	19%
Individual Space Heaters	29%	26%	19%	Central Chillers	19%	19%	18%
Furnaces	25%	21%	30%	Residential Central Air Conditioners	16%	12%	17%
Heat Pumps	10%	13%	14%	Heat Pumps	12%	14%	14%
District Heat	10%	8%	8%	District Chilled Water	4%	4%	4%
Other	11%	6%	5%	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		Cooling Equipment	
Packaged Heating Units	25%	Packaged Air Conditioning Units	54%
Boilers	21%	Room Air Conditioning	5%
Individual Space Heaters	2%	PTAC (2)	3%
Furnaces	20%	Centrifugal Chillers	14%
Heat Pumps	5%	Reciprocating Chillers	12%
District Heat	7%	Rotary Screw Chillers	3%
Unit Heater	18%	Absorption Chillers	2%
PTHP & WLHP (1)	2%	Heat Pumps	7%
	100%		100%

Note(s): 1) PTHP = Packaged 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**	#####	#####	

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	1,166	1,194	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	**2,219**	**1,861**	**1,408**	**1,024**	**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 Water Heater Stock for Residential Buildings, By Fuel Type

	Households in 2005 (millions)	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 includes those households that used hot water.
Souce(s): EIA, Residential Energy Consumption Survey 2005, Table HC 2.8, June 2008.

5.4.2 Water Heater Stock for Residential Buildings, By Storage Type

	Number and Percent of Households in 2005					
	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 includes those households that used hot water.
Souce(s): EIA, Residential Energy Consumption Survey 2005, Table HC 2.8, June 2008.

5.4.3 Water Heater Manufacturer Market Shares

	2006	2008
A.O. Smith/State Industries	23%	46%
Rheem Manufacturing	37%	37%
Bradford-White	14%	13%
American Water Heater	14%	(1)
Others	12%	4%
Total	100%	100%
Total Units Shipped (2)	9,446,076	8,190,043

Note(s): 1) Included in A.O. Smith/State Industries. 2) Excludes exports.
Source(s): Appliance Magazine, A Portrait of the U.S. Appliance Industry, Sept. 2007, p. 63 for 2006; Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 6 for 2008.

5.4.4 Water Heater Stock for Commercial Buildings, By Fuel Type

Fuel Type	Percent of Buildings in 2003 (1)
Electric	41%
Natural Gas	31%
Fuel Oil	2%
Propane/LPG	3%
District Heat	1%
No Water Heating	25%

Note(s): (1) Percentages add to 103% because some buildings use more than one fuel for water heating.

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)	Best-Available New Efficiency (4)
Electric Storage	EF	0.88	0.92	0.95
Electric Instantaneous	EF	(3)	0.93	1.00
Electric Heat Pump	EF	(3)	0.92	2.51
Gas-Fired Storage	EF	0.56	0.59	0.70
Gas-Fired Instantaneous	EF	(3)	0.62	0.98
Oil-Fired Storage	EF	0.55	0.51	0.68
Solar	SEF	N.A.	0.70	47
Commercial Type				
Electric Storage	Thermal Efficiency	98%	98%	100%
Gas-Fired Storage	Thermal Efficiency	82%	80%	99%
Oil-Fired Storage	Thermal Efficiency	77%	78%	84%

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. 4) Based on data from 2011 for electric heat pump, gas-fired storage and instantaneous, and solar water heaters and data from 2005 for the other types.

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 for electric storage, electric instantaneous, and oil-fired storage and all minimum efficiencies; EPA, Qualified Product Lists, Mar. 16, 2011 for best-available efficiencies for electric heat pump, gas-fired storage and instantaneous, and solar; and SRCC, Summary of SRCC Certified Solar Collector and Water Heating System Ratings, Apr. 2000, p. S16 - S20 for solar energy factors, Table 2.2, p. 4.

5.5.1 Market Share of Major HVAC Equipment Manufacturers ($2009 Million)

	Total Market Size
Air-Handling Units	1024
Cooling Towers	528
Pumps	330
Central System Terminal Boxes	190
Classroom Unit Ventilator	159
Fan Coil Units	122

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 2009, August 2010, Appendix D, p. 383 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	0	534	0	0	0	20	554
Food Service	83	1,100	0	0	0	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	0	741	2,168	7,464
Warehouse/Storage	119	1,482	0	0	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	0.0
Condenser Water Pump	0.2	0.2		0.3	0.3	0.0
Chilled Water Pump	0.2	0.2		0.1	0.2	0.0
Supply & Return Fans	0.7	0.5	0.6	1.2	1.9	1.9
Chiller/Compressor	1.9	1.8	3.3	1.7	2.3	4.0

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

5.5.5 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

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	787	828	984	1,297	984
Commercial/Institutional (except spotlight)	1,832	2,380	2,797	3,507	3,239
Industrial	389	529	676	718	628
Vehicular (1)	1,001	1,621	N.A.	N.A.	N.A.
Outdoor	906	1,062	1,473	1,957	1,923

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

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

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

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

5.6.4 2001 Total Lighting Technology Electricity Consumption, by Sector (Billion kWh per Year) (1)

	Residential		Commercial		Industrial		Other (2)		Total	
Incandescent										
Standard	176.2	87%	103.3	26%	2.2	2%	5.3	10%	287.0	38%
Halogen	5.5	3%	21.2	5%	0.4	0%	1.2	2%	28.3	4%
Fluorescent										
T5	N.A.		0.3	0%	0.0	0%	N.A.		0.3	0%
T8	N.A.		49.8	13%	22.7	21%	0.0	0%	72.5	10%
T12	N.A.		157.0	40%	49.0	45%	0.0	0%	206.0	27%
Compact	1.0	1%	12.6	3%	0.6	1%	N.A.		14.3	2%
Miscellaneous	18.4	9%	0.4	0%	0.1	0%	0.6	1%	19.5	3%
HID										
Mercury Vapor	0.6	0%	6.5	2%	3.2	3%	11.6	21%	21.9	3%
Metal Halide	N.A.		33.9	9%	24.7	23%	3.8	7%	62.4	8%
HP Sodium	0.1	0%	5.6	1%	5.0	5%	30.2	54%	41.0	5%
LP Sodium	N.A.		0.1	0%	0.0	0%	2.9	5%	3.1	0%
Total (3)	**201.8**	100%	**390.8**	100%	**107.9**	100%	**55.7**	100%	**756.1**	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, Volume I: National Lighting Inventory and Energy Consumption Estimate, September 2002, pg. 32-39; 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 Vapor	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, Volume I: National Lighting Inventory and Energy Consumption Estimate, September 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, Volume I: National Lighting Inventory and Energy Consumption Estimate, September 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	8.4%	3.4
Food Sales	2%	13.5	3.4%	10.8
Food Service	2%	12.3	3.1%	7.4
Health Care	5%	30.8	7.8%	9.7
Inpatient	3%	22.3	5.7%	11.8
Outpatient	2%	8.2	2.1%	6.6
Lodging	7%	36.3	9.3%	7.1
Mercantile	16%	90.3	23.0%	8.1
Retail (Other Than Mall)	6%	32.5	8.3%	7.5
Enclosed and Strip Malls	10%	57.7	14.7%	8.4
Office	18%	82.4	21.0%	6.8
Public Assembly	6%	7.9	2.0%	2.1
Public Order and Safety	2%	5.3	1.3%	4.8
Religious Worship	5%	5.0	1.3%	1.3
Service	6%	18.5	4.7%	4.6
Warehouse and Storage	13%	38.7	9.9%	3.8
Other	2%	17.3	4.4%	10.0
Vacant	1%	1.2	0.3%	0.5
Total (1)		**392.4**	**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	3,000 - 20,000	65 - 70
High-Pressure Sodium	50 - 124	29,000	22
Low-Pressure Sodium	18 - 180	18,000	0
Solid State Lighting	20 - 100	15,000 - 50,000	33-97

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; ENERGY STAR LED Light Bulb Program, Qualified Product List, Accessed 3/15/2011; LightingFacts.com Product List, Accessed 3/15/2011

5.7.1 Refrigeration System Shipments, by Type (Including Exports)

Appliance Type	1990 (thousands)	2000 (thousands)	2006 (thousands)	2008 (thousands)	2008 Value of Shipments ($million)
Refrigerator-Freezers (1)	7,317	9,462	#####	9,310 (2)	5,891
Freezers (chest and upright)	1,328	2,007	2,199	2,098	N.A.
Refrigerated Display Cases	359	347	181	N.A.	N.A.
Unit Coolers (3)	178	207	221	87	147
Ice-Making Machines	171	385	386	305	583
Water Cooler	253	348	300	N.A.	N.A.
Beverage Vending Machine	229	353	N.A.	N.A.	N.A.

Note(s): 1) Does not include commercial products value. 2) Standard sized refrigerator-freezers 6.5 cubic feet and over. 3) Excludes units rated from 4,001 to 18,000 Btu/hr.

Source(s): Appliance Magazine, U.S. Appliance Industry Statistical Review: 2000 to YTD 2010, July 2010 for 2008 refrigerator-freezer and freezer shipments; Appliance Magazine, 54th Annual Statistical Review, May 2007, p. S1-S4 for 2006 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 2006 refrigerator-freezer, unit cooler, and ice-making machine data; DOC, Current Industrial Reports: Refrigeration, Air Conditioning, and Warm Air Heating Equipment, MA333M(09)-1, August 2010, for 2008 refrigerator-freezer, unit cooler, and ice-making machine data and value of shipments; DOC, Current Industrial Reports: Major Household Appliances, MA335F(09), May 2010, for 2008 refrigerator-freezers value of shipments; 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's)	2000 (1000's)	2009 (1000's)	2009 Value of Shipments (4) ($million)
Room Air Conditioners	**3,799**	**6,496**	**5,786**	**206**
Ranges (total)	5,873	8,202	5,712	3,188
Electric Ranges	3,350	5,026	3,448	2,062
Gas Ranges	2,354	3,176	2,264	1,126
Microwave Ovens/Ranges	**7,693**	**12,644**	**9,626**	**N.A.**
Clothes Washers	**5,591**	**7,495**	**7,865**	**4,820**
Clothes Dryers (total)	**4,160**	**6,575**	**6,484**	**N.A. (5)**
Electric Dryers	3,190	5,095	5,201	N.A.
Gas Dryers	970	1,480	1,283	N.A.
Water Heaters (total)	**7,252**	**9,329**	**7,513**	**2,321**
Electric (1)	3,246	4,299	3,752	869
Gas and Oil (1)	4,005	5,006	3,761	1,452
Solar (2)	N.A.	24	N.A.	N.A.
Office Equipment				
Personal Computers (3)	N.A.	47,168	36,725	21,174
Copiers	N.A.	1,989	N.A.	N.A.
Printers	N.A.	27,945	18,542	2,900
Scanners	N.A.	9,400	N.A.	N.A.

Note(s): 1) Includes residential and small commercial units. 2) Shipments and value of shipments of entire systems. 3) Includes workstations, laptops, and notebooks. 4) Value of shipments (except for office equipment and microwaves) are based on Census unit shipment data, which are about 588 thousand units lower than industry data shown. 5) Included in clothes washers value of shipments.

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 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; AHRI, Historical Statistical Data - Residential Water Heaters, 2010 for 2009 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 Magazine, 52nd Annual Statistical Review, May 2005, p. S1-S4 for office equipment shipments; DOC, Current Industrial Reports: Major Household Appliances, MA335f(09)-1, May 2010, Table 2 for 2009 value of shipments except room air conditioners; DOC, Current Industrial Reports: Refrigeration, Air Conditioning, and Warm-Ari Heating Equipment, MA333M(09)-1, August 2010 for room air conditioner value of shipments; Appliance Magazine, U.S. Appliance Industry Statistical Review: 2000 to YTD 2010, p. 4 and p. 6 for appliance shipments; and Consumer Electronics Association, U.S. Consumer Electronics Sales & Forecasts 2006-2011, July 2010 for 2009 Office Equipment.

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

Appliance Type	1990 Households		1996 Households		2001 Households		2005 Households		2008 Households	
Room Air Conditioners	30.2	32%	30.4	31%	26.9	26%	27.4	25%	32.7	29%
Refrigerators	91.2	98%	96.8	98%	100.0	96%	104.7	96%	111.6	99%
Freezers	42.4	45%	41.9	42%	42.8	41%	36.1	33%	48.5	43%
Electric Ranges/Cooktops	58.4	63%	65.3	66%	69.2	66%	71.0	65%	68.8	61%
Gas Ranges/Cooktops	36.1	39%	38.3	39%	39.4	38%	42.2	39%	45.1	40%
Microwave Ovens	77.2	83%	89.5	91%	94.6	91%	97.2	89%	102.6	91%
Clothes Washers	86.4	93%	94.3	95%	96.9	93%	90.1	83%	107.1	95%
Electric Clothes Dryers	56.1	60%	60.4	61%	61.8	59%	67.6	62%	69.9	62%
Gas Clothes Dryers	19.1	21%	21.1	21%	19.8	19%	20.7	19%	22.6	20%
Personal Computers	N.A.	N.A.	43.5	44%	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Number of U.S. Households	**94.0**		**98.9**		**107.0**		**108.8**		**112.8**	

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 11; AHAM, AHAM 2005 Fact Book, 2006, Table 93, p. 28 for 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 2011 Early Release, Table A4, p. 9-10 for 2008 households; 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, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 5.

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

	Average Volume (cu. ft.) (1)	Consumption/Unit (kWh/yr)	Best-Available (kWh/yr)
1972	18.2	1726	N.A.
1980	19.6	1278	N.A.
1985	19.5	1058	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
2005	20.7	490	417
2006	22.3	506	464
2007	21.9	498	459
2008	21.4	483	N.A.
2009 (2)	21.0	450	334

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. 1) Represents the average adjusted volume, which is defined as the fresh volume plus 1.63 times the freezer volume. 2) Based on refrigerator-freezer units with adjusted volumes approximately equal to the average adjusted volume.

Source(s): AHAM, Efficiency and Consumption Trends 2009; 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 2001-2009 best available, http://www.energystar.gov/index.cfm?fuseaction=refrig.display_products_excel.

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

Total Units Shipped: 9,085,500

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%

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 5.

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

	Average Capacity (Btu/hr)	EER	Best-Available (EER)
1972	10227	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
2005	7,916	9.95	12.0
2006	9,197	10.02	12.0
2007	8,518	9.81	12.0
2008	8,760	9.93	12.0
2009	9,287	10.05	12.0

Source(s): AHAM, Efficiency and Consumption Trends 2009; 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 2001-2009 best available, http://www.energystar.gov/index.cfm?fuseaction=roomac.display_products_excel.

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, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 6.

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, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 6.

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, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 6.

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, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 6.

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

Note(s): Data has not been updated because market share for these products is no longer reported in Appliance Magazine.

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

Note(s): Data has not been updated because market share for these products is no longer reported in Appliance Magazine.
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

Note(s): Data has not been updated because market share for these products is no longer reported in Appliance Magazine.
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	7.8	8,774
Freezers	8 - 16	11	11.3	2,420
Room Air Conditioners	7 - 13	9	6.5	5,575
Microwave Ovens	7 - 10	9	N.A.	#####
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	8.1	4,052
Gas	7 - 15	11	8.1	4,934
Facsimile Machines	3 - 5	4	N.A.	3,133
Portable Computers	2 - 4	3	N.A.	#####

Note(s): Lifetimes based on use by the first owner of the product, and do not necessarily indicate that the product stops working after this period. A replaced unit may be discarded or used elsewhere. 1) Standard-size refrigerators only. 2)Ranges include free-standing, built-in, high-oven and cooktop/oven combination units.

Source(s): Appliance Magazine, U.S. Appliance Industry: Market Share, Life Expectancy & Replacement Market, and Saturation Levels, January 2010, p. 10 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	2009 U.S. Average New Efficiency	2009 Best Available New Efficiency	
Dishwashers	EF	0.40	0.68	1.43	
Clothes Washers (2)	MEF	0.92	1.85	3.35	

Commercial Appliance Type	Efficiency Parameter (1)	2008 Stock Efficiency	U.S. Average New Efficiency	2001 Best Available New Efficiency	
Cooking Equipment:					
Electric Appliances	EF	0.73			
Gas Appliances	EF	0.53			
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, Efficiency and Consumption Trends 2009; AHAM, AHAM 2005 Fact Book, 2006, Tables 21, p. 44 and Table 22, p. 45 for residential efficiencies; EPA, ENERGY STAR Appliances Qualified Porduct Lists, www.energystar.gov, March 2011 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 2010, May 2010, Table 32 for cooking equipment stock efficiency; and BTS/OBE, Characterization of Commercial Building Appliances, Aug. 1993 for commercial efficiencies.

5.7.17 Commercial Refrigeration - Annual Primary Energy Consumption

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 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	2008
Solar Thermal Collectors (2)	**19,398**	**11,409**	**8,354**	**16,963**
Residential	N.A.	5,851	7,473	13,000
Commercial	N.A.	295	810	1,294
Industrial	N.A.	(3)	57	128
Utility	N.A.	5,236	5	294
Other	N.A.	26	10	2,247 (4)
Photovoltaics (kW) (5)	(6) 6,897	13,837	88,221	986,504

Note(s): 1) Shipments for 1980-2000 include imports and exports; 2008 shipments are domestic only. 2) Solar thermal collectors: receive solar radiation, convert it to thermal energy, and are typically used forspace heating, water heating, and heating swimming pools.3) Industrial is included in Other. 4) Other includes all exports. 5) Generate electricity by the conversionof solar radiation to electrical energy; shipments for all years include imports and exports. 6) 1982.

Source(s): EIA, Annual Energy Review 2009, August 2010, Table 10.6, p. 297 for total thermal collector shipments 1980-2008; EIA, Annual Energy Review 1991, June 1992, Table 111, p. 251 for 1990 collector sector data; EIA, Renewable Energy Annual 2001, Nov. 2002, Table 18, p. 19 for 2000 collector sector data; EIA, Renewable Energy Annual 2008, Aug. 2010, Table 2.13, p. 64 for 2008 collector sector data; EIA, Annual Energy Review 2004, Aug. 2005, Table 10.5, p. 291 for 1980-1990 PV shipments; and EIA, Renewable Energy Annual 2008, Aug. 2010, Table 3.1, p. 79 for 2000-2008 PV shipments.

5.8.2 Thermal Solar Collector Shipments, by End Use (Thousand SF) (1)

Type	2000	2005	2006	2007	2008
Pool Heating	7,863	15,041	15,362	12,076	11,973
Hot Water	367	640	1,136	1,393	1,978
Space Heating	99	228	330	189	186
Space Cooling	0	2	3	13	18
Combined Space/Water Heating	2	16	66	73	148
Process Heating	20	0	0	27	50
Electricity Generation	3	114 (2)	3,847	6	361
Total	**8,354**	**16,041**	**20,744**	**15,153**	**16,963**

Note(s): 1) Total shipments include imports and exports for all years.For 2007 and 2008, end-use values only include domestic shipments. 2) 2005 to 2006 increase in electricity generation due to shipment to the Nevada Solar One Project.

Source(s): EIA, Renewable Energy Annual 2008, Aug. 2010, Table 2.1, p. 50 for 2000-2008 total collector shipments, and Table 2.13, p. 64 for 2007-2008 end-use shipments; EIA, Renewable Energy Annual 2001, Nov. 2002, Table 18, p. 19 for 2000 end-use shipments; EIA, Renewable Energy Annual 2003, June 2005, Table 18, p. 10 for 2003 end-use shipments; EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 38, p. 22 for 2004-2005 end-use shipments; and EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2006, Table 2.10, p. 21 for 2006 end-use shipments.

5.8.3 2008 Top Five Destinations of Thermal Solar Collector Shipments

State	Percent of Domestic U.S. Shipments
Florida	35%
California	25%
Arizona	6%
Hawaii	5%
Oregon	3%

Note(s): Domestic shipments equaled 14,716 in 2008, or 87% of total U.S. shipments.
Source(s): EIA, Renewable Energy Annual 2008, Aug. 2010, Table 2.4, p. 53.

5.8.4 Thermal Solar Collector Manufacturer Statistics

-	Number of Manufacturers in 2008:	74
-	Companies with 90% of their revenue coming from solar collector sales:	49
-	Percentage of shipped solar collectors produced by top 5 manufacturers:	83%

Source(s): EIA, Renewable Energy Annual 2008, Aug. 2010, p. 43-45.

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

	Residential	**Commercial**	Industrial	Transportation	Utility	Government	Other	Total
1995	**6.3**	**8.1**	7.2	2.4	3.8	2.0	1.3	31.1
2000	**24.8**	**13.7**	28.8	5.5	6.3	4.4	4.7	88.2
2002	**29.3**	**20.6**	32.2	12.9	7.6	8.6	0.8	112.1
2003	**23.4**	**32.6**	28.0	11.1	8.5	5.5	0.3	109.4
2004	**53.9**	**74.5**	30.5	1.4	3.2	3.3	14.3	181.1
2005	**75.0**	**89.5**	22.2	1.6	0.1	28.7	9.8	226.9
2006	**95.8**	**180.9**	28.6	2.5	4.0	7.7	17.9	337.3
2007	**68.4**	**140.4**	32.7	3.6	35.3	(2)	0.0	280.5
2008	**174.0**	**253.9**	51.5	9.1	35.8	(2)	0.0	524.3

Note(s): 1) Includes imports and exports for 2000-2006. 2007-2008 only includes domestic shipments. 2) No reported shipments to the government
Source(s): EIA, Renewable Energy Annual 2008, Aug. 2010, Table 3.7, p. 85 for 2007-2008; EIA, Renewable Energy Annual 2006, Aug. 2008, Table 2.23 for 2006; EIA, Solar Thermal and Photovoltaic Collector Manufacturing Activities 2005, Aug. 2006, Table 51, p. 35 for 2004-2005; EIA, Solar Thermal and Photovoltaic

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	46	280,475	237,209	517,684
2008	66	524,252	462,252	986,504

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; and EIA, Renewable Energy Annual 2008, August 2010 Table 3.1 and Table 3.2, p. 79-80.

5.8.7 2008 Top 10 Destinations of U.S. Photovoltaic Cell and Module Export Shipments, by Country

Country	Peak Kilowatts	Percent of U.S. Exports
Germany	198,230	43%
Spain	105,555	23%
Italy	49,830	11%
France	31,196	7%
Canada	17,819	4%
Singapore	12,297	3%
South Korea	10,763	2%
Australia	8,108	2%
China	4,418	1%
Austria	4,155	1%
Total U.S. Exports	462,252	100%

Note(s): Total U.S. exports of photovoltaic cells and modules increased by 95% from 2007 to 2008.
Source(s): EIA, Renewable Energy Annual 2008, August 2010, Table 3.14, p. 92-93.

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 Total Grid-Tied PV Capacity, by State

	PV Capacity as of 2007 (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 (3)	**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. 3) Estimated total grid-tied capacity differs from Table 6.3.10.

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	0.0	103.2
2007	150.1	55.0	205.1
Cumulative (1)	**469.9**	**282.0**	**751.9**

Note(s): 1) Cumulative grid-tied capacity as of 2007 differs from total estimate in Table 6.3.9.

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

5.9.1 United States Small Wind Units and Capacity

	Units	On-Grid Units	Off-Grid Units	Capacity kW	On-Grid kW	Off-Grid kW	Sales ($ Million)
2001 (1)	2100	-	-	2,100	-	-	-
2002 (1)	3100	-	-	3,100	-	-	-
2003 (1)	3200	-	-	3,200	-	-	-
2004	4671	-	-	4,878	-	-	14.9
2005	4324	-	-	3,285	-	-	9.9
2006	8329	453	7,876	8,565	4,522	4,043	33.2
2007	9092	1,292	7,800	9,737	5,720	4,017	42.0
2008	10386	2,984	7,402	17,374	13,610	3,764	72.7
2009	9800	-	-	20,300	-	-	82.4

	Remote Off-Grid(2) (< 1 kW)	Residential-Scale (1 - 10 kW)	Commericial Scale (11 - 100 kW)
% 2008 Units	65%	34%	2%
% 2008 Capacity	16%	44%	40%

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 (AWEA), Stimmel, Ron, 2008 AWEA Small Wind Turbine Global Market Study, June 2008 for 2006 and 2007 detail; AWEA, Stimmel, Ron, 2009 AWEA Small Wind Turbine Global Market Study for 2008 detail; and AWEA, Stimmel, Ron, 2010 AWEA Small Wind Turbine Global Market Study for 2001-2009 units and capacities.

5.9.2 Average Combined Heat and Power Capacity as of 2009, 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

5.9.3 Installed Combined Heat and Power Capacity as of 2009, 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

5.9.4 Installed Combined Heat and Power Capacity as of 2009, 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

5.9.5 Installed Combined Heat and Power Capacity as of 2009, 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

5.9.6 Characteristics of Commercial Distributed Generating Technologies, by Plant Type as of 2006

	Efficiency (HHV)		Installed Capital Costs of Typical DG Technologies			Service
New Plant Type	Electrical	Electrical + Thermal	Price ($2009 per kW)	Size (kW)	Cost ($2009 thousand)	Life (years)
Solar Photovoltaic	0.16	N.A.	6,999	25	175	30
Fuel Cell	0.36	0.72	6,066	200	1,213	20
Natural Gas Engine	0.32	0.77	1,318	200	264	20
Oil-Fired Engine	0.31	0.82	1,446	200	289	20
Natural Gas Turbine	0.23	0.66	2,110	1000	2,110	20
Natural Gas Microturbine	0.30	0.63	1,890	200	378	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 2009, Aug. 2010, Appendix D, p. 383.

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
1985	34.2%	29.7%	63.8%	36.0%	0.2%	100%		7.93
1990	34.1%	30.9%	65.0%	34.9%	0.2%	100%		9.26
1995	34.6%	31.6%	66.2%	33.6%	0.2%	100%		10.28
2000	34.9%	33.9%	68.7%	31.1%	0.2%	100%		11.67
2005	37.1%	34.8%	72.0%	27.8%	0.2%	100%		12.49
2008	**37.0%**	**35.8%**	**72.8% (1)**	**27.0%**	**0.2%**	**100%**		**12.73**
2010	38.8%	36.0%	74.8%	25.0%	0.2%	100%		12.79
2015	35.4%	37.2%	72.6%	27.2%	0.2%	100%		12.97
2020	35.1%	38.4%	73.5%	26.3%	0.2%	100%		13.54
2025	35.3%	39.5%	74.9%	24.8%	0.3%	100%		14.11
2030	35.7%	40.9%	76.6%	23.1%	0.4%	100%		14.70
2035	36.1%	42.1%	78.2%	21.4%	0.4%	100%		15.27

Note(s): 1) Buildings accounted for 81% (or $294 billion) of total U.S. electricity expenditures.

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for 2008-2035 consumption, and Table A3, p. 6-8 expenditures.

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

				Renewables					
	Natural Gas	Petroleum	Coal	Hydro.	Oth(2)	Total	Nuclear	Other (3)	Total
1980	15.6%	10.8%	50.0%	11.8%	0.5%	12.3%	11.3%	(1)	100%
1985	12.1%	4.2%	56.0%	11.3%	0.8%	12.1%	15.6%	(1)	100%
1990	10.9%	4.2%	53.0%	9.8%	2.2%	12.0%	19.9%	(1)	100%
1995	12.9%	2.3%	52.1%	9.4%	2.2%	11.6%	21.1%	(1)	100%
2000	13.9%	3.0%	53.0%	7.3%	2.1%	9.4%	20.6%	(1)	100%
2005	15.2%	3.1%	52.2%	6.7%	2.3%	9.0%	20.5%	(1)	100%
2008	**17.0%**	**1.2%**	**51.0%**	**6.2%**	**2.9%**	**9.1%**	**20.9%**	**0.8%**	**100%**
2010	19.2%	1.1%	48.3%	5.9%	3.7%	9.6%	20.9%	0.8%	100%
2015	17.5%	1.1%	45.6%	7.3%	5.6%	12.9%	22.1%	0.8%	100%
2020	16.6%	1.1%	46.1%	7.2%	6.1%	13.3%	22.3%	0.7%	100%
2025	15.6%	1.1%	47.9%	6.9%	6.5%	13.4%	21.4%	0.6%	100%
2030	16.4%	1.0%	47.8%	6.8%	6.7%	13.5%	20.7%	0.5%	100%
2035	17.3%	1.0%	47.4%	6.6%	7.2%	13.8%	19.9%	0.5%	100%

Note(s): 1) Electric imports included in renewables. 2) Includes geothermal, municipal solid waste, biomass, solar thermal, solar PV, and wind. 3)

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for 2008-2035 consumption and Table A17, p. 34-35 for renewables.

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

				Renewables						Growth Rate
	Natural Gas	Petroleum	Coal	Hydro.	Oth(2)	Total	Nuclear	Other (3)	Total	2008-Year
1980	3.80	2.62	12.16	2.87	0.11	2.98	2.74	(1)	24.30	-
1985	3.16	1.09	14.59	2.94	0.21	3.15	4.08	(1)	26.06	-
1990	3.33	1.29	16.26	3.01	0.67	3.69	6.10	(1)	30.67	-
1995	4.33	0.75	17.47	3.15	0.74	3.89	7.08	(1)	33.51	-
2000	5.32	1.14	20.22	2.77	0.81	3.58	7.86	(1)	38.12	-
2005	6.04	1.23	20.74	2.67	0.90	3.57	8.16	(1)	39.74	-
2008	**6.85**	**0.47**	**20.51**	**2.49**	**1.17**	**3.67**	**8.43**	**0.31**	**40.24**	
2010	7.69	0.45	19.37	2.37	1.48	3.85	8.39	0.32	40.07	-0.2%
2015	6.96	0.43	18.10	2.88	2.22	5.11	8.77	0.31	39.68	-0.2%
2020	6.88	0.45	19.09	2.97	2.53	5.49	9.22	0.29	41.43	0.2%
2025	6.72	0.47	20.64	2.99	2.79	5.78	9.22	0.27	43.10	0.4%
2030	7.32	0.47	21.35	3.04	3.00	6.04	9.22	0.24	44.64	0.5%
2035	7.97	0.48	21.83	3.06	3.31	6.38	9.19	0.25	46.09	0.5%

Note(s): 1) Electric imports included in renewables. 2) Includes geothermal, municipal solid waste, biomass, solar thermal, solar PV, and wind. 3)

Source(s): EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for 2008-2035 consumption, and Table A17, p. 34-35 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)	2008-year
1980	346	246	1,162	276	6	282	251	N.A.	2,286	-
1985	292	100	1,402	281	11	292	384	N.A.	2,470	-
1990	265	118	1,560	290	35	324	577	61	2,905	-
1995	317	62	1,658	305	39	345	673	141	3,197	-
2000	399	98	1,911	271	45	316	754	165	3,643	-
2005	553	111	1,956	267	53	320	782	180	3,903	-
2008	**683**	**39**	**1,932**	**268**	**79**	**347**	**806**	**167**	**3,974**	**-**
2010	785	39	1,805	289	81	371	803	160	3,963	-0.1%
2015	703	38	1,753	297	199	496	839	159	3,989	0.1%
2020	700	40	1,849	298	227	525	882	152	4,148	0.4%
2025	688	41	1,990	298	244	542	882	152	4,295	0.5%
2030	790	41	2,052	299	255	554	882	153	4,472	0.5%
2035	903	42	2,092	299	271	569	879	149	4,634	0.6%

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 2011 Early Release, Dec. 2010, Table A8, p. 16-17 for 2008-2035; EIA, Annual Energy Review 2009, Aug. 2010, Table 8.2c, p. 230 for 1990-2007; 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
1985	N.A.	N.A.	N.A.	N.A.	79.4	0.0	564.4
1990	302.3	N.A.	N.A.	N.A.	99.6	19.5	628.4
1995	306.0	N.A.	N.A.	N.A.	99.5	21.4	654.6
2000	310.2	N.A.	N.A.	N.A.	97.9	19.5	693.3
2005	309.0	N.A.	N.A.	N.A.	100.0	21.3	855.6
2008	**304.4**	**114.6**	**157.1**	**131.70**	**100.6**	**21.8**	**830.2**
2010	313.5	113.2	166.0	135.53	101.1	21.8	851.1
2015	312.8	100.4	171.0	137.39	105.7	21.8	849.2
2020	314.2	90.6	171.1	142.63	111.1	21.8	851.6
2025	314.2	90.1	177.0	152.78	111.1	21.8	867.0
2030	314.2	90.1	201.2	165.26	111.1	21.8	903.7
2035	314.5	88.1	224.9	179.10	111.1	21.8	939.5

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

Source(s): EIA, Annual Energy Outlook 1994, Jan. 1994, Table A9, p. 66 and Table A16, p. 73 for 1990; EIA, Annual Energy Review 2009, Aug. 2010, Table 8.11b; and EIA, AEO 2011 Early Release, Dec. 2010, Table A9, p. 20-21 and Table A16, p. 32-33 for 2008-2035.

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

	Conv. Hydropower	Geothermal	Municipal Solid Waste	Biomass	Solar Thermal	Solar PV	Wind	Total
1980	81.7	0.9	0.0	0.1	N.A.	N.A.	N.A.	82.7
1985	88.9	1.6	0.2	0.2	0.0	N.A.	0.0	90.8
1990	73.3	2.7	2.1	1.2	0.3	N.A.	1.8	81.4
1995	77.4	3.0	3.0	1.8	0.3	N.A.	1.7	87.3
2000	78.2	2.8	3.3	1.7	0.4	N.A.	2.4	88.8
2005	76.9	2.3	3.0	1.6	0.4	N.A.	8.7	92.9
2008	**76.9**	**2.4**	**3.4**	**2.2**	**0.5**	**0.0**	**24.9**	**110.3**
2010	76.9	2.4	3.4	2.2	0.6	0.1	37.5	123.0
2015	77.4	2.6	3.4	2.2	1.3	0.2	51.8	138.7
2020	77.6	3.1	3.4	2.2	1.3	0.2	51.9	139.7
2025	78.2	3.8	3.4	2.2	1.3	0.3	54.2	143.3
2030	79.1	4.7	3.4	2.2	1.3	0.4	55.3	146.5
2035	79.7	5.8	3.4	2.2	1.4	0.6	56.4	149.4

Source(s): EIA, Annual Energy Review 2009, Aug. 2010, Table 8.11b for 1980-2007; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A9, p. 20-21 and Table A16, p. 32-33 for 2008-2035.

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

Electric Generator	Typical New Plant Capacity (MW)	Number of New Power Plants to Meet Demand 2010	2015	2020	2025	2030
Coal Steam	600	9	19	23	23	23
Combined Cycle	400	2	17	18	32	93
Combustion Turbine/Diesel	160	8	37	75	138	216
Nuclear Power	1,350	-	1	5	5	5
Pumped Storage	145 (2)	-	-	-	-	-
Fuel Cells	10	-	-	-	-	-
Conventional Hydropower	20 (2)	-	27	38	67	117
Geothermal	50	-	3	13	27	47
Municipal Solid Waste	30	-	-	-	-	-
Wood and Other Biomass	80	-	-	-	-	-
Solar Thermal	100	1	7	7	8	8
Solar Photovoltaic	5	7	24	37	55	76
Wind	50	252	535	537	581	604
Total		**280**	**674**	**757**	**944**	**1,202**
Distributed Generation	160 (3)					

Note(s): 1) Cumulative additions after Dec. 31, 2009. 2) Based on current stock average capacity. 3) Combustion turbine/diesel data used.

Source(s): EIA, Annual Energy Outlook (AEO) 2011 Early Release, Dec. 2010, Table A9, p. 20-21 and Table A16, p. 32-33; EIA, Assumption to the AEO 2010, May 2010, Table 8.2, p. 91; 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 2009 Existing Capacity, by Energy Source (GW)

Plant Fuel Type	Number of Generators	Generator Nameplate Capacity	Net Summer Capacity	Net Winter Capacity
Coal	1,436	339	314	316
Petroleum	3,757	63	57	61
Natural Gas	5,470	460	401	432
Other Gases	98	2	2	2
Nuclear	104	107	101	102
Hydroelectric Conventional	4,005	78	79	78
Wind	620	35	34	34
Solar Thermal and Photovoltaic	110	1	1	1
Wood and Wood Derived Fuels	353	8	7	7
Geothermal	222	3	2	3
Other Biomass	1,502	5	4	4
Pumped Storage	151	21	22	22
Other	48	1	1	1
Total	**17,876**	**1,122**	**1,025**	**1,064**

Source(s): EIA, Electric Power Annual 2009, Jan. 2011, Table 1.2, p. 17.

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	18.90%
1996	602.4	730.4	17.50%
1997	618.4	737.9	16.20%
1998	638.1	744.7	14.30%
1999	653.9	765.7	14.60%
2000	680.9	808.1	15.70%
2001	674.8	789.0	14.50%
2002	696.4	833.4	16.40%
2003	696.8	856.1	18.60%
2004	692.9	875.9	20.90%
2005	746.5	882.1	15.40%
2006	776.5	891.2	12.90%
2007	766.8	914.4	16.10%
2008	744.2	909.5	18.20%
2009	713.1	916.4	22.20%

Note(s): 1) Net internal demand represents 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 for 1995-1997; and EIA, Electric Power Annual 2009, Nov. 2010, Table 4.2, p. 41 for 1998-2009.

6.2.3 Electric Capacity Factors, by Year and Fuel Type (1)

	Coal	Petroleum	Natural Gas	Nuclear	Conventional Hydroelectric	Solar/PV	Wind	Total
1990	58.9%	17%	23%	66%	45%	13%	18%	46%
1995	61.8%	11%	22%	77%	45%	17%	21%	47%
2000	70.3%	18%	22%	88%	40%	15%	27%	51%
2001	68.2%	20%	21%	89%	31%	16%	20%	48%
2002	69.0%	16%	18%	90%	38%	16%	27%	46%
2003	70.9%	21%	14%	88%	40%	15%	21%	44%
2004	71.0%	22%	16%	90%	39%	17%	25%	45%
2005	72.2%	22%	17%	89%	40%	15%	23%	45%
2006	71.4%	11%	19%	90%	42%	14%	27%	45%
2007	72.5%	12%	21%	92%	36%	14%	24%	46%
2008	71.2%	8%	20%	91%	37%	18%	26%	45%
2009 (2)	63.2%	6%	21%	90%	40%	15%	24%	42%

Note(s): 1) EIA defines capacity factor to be "the ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period. 2) Preliminary.

Source(s) EIA, Annual Energy Review 2009, Aug. 2010, 8.2c, p. 232 and Table 8.11b, p. 265.

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 (2008-year)
1980	29.3%	11,645	-
1985	30.2%	11,281	-
1990	30.1%	10,834	-
1995	30.5%	10,637	-
2000	30.5%	10,658	-
2005	31.3%	10,467	-
2008	**31.6%**	**10,303**	-
2010	31.9%	10,688	-1.9%
2015	32.7%	10,436	-0.2%
2020	32.7%	10,440	-0.1%
2025	32.7%	10,423	-0.1%
2030	32.9%	10,362	0.0%
2035	33.1%	10,302	0.0%

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

Percent of Electric Generator Fuel Input	2.6%
Percent of Net Electricity Generated (4)	7.4%

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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for generator consumption and Table A8, p. 18-19 for electricity sales; EIA, Annual Energy Review 2009, Aug. 2010, Figure 8.0, p. 225 for T&D losses; EIA, State Energy Data Report 2008, Jun. 2010 Tables 8-12 for Electricity Consumption and Generator Fuel Consumption.

6.2.5 2008 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)
Coal	51%	236	36
Petroleum	1%	17	94
Natural Gas	17%	84	136
Nuclear	21%	1,029	3
Renewable (3)	9%	127	182
Total	100%		**450**

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 2008. 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 2009, Jan. 2011, Table 1.2, p. 17; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A2, p. 3-5 for consumption and Table A8, p. 18-19 for electricity supply.

6.2.6 Cost of an Electric Quad Used in the Buildings Sector ($2009 Billion)

	Residential	Commercial	**Buildings Sector**
1980	10.58	10.82	10.69
1985	11.69	11.49	11.60
1990	10.53	9.72	10.15
1995	10.14	9.17	9.67
2000	9.13	8.14	8.64
2005	9.53	8.75	9.15
2008	**11.52**	**10.59**	**11.06**
2010	11.77	9.98	10.91
2015	11.48	9.69	10.57
2020	11.28	9.55	10.37
2025	11.22	9.59	10.36
2030	11.27	9.61	10.39

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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A3, p. 6-8; EIA, State Energy Data 2008: Consumption, Jun. 2010, Tables 8-12, p. 18-22 for 1980-2005; EIA, State Energy Data 2008: Prices and Expenditures, Jun. 2010, Tables 2-3, p. 24-25 for 1980-2005 and prices; and EIA, Annual Energy Review 2009, Aug. 2010, Appendix D, Gross Domestic Product and Implicit Price Deflators, p. 383.

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

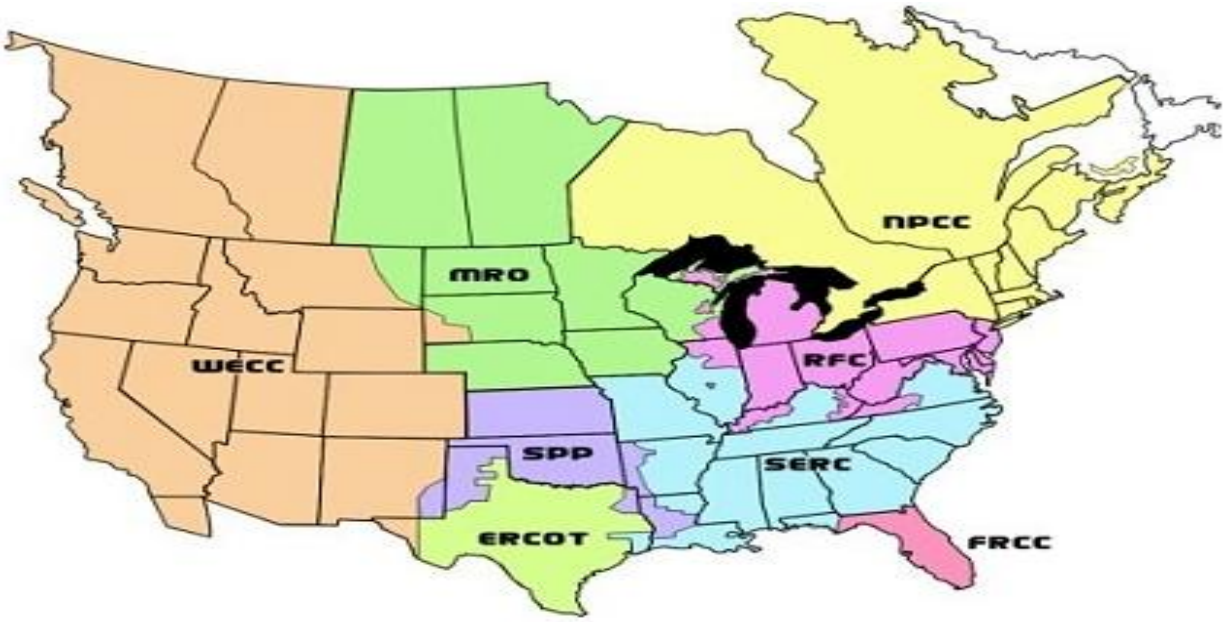
New Plant Type	Heatrate (1) in 2009 (Btu/kWh)	Size (MW)	Overnight Costs (2) (2008 $/kW)	Total Capital Costs of Typical New Plant ($2008 million)
Scrubbed Coal	9,200	600	2223	1334
Integrated Coal-Gasification Combined Cycle (IGCC)	8,765	550	2569	1413
IGCC w/Carbon Sequestration	10,781	380	3776	1435
Conv. Gas/Oil Combined Cycle	7,196	250	984	246
Adv. Gas/Oil Combined Cycle	6,752	400	968	387
Conv. Combustion Turbine	10,788	160	685	110
Adv. Combustion Turbine	9,289	230	948	218
Fuel Cell	7,930	10	5478	55
Advanced Nuclear	10,488	1350	3820	5157
Municipal Solid Waste	13,648	30	2599	78
Conventional Hydropower (3)	9,884	500	2291	1146
Wind	9,884	50	1966	98

Stock Plant Type	2008	2010	2015	2020	2025	2030
Fossil Fuel Steam Heat Rate (Btu/kWh)	9,893	9,872	9,619	9,653	9,706	9,609
Nuclear Energy Heat Rate (Btu/kWh)	10,453	10,453	10,453	10,453	10,453	10,453

Note(s): 1) Plant use of electricity is included in heat rate calculations; however, transmission and distribution losses of the electric grid are excluded.
2) Overnight costs represent the capital costs of new projects initiated in 2009. Includes contingency factors and exlcudes interest charges.
3) Hydro costs and performance characteristics are site-specific. This table provides the cost of the least expensive plant that could be built in the Northwest Power Pool region, where most proposed sites are located.

Source(s): EIA, Assumptions to the AEO 2010, Apr. 2010, Table 8.2. p. 91 for 2009 plant characteristics; EIA, Annual Energy Outlook 2008, Mar. 2008, Table A2, p. 117-119, and Table A8, p. 131-132 for estimated stock plant heat rates.

6.2.8 NERC Regions Map



Source(s): EIA, Form EIA-411, Coordinated Bulk Power Supply Program Report, Feb. 2007

6.2.9 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.

6.2.10 Top 10 U.S. States by Existing Wind Power Capacities

	Existing Capacity		Capacity Under Construction
State	(MW)	(%)	(MW)
Texas	9,727	27%	350
Iowa	3,670	10%	0
California	2,739	7%	443
Oregon	2,095	6%	201
Washington	1,964	5%	735
Illinois	1,848	5%	587
Minnesota	1,818	5%	677
New York	1,274	3%	95
Colorado	1,248	3%	552
Indiana	1,238	3%	99
U.S. Total	**36,698**		**6,925**

Note(s): Estimates of existing capacity and capacity under construction are current as of September 2010. Does not include small wind projects, i.e. those with capacities of 100 kW or less. Data provided by AWEA member companies and updated quarterly.

Source(s): American Wind Energy Association (AWEA), U.S. Projects Database, accessed February 2011 at <http://archive.awea.org/projects/default.aspx>.

6.3.1 Natural Gas Overview (Trillion Cubic Feet)

	Production	Supplemental Gas	Net Import	Storage Withdrawal	Balancing Item (1)	Consumption (2)
1980	19.40	0.15	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
2008	**20.29**	**0.06**	**2.98**	**0.03**	**-0.13**	**23.23**
2010	21.32	0.07	2.76	-0.51	0.26	23.89
2015	22.10	0.06	2.78	-0.14	0.07	24.87
2020	23.02	0.06	2.13	-0.12	0.06	25.15
2025	23.64	0.06	1.30	-0.10	0.05	24.96
2030	24.71	0.06	0.97	-0.07	0.04	25.70
2035	26.10	0.06	0.32	-0.05	0.02	26.45

Note(s): 1) Quantities lost an imbalances in data due to differences among data sources. Excludes intransit shipments that cross the U.S.-Canada border. 2) Natural gas consumption statistics are compiled from surveys of natural gas production, transmission, and distribution companies and from surveys of electric power generation. Consumption by sector from these surveys is compiled on a national and individual State basis and then balanced with national and individual State supply data.

Source(s): EIA, Annual Energy Review 2009, Aug. 2010, Table 6.1, p. 187 for 1980-2008; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A13, p. 27-28 for 2009-2035.

6.3.2 Natural Gas in Underground Storage (Billion Cubic Feet)

	Base Gas	Working Gas	Total	Underground Storage Capacity	
1980	3,642	2,655	6,297	7,434	85%
1990	3,868	3,068	6,936	7,794	89%
2000	4,352	1,719	6,071	8,241	74%
2001	4,301	2,904	7,204	8,415	86%
2002	4,340	2,375	6,715	8,207	82%
2003	4,303	2,563	6,866	8,206	84%
2004	4,201	2,696	6,897	8,255	84%
2005	4,200	2,635	6,835	8,268	83%
2006	4,211	3,070	7,281	8,330	87%
2007	4,234	2,879	7,113	8,402	85%
2008	4,232	2,840	7,073	8,499	83%

Source(s): EIA, Annual Energy Review 2009, August 2010, Table 6.6, p. 197.

6.3.3 Natural Gas Well Productivity

	Gross Withdrawals from Wells (billion cubic feet)	Producing Wells (thousand)	Average Productivity (thousand cubic feet per day)
1980	17,573	182	96,550
1990	16,054	269	59,657
2000	17,726	276	57,964
2001	18,129	373	48,565
2002	17,795	388	45,890
2003	17,882	393	45,463
2004	17,885	406	44,036
2005	17,472	426	41,025
2006	17,996	441	40,851
2007	17,065	453	37,676
2008	18,011	479	37,636
2009	18,881	496	38,089

Source(s): EIA, Annual Energy Review 2009, August 2010, Table 6.4, p. 193.

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	0.63	3.68	19.88
1990	4.39	2.62	8.25	0.66	3.24	19.17
2000	5.00	3.18	9.29	0.65	5.21	23.33
2008	**4.87**	**3.13**	**7.88**	**0.67**	**6.67**	**23.22**
2010	4.77	3.10	7.84	0.68	7.50	23.89
2015	4.80	3.35	9.25	0.68	6.79	24.87
2020	4.84	3.48	9.42	0.70	6.72	25.15
2025	4.83	3.55	9.30	0.73	6.56	24.96
2030	4.82	3.66	9.31	0.77	7.14	25.70
2035	4.77	3.80	9.31	0.81	7.78	26.45

Source(s): EIA, Annual Energy Review 2009, December 2010, Table 6.5, p. 195 for 1980-2000; and EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A13, p. 26-27 for 2008-2035

6.3.6 Top 10 Natural Gas Producing States, 2009 (1)

State	Marketed Production (2) (billion cubic feet)	Share of U.S. Production
Texas	6,819	32%
Wyoming	2,335	11%
Oklahoma	1,858	9%
Louisiana	1,549	7%
Colorado	1,499	7%
New Mexico	1,383	6%
Arkansas	680	3%
Utah	444	2%
Alaska	397	2%
Kansas	354	2%
		80%
Total U.S. Production	21,604	

Note(s): 1) State production includes offshore production in state waters, where applicatble. Offshore production from federal waters in the Gulf of Mexico totaled 2,429 billion cubic feet, or 11% of U.S. Production, in 2009. 2) Marketed production equals gross withdrawals less gas used for repressuring, quantitites vented and flared, and nonhydrocarbon gases removed in treating or processing operations. Includes all quanitities of gas used in field and processing plant operations.

Source(s): EIA, Natural Gas Annual 2009, Dec. 2010, Table 2, p. 4 for values and p. 183 for definitions.

6.4.1 Emissions of Carbon Dioxide from Electric Utilities (Million Metric Tons)

1990	1,980
1995	1,955
2000	2,301
2005	2,397
2008	**2,357**
2010	2,298
2015	2,139
2020	2,218
2025	2,359
2030	2,459

Source(s): EIA, Emissions of Green House Gases in the United States 2006, p. 16, November 2007; EIA, Annual Energy Outlook 2011 Early Release, Dec. 2010, Table A18, p. 36.

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
2008	**1.00**	**9.05**	**48.50**	**0.00**	**0.30**	**58.84**
2009	0.00	0.29	0.00	0.00	0.00	0.29
2010	0.00	1.15	0.00	0.00	0.00	1.15
2011	0.00	0.55	0.00	0.00	0.00	0.55
2012	0.00	0.00	0.00	0.00	0.00	0.00
2013	0.00	0.20	0.00	0.00	0.00	0.20
2014	0.00	0.00	0.00	0.00	0.00	0.00
2015	0.00	0.18	0.00	0.00	0.00	0.18
2016	0.00	0.02	0.00	0.00	0.00	0.02
2017	0.00	0.10	0.00	0.00	0.00	0.10
2018	0.00	0.21	0.00	0.00	0.00	0.21
2019	0.00	0.24	0.00	0.00	0.00	0.24
2020	0.00	0.07	0.00	0.00	0.00	0.07
2021	0.00	0.02	0.00	0.00	0.00	0.02
2022	0.00	0.00	0.00	0.00	0.00	0.00
2023	0.00	0.00	0.00	0.00	0.00	0.00
2024	0.00	0.00	0.00	0.00	0.00	0.00
2025	0.00	0.00	0.28	0.00	0.00	0.28
2026	0.00	0.00	0.70	0.00	0.00	0.70
2027	0.00	0.05	1.03	0.00	0.00	1.08
2028	0.00	0.26	1.21	0.00	0.00	1.47
2029	0.00	0.37	1.57	0.00	0.00	1.94
2030	0.00	0.59	1.80	0.00	0.00	2.38
2031	0.00	1.01	2.46	0.00	0.00	3.47
2032	0.00	1.18	2.55	0.00	0.00	3.73
2033	0.00	1.34	2.76	0.00	0.00	4.10
2034	0.00	0.00	0.00	0.00	0.00	0.00
2035	0.00	0.00	0.00	0.00	0.00	0.00

Note(s): 1) This table provides estimates of the carbon emissions resulting from consumption of a primary quad at electric utilities. Projected (2009-2035) 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 2009-2010. 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 2011 Early Release, Dec. 2010, Table A2, p. 3-5 and Table A18, p. 36.

6.5.1 2009 Spending by Ratepayer-Funded Electric and Gas Efficiency Programs

	Total Program Expenditures in 2009 by Customer Class ($millions)						
	Efficiency Programs						
Region (1)	C&I (2)	Residential	Low Income	Other (3)	Total	Load Mgmt.	Grand Total
New England	203	135	49	12	399	8	406
Mid-Atlantic	338	139	139	24	640	13	653
Midwest	224	186	83	89	581	102	683
South Central	50	66	42	13	171	70	241
South Atlantic	37	131	7	30	205	277	481
Pacific NW	132	118	18	78	345	19	364
Pacific West	540	277	210	106	1,133	257	1,390
Southwest	84	143	15	13	255	48	302
Additional (4)	8	22	22	7	58	0	58
United States	1,615	1,217	583	371	3,786	793	4,579

	Electric Program Expenditures in 2009 by Customer Class ($millions)						
	Efficiency Programs						
Region (1)	C&I (2)	Residential	Low Income	Other (3)	Total	Load Mgmt.	Grand Total
New England	186	99	37	12	333	8	341
Mid-Atlantic	305	82	69	24	479	13	491
Midwest	190	125	26	64	404	102	505
South Central	50	64	42	13	168	70	238
South Atlantic	36	122	5	30	192	277	469
Pacific NW	122	100	15	76	312	19	331
Pacific West	476	239	106	84	904	257	1,161
Southwest	82	91	9	9	191	48	239
United States	1,445	921	308	311	2,983	793	3,776

	Gas Program Expenditures in 2009 by Customer Class ($millions)				
	Efficiency Programs				
Region (1)	C&I (2)	Residential	Low Income	Other (3)	Total
New England	17	37	12	0	66
Mid-Atlantic	34	57	71	0	162
Midwest	34	61	57	25	177
South Central	1	2	0	0	3
South Atlantic	1	9	2	1	12
Pacific NW	10	19	3	2	33
Pacific West	64	38	104	22	228
Southwest	2	52	6	4	63
Additional (4)	8	22	22	7	58
United States	170	296	276	61	803

Note(s): (1) Regions match Census divisions and Census regions except for "Pacific NW" (ID, MT, OR, WA), "Pacific West" (AK, CA, HI), and "Southwest" (AZ, CO, NV, NM, UT, WY). (2) Commercial and Industrial. (3) In cases in which EM&V is not allocated by customer class, it is included in "other." (4) Total of gas budgets from respondents that did not grant permission to release their data at the state level. This total includes data from CO, ID, IL, KY, MI, NY, OH, PA, TX, and WA.

Source(s): Consortium for Energy Efficiency, "State of the Efficiency Program Industry: 2009 Expenditures, Impacts & 2010 Budgets," Dec. 10, 2010. Tables 3, 5, and 8.

6.5.2 Funding for States with Active Public Benefit Efficiency 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,

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

6.5.3 Demand-Side Management Funds Collected for Energy Effciency Programs in 2000 (1)

	Total Expenditures ($2009 million)	Per Capita Spendings ($2009/person)
Connecticut	82.2	24.12
Massachusetts	122.8	19.32
Rhode Island	17.3	16.51
New Jersey	137.8	16.34
Vermont	7.8	12.76
Maine	15.6	12.23
Wisconsin	60.9	11.34
Hawaii	13.6	11.23
New York	201.6	10.62
California	355.0	10.44
National (2)	**1,356**	**4.81**

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; and EIA, Annual Energy Review 2009, August 2010, Appendix D, p. 383 for price inflators.

7.1.1 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.

7.1.2 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.

7.1.3 State Energy Efficient Appliance Rebate Program

	Planned Program Total			Program to Date (Dec. 31, 2010)		
Home Appliances	Number of	Average	Rebates	Number of	Average	Rebates
Air Conditioners (Room)	214,317	51	10,912	28,089	65	1,814
Clothes Washers	579,412	112	64,996	480,202	110	52,832
Dishwashers	229,865	94	21,603	244,910	91	22,203
Freezers	43,580	95	4,142	21,682	94	2,029
Refrigerators	558,773	137	76,583	487,599	133	64,798
HVAC						
Air Conditioners (Central)	38,800	298	11,543	30,654	403	12,365
Boiler Reset Controls	350	100	35	158	100	16
Boilers (Gas)	7,128	356	2,534	2,785	632	1,759
Boilers (Oil)	13,311	316	4,205	2,161	425	919
Boilers (Propane)	800	300	240	43	214	9
Furnaces (Gas)	79,051	305	24,141	61,103	396	24,212
Furnaces (Oil)	4,754	236	1,122	406	379	154
Furnaces (Propane)	4,361	432	1,885	1,022	314	321
Heat Pumps (Air Source)	35,317	340	12,010	33,199	487	16,160
Heat Pumps (Ground Source)	3,376	387	1,306	1,675	912	1,528
Water Heaters						
Electric Heat Pump	24,030	256	6,144	3,099	278	861
Gas Condensing	5,629	165	927	0	0	0
Gas Storage	73,448	114	8,372	14,974	123	1,842
Gas Tankless	37,183	217	8,085	9,029	263	2,375
Indirect	375	150	56	262	150	39
Propane Storage	4,420	47	208	126	151	19
Propane Tankless	1,080	300	324	119	192	23
Solar, Electric Backup	5,710	242	1,380	293	735	215
Solar, Gas Backup	4,847	459	2,223	94	1,267	119
Solar, Indirect Backup	380	750	285	28	1,107	31
All Products	**1,970,297**	**135**	**265,262**	**1,423,712**	**145**	**206,641**

Note(s): Planned program totals based on state plans submitted to the U.S. Department of Energy. Actual results based on state reporting to the U.S. Department of Energy through 12/31/2010. This program was created under the Energy Policy Act of 2005 and received $300 million in funding through the American Recovery and Reinvestment Act of 2009. Under this program, eligible consumers may obtain rebates on the purchase of new energy-efficient appliances when they replace used appliances. Additional information at http://www.energysavers.gov/financial/70000.html

Source(s): U.S. Department of Energy

7.1.4 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.

7.1.5 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.

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

			Montreal Protocol Reduction		U.S. Clean Air Act Reduction	
Gas	Manufacturing Base Level (2)	Manufacturing Freeze (3)	%	By	%	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	35.0%	2004	35%	2003
			75.0%	2010	75%	2010
			90.0%	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.

7.1.7 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.

7.1.8 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.

7.1.9 The Clean Air Act

1970 Amendments

- Established the National Ambient Air Quality Standards (NAAQS) for stationary sources and placed limits on mobile sources.
- Established the New Source Performance Standards (NSPS) which mandated a strict limit on emissions from new pollution sources.
- Expanded on the State Implemenation Plans (SIPs) to carry out mandates.

1977 Amendments

- Categorized regions into attinment 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 with regards to mobile emissions sources.

1990 Amendments

- Established a sulfur 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 trade (bought and sold) amongst polluting parties to minimize cost.
- Mandated the control of 189 hazardous pollutants.
- Updated and expanded provisions of the NAAQS.

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 Air Act, accessed February 2011 at <http://www.epa.gov/air/caa/caa_history.html>

7.2.1 Tax Incentives of the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010

Energy Efficient Appliance Credit (modified and extended through 2011)
--$25-75 for efficient dishwashers.
--$175-225 for efficient clothes washers
--$150-200 for efficient refrigerators.

Credit for Efficiency Improvements to Existing Homes (modified and extended through 2011)
--Tax credit equal to 10% of the amount paid or incurred by the taxpayer for a qualifying energy efficiency improvement, up to a maximum of $500.
--This includes up to $50 for any advanced main air circulating fan, $150 for qualifying natural gas, propane, or oil furnaces or hot water boilers, and $300 for "any item of energy-efficient building property."

Efficient New Homes
--Extends the tax credit for new energy efficient homes through 2011.

Source(s): Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010. December 17, 2010. Public Law 111-312; and The United States Senate Committee on Finance, Summary of the Reid-McConnell Tax Relief, Unemployment Insurance Reauthorization and Job Creation Act of 2010. December 10, 2010.

7.2.2 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.

7.2.3 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.

7.2.4 Tax Incentives 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.

7.2.5 Tax Incentives 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.

7.2.6 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.

7.2.7 Federal Energy Efficiency Tax Credits for Individuals, Number and Average Value of Credits Claimed

	2006		2007		2008	
	Number of Tax Returns	Average Value ($)	Number of Tax Returns	Average Value ($)	Number of Tax Returns	Average Value ($)
Insulation material (QE)	*1,460,348*	*1,706*	*1,353,994*	*1,681*	*N/A*	*N/A*
Exterior windows including skylights (QE)	*1,871,128*	*1,557*	*1,690,107*	*2,426*	*N/A*	*N/A*
Exterior doors (QE)	*1,418,741*	*1,303*	*1,404,330*	*1,293*	*N/A*	*N/A*
Metal roof with coatings (QE)	*69,920*	*4,634*	*98,777*	*5,157*	*N/A*	*N/A*
Subtot. energy efficiency improvements (QE)	*3,353,701*	*2,260*	*3,273,733*	*2,154*	*N/A*	*N/A*
Subtot. energy efficiency improvements (C)	3,352,062	226	3,273,732	215	N/A	N/A
Energy-efficient building property (C) (1)	676,289	291	989,831	291	N/A	N/A
Furnace or hot water boiler (C)	1,080,293	149	874,188	149	N/A	N/A
Advanced main air circulating fan (C)	234,435	50	216,929	49	N/A	N/A
Subtotal residential energy property (C)	1,674,696	220	1,722,322	249	N/A	N/A
Total nonbusiness energy property (2)	4,314,054	222	4,292,496	219	N/A	N/A
Solar electric property (QE)	*25,854*	*11,026*	*33,822*	*11,207*	*92,052*	*5,206*
Solar electric property (C)	25,551	1,239	33,822	1,134	92,052	841
Solar water heating property (QE)	*24,357*	*4,399*	*26,211*	*4,108*	*61,339*	*3,607*
Solar water heating property (C)	24,357	859	26,211	1,055	61,339	911
Fuel cell property (QE)	*1,519*	*2,048*	*1,344*	*2,166*	*8,845*	*1,961*
Fuel cell property (C)	1,006	729	1,344	650	8,841	584
Small wind energy property (QE)	*N/A*	*N/A*	*N/A*	*N/A*	*5,104*	*42,179*
Small wind energy property (C)	N/A	N/A	N/A	N/A	5,101	1,526
Geothermal heat pump property (QE)	*N/A*	*N/A*	*N/A*	*N/A*	*58,502*	*8,276*
Geothermal heat pump property (C)	N/A	N/A	N/A	N/A	58,502	1,330
Total residential energy-efficient property (QE)	*49,460*	*1,078*	*67,281*	*1,183*	*220,211*	*1,118*
Total residential energy-efficient property (2)	44,616	963	61,302	1,132	201,389	1,048
Grand total residential energy credits (2)	**4,344,189**	**230**	**4,325,767**	**233**	**201,389**	**1,048**

Note(s): N/A = Credit not available. (QE) Qualifying expense. (C) Credit. (1) Includes certain high-efficiency heat pumps; central air conditioners; heat pump, natural gas, propane, and oil water heaters; and biomass stoves. (2) After adjustments for other credits, etc.

Source(s): Dept. of the Treasury, Internal Revenue Service, "2006 Estimated Data Line Counts Individual Income Tax Returns" (August 2008), "2007 Estimated Data Line Counts Individual Income Tax Returns" (August 2009), and "2008 Estimated Data Line Counts Individual Income Tax Returns" (August 2010).

7.3.1 Efficiency Standards for Residential Central Air Conditioners and Heat Pumps (1)

Type	SEER (3)	HSPF (4)
Split System Air Conditioners	13.0	--
Split System Heat Pumps	13.0	7.7
Single Package Air Conditioners	13.0	--
Single Package Heat Pumps	13.0	7.7
Through-the-Wall Air Conditioners and Heat Pumps:		
-Split System (2)	10.9	7.1
-Single Package (2)	10.6	7.0
Small Duct, High Velocity Systems	13.0	7.7
Space Constrained Products		
-Air Conditioners	12.0	--
-Heat Pumps	12.0	7.4

Note(s): 1) Effective for products manufactured on or after January 23, 2006. 2) Applies to products manufactured prior to January 23, 2010. 3) Seasonal Energy Efficiency Ratio. 4) Heating Seasonal Performance Factor.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.3.2 Efficiency Standards for Residential Furnaces

Effective for products manufactured before November 19, 2015

	AFUE (%) (2)
Furnaces (excluding classes noted below)	78
Mobile Home Furnaces	75
Small Furnaces with input rate < 45,000 Btu/hr (1)	
- Weatherized (outdoor)	78
- Non-Weatherized (indoor)	78

Effective for products manufactured on or after November 19, 2015

	AFUE (%) (2)
Non-Weatherized Gas Furnaces	80
Weatherized Gas Furnaces	81
Mobile Home Oil-Fired Furnaces	75
Mobile home Gas Furnaces	80
Non-Weatherized Oil-Fired Furnaces	82
Weatherized Oil-Fired Furnaces	78

Note(s): 1) Excludes those intended solely for installation in mobile homes. 2) Annual Fuel Utilization Efficiency.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.3.3 Efficiency Standards for Residential Boilers

Effective for products manufactured before September 1, 2012

	AFUE(%) (1)
Boilers (excluding gas steam)	80
Gas Steam Boilers	75

Effective for products manufactured on or after September 1, 2012 (2)

	AFUE (%) (1)	Design Requirements
Gas Hot Water	82	No Constant Burning Pilot Automatic Means for Adjusting Water Temperature
Gas Steam	80	No Constant Burning Pilot
Oil Hot Water	84	Automatic Means for Adjusting Water Temperature
Oil Steam	82	None
Electric Hot water	None	Automatic Means for Adjusting Water Temperature
Electric Steam	None	None

Note(s): 1) Annual Fuel Utilization Efficiency. 2) Boilers manufactured to operate without any need for electricity, an electric connection, electric gauges, electric pumps, electric wires, or electric devices are not required to comply with the revised standards that take effect September 1, 2012. These must, however, meet the standards that were effective prior to September 1, 2012.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.3.4 Efficiency Standards for Residential Direct Heating Equipment, Including Pool Heaters

Effective for products manufactured January 1, 1990 through April 15, 2013

Direct Heating Equipment Type	Standard Level (1) (AFUE %)
Gas wall fan type up to 42,000 Btu/hr	73
Gas wall fan type over 42,000 Btu/hr	74
Gas wall gravity type up to 10,000 Btu/hr	59
Gas wall gravity type over 10,000 Btu/hr up to 12,000 Btu/hr	60
Gas wall gravity type over 12,000 Btu/hr up to 15,000 Btu/hr	61
Gas wall gravity type over 15,000 Btu/hr up to 19,000 Btu/hr	62
Gas wall gravity type over 19,000 Btu/hr up to 27,000 Btu/hr	63
Gas wall gravity type over 27,000 Btu/hr up to 46,000 Btu/hr	64
Gas wall gravity type over 46,000 Btu/hr	65
Gas floor up to 37,000 Btu/hr	56
Gas floor over 37,000 Btu/hr	57
Gas room up to 18,000 Btu/hr	57
Gas room over 18,000 Btu/hr up to 20,000 Btu/hr	58
Gas room over 20,000 Btu/hr up to 27,000 Btu/hr	63
Gas room over 27,000 Btu/hr up to 46,000 Btu/hr	64
Gas room over 46,000 Btu/hr	65
Gas-fired pool heater	Thermal Efficiency = 78%

Effective for products manufactured on or after April 16, 2013

Direct Heating Equipment Type	Standard Level (1) (AFUE %)
Gas wall fan type up to 42,000 Btu/hr	75
Gas wall fan type over 42,000 Btu/hr	76
Gas wall gravity type up to 27,000 Btu/hr	65
Gas wall gravity type over 27,000 Btu/hr up to 46,000 Btu/hr	66
Gas wall gravity type over 46,000 Btu/hr	67
Gas floor up to 37,000 Btu/hr	57
Gas floor over 37,000 Btu/hr	58
Gas room up to 20,000 Btu/hr	61
Gas room over 20,000 Btu/hr up to 27,000 Btu/hr	66
Gas room over 27,000 Btu/hr up to 46,000 Btu/hr	67
Gas room over 46,000 Btu/hr	68
Gas hearth up to 20,000 Btu/hr	61
Gas hearth over 20,000 Btu/hr up to 27,000 Btu/hr	66
Gas hearth over 27,000 Btu/hr up to 46,000 Btu/hr	67
Gas hearth over 46,000 Btu/hr	68
Gas-fired pool heater	Thermal Efficiency = 82%

Note(s): 1) Annual Fuel Utilitization Efficiency.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010; Energy Conservation Standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters: Final Rule, Federal Register, 75 FR 20112, April 16, 2010.

7.3.5 Efficiency Standards for Residential Dehumidifiers

Effective for products manufactured between October 1, 2007 and November 30, 2012

Product Capacity (pints/day)	Minimum Energy Factor (liters/kWh)
25.00 or less	1.00
25.01-35.00	1.20
35.01-54.00	1.30
54.01-74.99	1.50
75.00 or more	2.25

Effective for products manufactured on or after October 1, 2012

Product Capacity (pints/day)	Minimum Energy Factor (liters/kWh)
35.00 or less	1.35
35.01-45.00	1.50
45.01-54.00	1.60
54.01-75.00	1.70
75.00 or more	2.50

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.4.1 Efficiency Standards for Commercial Warm Air Furnaces

Effective for products manufactured on or after January 1, 1994

	Thermal Efficiency (1)
Gas-fired, with capacity ≥ 225,000 Btu/hr	Not less than 80%
Oil-fired, with capacity ≥ 225,000 Btu/hr	Not less than 81%

Note(s): 1) Measured at the maximum rated capacity.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart D - Commercial Warm Air Furnaces. January 1, 2010.

7.4.2 Efficiency Standards for Commercial Packaged Boilers

Effective for products manufactured between January 1, 1994 and March 1, 2012

	Combustion Efficiency (1)
Gas-fired, with capacity ≥ 300,000 Btu/hr	Not less than 80%
Oil-fired, with capacity ≥ 300,000 Btu/hr	Not less than 83%

Effective for products manufactured on or after March 2, 2012

	Size (Btu/hr)	Efficiency Level (1)
Gas-fired, hot water	≥300,000 and ≤2,500,000	80% thermal efficiency
Gas-fired, hot water	>2,500,000	82% combustion efficiency
Oil-fired, hot water	≥300,000 and ≤2,500,000	82% thermal efficiency
Oil-fired, hot water	>2,500,000	84% combustion efficiency
Gas-fired except natural draft, steam	≥300,000 and ≤2,500,000	79% thermal efficiency
Gas-fired except natural draft, steam	>2,500,000	79% thermal efficiency
Gas-fired-natural draft, steam	≥300,000 and ≤2,500,000	77% thermal efficiency
Gas-fired-natural draft, steam	>2,500,000	77% thermal efficiency
Oil-fired, steam	≥300,000 and ≤2,500,000	81% thermal efficiency
Oil-fired, steam	>2,500,000	81% thermal efficiency

Effective March 2, 2022	Size (Btu/hr)	Thermal Efficiency (1)
Gas-fired natural draft, steam	≥300,000 and ≤2,500,000	79%
Gas-fired natural draft, steam	>2,500,000	79%

Note(s): 1) Measured at the maximum rated capacity.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart E - Commercial Packaged Boilers. January 1, 2010.

7.4.3 Efficiency Standards for Commercial Air Conditioners and Heat Pumps (1)

Type	Cooling Capacity (Btu/hr)	Category (2)	Efficiency Level
Small commercial package air conditioning and heating equipment (air-cooled, three-phase)	<65,000	AC	SEER = 13.0
		HP	SEER = 13.0
Single package vertical air conditioners and single package vertical heat pumps, single-phase and three phase	<65,000	AC	EER = 9.0
		HP	EER = 9.0, COP = 3.0
Single package vertical air conditioners and single package vertical heat pumps	≥65,000 and <135,000	AC	EER = 8.9
		HP	EER = 8.9, COP = 3.0
Single package vertical air conditioners and single package vertical heat pumps	≥135,000 and <240,000	AC	EER = 8.6
		HP	EER = 8.6, COP = 2.9
Small commercial package air-conditioning and heating equipment (air-cooled)	≥65,000 and <135,000	AC	EER = 11.2 (3)
			EER = 11.0 (4)
		HP	EER = 11.0 (3)
			EER = 10.8 (4)
Large commercial package air-conditioning and heating equipment (air-cooled)	≥135,000 and <240,000	AC	EER = 11.0 (3)
			EER = 10.8 (4)
		HP	EER = 10.6 (3)
			EER = 10.4 (4)
Very large commercial package air-conditioning and heating equipment (air-cooled)	≥240,000 and <760,000	AC	EER = 10.0 (3)
			EER = 9.8 (4)
		HP	EER = 9.5 (3)
			EER = 9.3 (4)
Small commercial package air-conditioning heat pump	≥65,000 and <135,000	HP	COP = 3.3
Large commercial package air-conditioning heat pump	≥135,000 and <240,000	HP	COP = 3.2
Very large commercial package air-conditioning heat pump	≥240,000 and <760,000	HP	COP = 3.2

Note(s): EER = Energy Efficiency Ratio, COP = Coefficient of Performance. 1) Effective for products manufactured on or after January 1, 2010, excpet for air-cooled, three-phase small commercial package air-conditioning and heating equipment <65,000 Btu/hr for which standards are effective for products manufactured on or after June 16, 2008. 2) AC = Air Conditioner, HP = Heat Pump. 3) Applies to equipment with electric resistance heating or no heating. 4) Applies to equipment with all other integrated heating-system types.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart F - Commercial Air Conditioners and Heat Pumps. January 1, 2010.

7.4.4 Efficiency Standards for Commercial PTACs and PTHPs (1)

Type	Size	Cooling Capacity (Btu/hr)	Efficiency Level (2)
PTAC	Standard	<7,000	EER = 11.7
		7,000-15,000	EER = 13.8 - (0.300 x Cap)
		>15,000	EER = 9.3
	Non-Standard	<7,000	EER = 9.4
		7,000-15,000	EER = 10.9 - (0.213 x Cap)
		>15,000	EER = 7.7
PTHP	Standard	<7,000	EER = 11.9
			COP = 3.3
		7,000-15,000	EER = 14.0 - (0.300 x Cap)
			COP = 3.7 - (0.052 x Cap)
		>15,000	EER = 9.5
			COP = 2.9
	Non-Standard	<7,000	EER = 9.3
			COP = 2.7
		7,000-15,000	EER = 10.8 - (0.213 x Cap)
			COP = 2.9 - (0.026 x Cap)
		>15,000	EER = 7.6
			COP = 2.5

Effeciency standards for water-cooled and evaporatively-cooled commercial package air conditioning and heating equipment (240,000 ≤ Btu/hr < 760,000) manufactured on or after January 10, 2011:

--with electric resistance heat or without heating: EER ≥ 11.0

--with all other types of heating: EER ≥ 10.8

Note(s): 1) PTAC = Packaged Terminal Air Conditioner, PTHP = Packaged Terminal Heat Pump. Effective for non-standard sized units manufactured on or after September 30, 2010 and for standard sized units manufactured on or after September 30, 2012. 2) EER = Energy Efficiency Ratio, COP = Coefficient of Performance. "Cap" means cooling capacity in thousand Btu/hr at 95 degree F outdoor dry-bulb temperature.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart F - Commercial Air Conditioners and Heat Pumps. January 1, 2010.

7.4.5 Efficiency Standards for Commercial Unit Heaters

Unit heaters manufactured on or after August 8, 2008 must:

-Be equipped with an intermittent ignition device and

-Have power venting or an automatic flue damper.

-For unit heaters where combustion air is drawn from conditioned space, an automatic vent damper may be used as an alternative to an automatic flue damper.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart N - Unit Heaters. January 1, 2010.

7.5.1 Efficiency Standards for Residential Room Air Conditioners (1)

Without Reverse Cycle, With Louvered Sides

Capacity (Btu/hr):	EER (2)
<6,000	9.7
6,000-7,999	9.7
8,000-13,999	9.8
14,000-19,999	9.7
20,000+	8.5

Without Reverse Cycle, Without Louvered Sides

Capacity (Btu/hr):	EER (2)
<6,000	9.0
6,000-7,999	9.0
8,000-13,999	8.5
14,000-19,999	8.5
20,000+	8.5

With Reverse Cycle, With Louvered Sides

Capacity (Btu/hr):	EER (2)
<20,000	9.0
20,000+	8.5

With Reverse Cycle, Without Louvered Sides

Capacity (Btu/hr):	EER (2)
<14,000	8.5
14,000+	8.0

Casement Models

Type:	EER (2)
Casement-Only	8.7
Casement-Slider	9.5

Note(s): 1) Effective for products manufactured on or after October 1, 2000. 2) EER = Energy Efficiency Ratio.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.5.2 Efficiency Standards for Residential Refrigerators and Freezers (1)

Product Class	Maximum Energy Use (kWh) (2)
1) Refrigerators and refrigerator-freezers with manual defrost	8.82AV + 248.4
2) Refrigerator-freezers, partial automatic defrost	8.82AV + 248.4
3) Refrigerator-freezers, automatic defrost with top-mounted freezer without through-the-door ice service and all refrigerators, automatic defrost	9.80AV + 276.0
4) Refrigerator-freezers, automatic defrost with side-mounted freezer without through-the-door ice service	4.91AV + 507.5
5) Refrigerator-freezers, automatic defrost with bottom-mounted freezer without through-the-door ice service	4.60AV + 459.0
6) Refrigerator freezers, automatic defrost with top-mounted freezer with through-the-door ice service	10.20AV + 356.0
7) Refrigerator-freezers, automatic defrost with side-mounted freezer with through-the-door ice service	10.10AV + 406.0
8) Upright freezers with manual defrost	7.55AV + 258.3
9) Upright freezers with automatic defrost	12.43AV + 326.1
10) Chest freezers and all other freezers except compact freezers	9.88AV + 143.7
11) Compact refrigerators and refrigerator-Freezers with manual defrost	10.70AV + 299.0
12) Compact refrigerator-freezers, partial automatic defrost	7.00AV + 398.0
13) Compact refrigerator-freezers, automatic defrost with top-mounted freezer and all	12.70AV + 355.0
14) Compact refrigerator-freezers, automatic defrost with side-mounted freezer	7.60AV + 501.0
15) Compact refrigerator-freezers, automatic defrost with bottom-mounted freezer	13.10AV + 367.0
16) Compact upright freezers with manual defrost	9.78AV + 250.8
17) Compact upright freezers wth automatic defrost	11.40AV + 391.0
18) Compact chest freezers	10.45AV + 152.0

Note(s): refrigerated volume exceeding 39 cubic feet or freezers with total refrigerated volume exceeding 30 cubic feet. AV = total adjusted volume (ft^3).

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.5.3 Efficiency Standards for Residential Water Heaters (1)

Effective for products manufactured from January 20, 2004 through April 15, 2015

Gas-Fired Storage Water Heaters
EF = 0.67 - (0.0019 x Rated Storage Volume in gallons)

Oil-Fired Water Heaters
EF = 0.59 - (0.0019 x Rated Storage Volume in gallons)

Instantaneous Gas-Fired Water Heaters
EF = 0.62 - (0.0019 x Rated Storage Volume in gallons)

Instantaneous Electric and Table Top Water Heaters
EF = 0.93 - (0.00132 x Rated Storage Volume in gallons)

Electric Storage Water Heaters
EF = 0.97 - (0.00132 x Rated Storage Volume in gallons)

Effective for products manufactured on or after April 16, 2015

Gas-Fired Storage Water Heaters

Rated Storage Volume ≤ 55 gallons	EF = 0.675 - (0.0015 x Rated Storage Volume in gallons)
Rated Storage Volume > 55 gallons	EF = 0.8012 - (0.00078 x Rated Storage Volume in gallons)

Electric Storage Water Heaters

Rated Storage Volume ≤ 55 gallons	EF = 0.960 - (0.0003 x Rated Storage Volume in gallons)
Rated Storage Volume > 55 gallons	EF = 2.057 - (0.00113 x Rated Storage Volume in gallons)

Instantaneous Water Heaters

Gas-Fired	EF = 0.82 - (0.0019 x Rated Storage Volume in gallons)
Electric	EF = 0.93 - (0.00132 x Rated Storage Volume in gallons)

Oil-Fired Storage Water Heaters
EF = 0.68 - (0.0019 x Rated Storage Volume in gallons)

Table Top Water Heaters
EF = 0.93 - (0.00132 x Rated Storage Volume in gallons)

Note(s): 1) EF stands for "Energy Factor," while the Rated Storage Volume is a measure of capacity specified by the manufacturer.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010; Energy Conservation standards for Residential Water Heaters, Direct Heating Equipment, and Pool Heaters: Final Rule, Federal Register, 75 FR 20112, April 16, 2010.

7.5.4 Efficiency Standards for Wet Cleaning Equipment

Clothes Washers:

Effective from products manufactured from January 1, 2007 through December 31, 2011

	Modified Energy Factor (ft^3/kWh/cycle)	Water Factor (gallons/ft^3)
Top-Loading, Compact (Capacity < 1.6 ft^3)	0.65	--
Front-Loading, Compact (Capacity < 1.6 ft^3)	1.26 (ft^3/kWh/cycle)	--
Top-Loading, Semi-Automatic (1)	--	--
Suds-Saving (1)	--	--

Effective for products manufactured on or after January 1, 2011

	Modified Energy Factor (ft^3/kWh/cycle)	Water Factor (gallons/ft^3)
Top-Loading, Compact (Capacity ≥ 1.6 ft^3)	1.26 (ft^3/kWh/cycle)	9.50
Front-Loading, Compact (Capacity ≥ 1.6 ft^3)	1.26 (ft^3/kWh/cycle)	9.50

Clothes Dryers:

Effective for products manufactured on or after May 14, 1994

	Energy Factor (lbs/kWh)
Electric, Standard (Capacity ≥ 4.4 ft^3)	3.01
Electric, Compact 120v (Capacity < 4.4 ft^3)	3.13
Electric, Compact 240v (Capacity < 4.4 ft^3)	2.90
Gas	2.67

Dishwashers:

Effective for products manufactured on or after January 1, 2010 (2)

	Maximum Energy Consumption (kWh/yr)	Maximum Gallons per Cycle
Standard	355	6.5
Compact	260	4.5

Note(s): 1) Must have an unheated rinse water option. 2) Size is to be determined by ANSI/AHAM DW-1.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.6.1 Efficiency Standards for Remote Commercial Refrigerators, Freezers, and Refrigerator-Freezers (1)

Models with a self-contained condensing unit and without doors, models with a remote condensing unit, and commercial ice-cream freezers

Category	Equipment Class Designation	Maximum Daily Energy Consumption (kWh/day)
Remote Condensing Commercial Refrigerators and Commercial Freezers	VOP.RC.M	0.82 x TDA + 4.07
	VOP.RC.L	2.27 x TDA + 6.85
	SVO.RC.M	0.83 x TDA + 3.18
	SVO.RC.L	2.27 x TDA + 6.85
	HZO.RC.M	0.35 x TDA + 2.88
	HZO.RC.L	0.57 x TDA + 6.88
	VCT.RC.M	0.22 x TDA + 1.95
	VCT.RC.L	0.56 x TDA + 2.61
	HCT.RC.M	0.16 x TDA + 0.13
	HCT.RC.L	0.34 x TDA + 0.26
	VCS.RC.M	0.11 x V + 0.26
	VCS.RC.L	0.23 x V + 0.54
	HCS.RC.M	0.11 x V + 0.26
	HCS.RC.L	0.23 x V + 0.54
	SOC.RC.M	0.51 x TDA + 0.11
	SOC.RC.L	1.08 x TDA + 0.22
Commercial Ice-Cream Freezers	VOP.RC.I	2.89 x TDA + 8.7
	SVO.RC.I	2.89 x TDA + 8.7
	HZO.RC.I	0.72 x TDA + 8.74
	VCT.RC.I	0.66 x TDA + 3.05
	HCT.RC.I	0.4 x TDA + 0.31
	VCS.RC.I	0.27 x V + 0.63
	HCS.RC.I	0.27 x V + 0.63
	SOC.RC.I	1.26 x TDA + 0.26

Key:

Equipment Family:
- VOP = Vertical Open
- SVO = Semivertical Open
- HZO - Horizontal Open
- VCT = Vertical Closed Transparent
- HCT = Horizontal Closed Transparent
- VCS = Vertical Closed Solid
- HCS = Horizontal Closed Solid
- SOC = Service Over Counter

Condensing Unit Configuration:
- RC = Remote
- SC = Self-Contained

Rating Temp (Operating Temp) - (Deg. F):
- M = 38 (≥32)
- L = 0 (<32)
- I = -15 (≥-5)

Note(s): 1) AV means the adjusted volume (ft^3). V means the chilled or frozen compartment volume (ft^3). TDA means the total display area (ft^2) of the case. Effective for products manufactured on or after January 1, 2012.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart C - Commercial Refrigerators, Freezers and Refrigerator-Freezers. January 1, 2010.

7.6.2 Efficiency Standards for Self-Contained Commercial Refrigerators, Freezers, and Refrigerator-Freezers (1)

Models designed for holding temperature applications (2)

Category	Maximum Daily Energy Consumption (kWh/day)
Refrigerators with Solid Doors	0.10V + 2.04
Refrigerators with Transparent Doors	0.12V + 3.34
Freezers with Solid doors	0.40V + 1.38
Freezers with Transparent Doors	0.75V + 4.10
Refrigerator/Freezers with Solid Doors	the greater of 0.27AV - 0.71 or 0.70

Models with a self-contained condensing unit and without doors, models with a remote condensing unit, and commercial ice-cream freezers (3)

Category	Equipment Class Designation	Maximum Daily Energy Consumption (kWh/day)
Self-Contained Commercial Refrigerators and Commercial Freezers without Doors.	VOP.SC.M	1.74 x TDA + 4.71
	VOP.SC.L	4.37 x TDA + 11.82
	SVO.SC.M	1.73 x TDA + 4.59
	SVO.SC.L	4.34 x TDA + 11.51
	HZO.SC.M	0.77 x TDA + 5.55
	HZO.SC.L	1.92 x TDA + 7.08
Commercial Ice-Cream Freezers	VOP.SC.I	5.55 x TDA + 15.02
	SVO.SC.I	5.55 x TDA + 14.63
	HZO.SC.I	2.44 x TDA + 9
	VCT.SC.I	0.67 x TDA + 3.29
	HCT.SC.I	0.56 x TDA + 0.43
	VCS.SC.I	0.38 x V + 0.88
	HCS.SC.I	0.38 x V + 0.88
	SOC.SC.I	1.76 x TDA + 0.36

Key:

Equipment Family:
- VOP = Vertical Open
- SVO = Semivertical Open
- HZO - Horizontal Open
- VCT = Vertical Closed Transparent
- HCT = Horizontal Closed Transparent
- VCS = Vertical Closed Solid
- HCS = Horizontal Closed Solid
- SOC = Service Over Counter

Condensing Unit Configuration:
- RC = Remote
- SC = Self-Contained

Rating Temp (Operating Temp) - (Deg. F):
- M = 38 (≥32)
- L = 0 (<32)
- I = -15 (≥-5)

Other

Commercial refrigerators with a self contained condensing unit designed for pull-down temperature applications and transparent doors shall have a daily energy consumption (kWh/day) of not more than 0.126V + 3.51 (2)

Note(s): 1) AV means the adjusted volume (ft^3). V means the chilled or frozen compartment volume (ft^3). TDA means the total display area (ft^2) of the case. 2) Effective for products manufactured on or after January 1, 2010. 3) Effective for products manufactured on or after January 1,

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart C - Commercial Refrigerators, Freezers and Refrigerator-Freezers. January 1, 2010.

7.6.3 Efficiency Standards for Automatic Commercial Ice Makers (1)

Equipment Type	Type of Cooling	Harvest Rate (lbs ice/24 hrs)	Maximum Energy Use (2) (kWh/100 lbs Ice)	Maximum Condenser Water Use (3) (gal/100 lbs Ice)
Ice Making Head	Water	<500	7.80 - 0.0055H	200 - 0.022H
Ice Making Head	Water	≥500 and <1436	5.58 - 0.0011H	200 - 0.022H
Ice Making Head	Water	≥1436	4.00	200 - 0.022H
Ice Making Head	Air	<450	10.26 - 0.0086H	N/A
Ice Making Head	Air	≥450	6.89 - 0.0011H	N/A
Remote Condensing (not remote compressor)	Air	<1000	8.85 - 0.0038H	N/A
	Air	≥1000	5.10	N/A
Remote Condensing and Remote Compressor	Air	<934	8.85 - 0.0038H	N/A
	Air	≥934	5.30	N/A
Self Contained	Water	<200	11.40 - 0.019H	191 - 0.315H
Self Contained	Water	≥200	7.60	191 - 0.315H
Self Contained	Air	<175	18.0 - 0.0469H	N/A
Self Contained	Air	≥175	9.80	N/A

Note(s): 1) Effective for products manufactured on or after January 1, 2010, for commercial ice makers that produce cube type ice, with capacities between 50 and 2500 pounds per 24-hour period. 2) H = Harvest rate in pounds per 24 hours. 3) Water use is for the condenser only and does not include potable water used to make ice.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart H - Automatic Commercial Ice Makers. January 1, 2010.

7.6.4 Efficiency Standards for Refrigerated Beverage Vending Machines (1)

Equipment Class	Consumption Maximum (kWh/day) (2)
Class A (3)	MDEC = 0.055 x V + 2.56
Class B (4)	MDEC = 0.073 x V + 3.16
Combination Vending Machines	*Reserved*

Note(s): [illegible] or canned beverage vending machines that are fully cooled. 4) Refrigerated bottled or canned beverage vending machines not considered to be Class A.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart Q - Refrigerated Bottled or Canned Beverage Vending Machines. January 1, 2010.

7.6.5 Efficiency Standards for Walk-in Coolers and Walk-in Freezers (1)

Doors

Units must have automatic door closers that firmly close all walk-in doors with widths at or under 3 ft, 9 in and heights at or under 7 ft that have been closed to within 1 inch of full closure.

Units must have strip doors, spring hinged doors, or another method of minimizing infiltration when doors are open.

Insulation (2)

Coolers must have wall, ceiling, and door insulation of at least R-25.

Freezers must have wall, ceiling, and door insulation of at least R-32.

Freezer floor insulation must be at least R-28

Motors

Elevator Fan Motors less than 1 horsepower and less than 460 volts:

-Must be Electronically commutated motors (brushless direct current motors) or 3-phase motors.

Condenser fan motors under 1 horsepower:

-Must be electronically commutated motors (brushless direct current motors) or

-permanent split capacitor-type motors or

-3-phase motors.

Interior Lights

All interior lights should use light sources of 40 lumens/watt or more, including any ballast losses, however:

-Light sources with an efficacy of 40 lumens per watt or less, including ballast losses (if any), may be used in conjunction with a timer or device that turns off the lights less than 15 minutes after people have exited the walk-in cooler or freezer.

Transparent Reach-in Doors and Windows in Doors

Freezers:

-shall be of triple-pane glass with either heat-reflective treated glass or gas fill.

Coolers:

-shall be of double-pane glass or triple-pane glass with either heat-reflective treated glass or gas fill.

Antisweat Heat Controls

Units with an antisweat heater without antisweat heat controls:

-must have a total door rail, glass, and frame heater power draw of not more than 7.1 watts per square foot of door opening (freezers) and 3.0 watts/square foot of door opening (coolers).

If the unit has an antisweat heater and antisweat heat controls, and the frame heater power draw is greater than the amount specified above:

-the antisweat heat controls shall reduce the energy use of the antisweat heater in a quantity corresponding to the relative humidity in the air outside the door or to the condensation on the inner glass pane.

Note(s): 1) Effective for products manufactured on or after January 1, 2009. 2) Wall, ceiling, and door insulation requirements do not apply to glazed portions of doors or structural members.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart R - Walk-in Coolers and Walk-in Freezers. January 1, 2010.

7.6.6 Efficiency Standards for Commercial Water Heaters (1)

Type	Size	Min. Thermal Efficiency (%)	Max. Standby Loss (2) (Btu/hr, unless otherwise noted)
Electric storage water heaters	All	N/A	0.30 + 27/Vm (%/hr)
Gas-fired storage water heaters	≤155,000 Btu/hr	80%	Q/800 + 110(Vr)^(1/2)
	>155,000 Btu/hr	80%	Q/800 + 110(Vr)^(1/2)
Oil-fired storage water heaters	≤155,000 Btu/hr	78%	Q/800 + 110(Vr)^(1/2)
	>155,000 Btu/hr	78%	Q/800 + 110(Vr)^(1/2)
Gas-fired instantaneous water heaters and hot water supply boilers	≤10 gal	80%	N/A
	>10 gal	80%	Q/800 + 110(Vr)^(1/2)
Oil-fired instantaneous water heaters and hot water supply boilers	≤10 gal	80%	N/A
	>10 gal	78%	Q/800 + 110(Vr)^(1/2)

Note(s): 1) Effective for products manufactured on or after October 29, 2003, except for hot water supply boilers with a capacity less than 10 gallons for which standards are effective for products manufactured on or after October 21, 2005. 2) Vm = measured storage volume in gallons. Vr = rated volume in gallons. Q = nameplate input rate in Btu/hr.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart G - Commercial Water Heaters, Hot Water Supply Boilers, and Unfired Hot Water Storage Tanks. January 1, 2010.

7.6.7 Efficiency Standards for Commercial Clothes Washers (1)

All commercial clothes washers manufactured on or after January 1, 2007 must have:

--A modified energy factor of at least 1.26

--A water consumption factor of not more than 9.5

Effective for all commercial clothes washers manufactured on or after January 8, 2013

Equipment Class	Modified Energy Factor (ft^3/kWh/cycle):	Water Factor (gal/ft^3/cycle)
Top-Loading	1.60	8.50
Front-Loading	2.00	5.50

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart I - Commercial Clothes Washers. January 1, 2010; and Energy Conservation Standards for Certain Consumer Products (Dishwashers, Dehumidifiers, Microwave Ovens, and Electric and Gas Kitchen Ranges and Ovens) and for Certain Commerical and Industrial Equipment (Commercial Clothes Washers); Final Rule, Federal Register, 75 FR 1122, January 8, 2003.

7.7.1 Efficiency Standards for Fluorescent Lamp Ballasts (1)

Application for Operation of:	Ballast Input Voltage	Total Nominal Lamp Watts	Ballast Efficiency Factor
One F34T12 Lamp	120/277	34	2.61
Two F34T12 Lamps	120/277	68	1.35
Two F96T12/ES Lamps	120/277	120	0.77
Two F96T12HO/ES Lamps	120/277	190	0.42

Standards do not apply to:

-A Ballast designed for dimming up to 50% or less of its maximum output.
-A Ballast designed for use with two F96T12HO lamps at ambient temperatures of -20 deg. F or less and as an outdoor sign.
-A Ballast with a power factor of less than 0.90, designed and labeled for use only in residential building applications.

Note(s): 1) Effective for products manufactured or sold by the manufacturer on or after July 1, 2009, or incorporated into a luminaire by a luminaire manufacturer on or after July 1, 2010. Applies to products designed to operate at nominal input voltages of 120 or 277 volts and input current frequencies of 60 Hertz. Includes replacement ballasts manufactured on or after July 1, 2010 or sold by the manufacturer on or after October 1, 2010.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.7.2 Efficiency Standards for General Service Fluorescent Lamps

Effective for products manufactured before July 14, 2012

Lamp Type (1)	Nominal Lamp Wattage (W)	Minimum CRI	Minimum Average Lamp Efficacy (lm/W)	Effective Date
4-Foot Medium Bipin	>35	69	75.0	November 1, 1995
4-Foot Medium Bipin	≤35	45	75.0	November 1, 1995
2-Foot U-Shaped	>35	69	68.0	November 1, 1995
2-Foot U-Shaped	≤35	45	64.0	November 1, 1995
8-Foot Slimline	>65	69	80.0	May 1, 1994
8-Foot Slimline	≤65	45	80.0	May 1, 1994
8-Foot High Output	>100	69	80.0	May 1, 1994
8-Foot High Output	≤100	45	80.0	May 1, 1994

Effective for products manufactured on or after July 14, 2012

Lamp Type	Correlated Color Temperature (K)	Minimum Average Lamp Efficacy (lm/W)
4-Foot Medium Bipin	≤4,500	89
4-Foot Medium Bipin	>4,500 and ≤7,000	88
2-Foot U-Shaped	≤4,500	84
2-Foot U-Shaped	>4,500 and ≤7,000	81
8-Foot Slimline	≤4,500	97
8-Foot Slimline	>4,500 and ≤7,000	93
8-Foot High Output	≤4,500	92
8-Foot High Output	>4,500 and ≤7,000	88
4-Foot Miniature Bipin, Standard Output	≤4,500	86
4-Foot Miniature Bipin, Standard Output	>4,500 and ≤7,000	81
4-Foot Miniature Bipin, High Output	≤4,500	76
4-Foot Miniature Bipin, High Output	>4,500 and ≤7,000	72

Note(s): 1) Do not apply to 4-foot medium bipin lamps or 2-foot U-shaped lamps with rated wattages less than 28W; 8-foot high outputt lamps not defined in ANSI C78.81 or related supplements, or not 0.800 nominal amperes; or 8-foot slimline lamps not defined in ANSI 78.3.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy Conservation Standards and Their Effective Dates. January 1, 2010; and Energy Conservation Standards and Test Procedures for General Service Fluorescent Lamps and Incandescent Reflector Lamps; Final Rule, Federal Register, 74 FR 34080, July 14, 2009.

7.7.3 Efficiency Standards for Incandescent Reflector Lamps (1)

Effective for lamps manufactured after November 1, 1995 and before July 14, 2012

Nominal Lamp Wattage	Minimum Average Lamp Efficacy (lm/W)
40-50	10.5
51-66	11.0
67-85	12.5
86-115	14.0
116-155	14.5
156-205	15.0

Effective for lamps manufactured on or after July 14, 2012

Rated Lamp Wattage	Lamp Spectrum	Lamp Diameter (in)	Rated Voltage (V)	Minimum Average Lamp Efficacy (lm/W) (2)
40-205	Standard Spectrum	>2.5	≥125	6.8*P^0.27
40-205	Standard Spectrum	>2.5	<125	5.9*P^0.27
40-205	Standard Spectrum	≤2.5	≥125	5.7*P^0.27
40-205	Standard Spectrum	≤2.5	<125	5.0*P^0.27
40-205	Modified Spectrum	>2.5	≥125	5.8*P^0.27
40-205	Modified Spectrum	>2.5	<125	5.0*P^0.27
40-205	Modified Spectrum	≤2.5	≥125	4.9*P^0.27
40-205	Modified Spectrum	≤2.5	<125	4.2*P^0.27

Note(s): 1) Subject to exclusions, these specified standards apply to ER, BR, and BPAR incandescent refrlector lamps and similar bulb shapes on and after January 1, 2008. Subject to exclusions, these standards apply to incandescent reflector lamps with diameters between 2.25 and 2.75 inches on and after June 15, 2008. These standards do not apply to ER30, BR30, BR40, or ER40 lamps rated at 50W or less, These standards do not apply to BR30, BR40, or ER40 lamps rate at 65W. These standards do not apply to R20 incandescent reflector lamps rated 45W or less. 2) P = rated lamp wattage, in watts.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.7.4 Efficiency Standards for Ceiling Fans, Ceiling Fan Light Kits, and Torchieres (1)

All ceiling fans must have:
- -Fan speed controls separate from lighting controls;
- -Adjustable speed controls; and
- -The capability of reversible fan action, except for industrial and outdoor fans, and those for which a safety standard would be violated.

All ceiling fan light kits with medium screw base sockets must:
- -Meet the ENERGY STAR Program requirements for Compact fluorescent Lamps (CFLs), version 3; and
- -Use light sources other than CFLs that have lumens per watt performance at least equivalent to comparable configured CFLs meeting the above criteria.

All fan light kits with pin-based sockets for fluorescent lamps must:
- -Meet the ENERGY STAR program grequirements for residential light fixtures version 4.0.

All ceiling fan light kits with socket types other than those covered above must:
- -Not be capable of operating with lamps that total more than 190 watts; and
- -Be packaged to include lamps that meet the requirements for ceiling fan light kits.

Torchieres:
- -Must consume not more than 190 watts of power; and
- -must not be capable of operating with lamps that total more than 190 watts.

Note(s): 1) Effective for ceiling fans and ceiling fan light kits manufactured on or after January 1, 2007. Effective torchieres manufactured on or after January 1, 2006.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.7.5 Efficiency Standards for Medium Base Compact Fluorescent Lamps (1)

Factor	Requirements
Lamp Power (W) & Configuration	Minimum Efficacy: lumens/watt (based upon initial lumen data)
Bare Lamp:	
Lamp Power < 15	45.0
Lamp Power ≥ 15	60.0
Covered Lamp (no reflector):	
Lamp Power < 15	40.0
15 ≤ Lamp Power < 19	48.0
19 ≤ Lamp Power < 25	50.0
25 ≤ Lamp Power	55.0
1,000-hour Lumen Maintenance	The average of at least 5 lamps must be a minimum 90.0% of initial (100-hour) lumen outputt @ 1,000 hours of rated life.
Lumen Maintenance\	80.0% of initial (100-hour) rating at 40 percent of rated life (per ANSI C78.5 Clause 4.10).
Rapid Cycle Stress Test	Per ANSI 78.5 and IESNA LM-65 (clauses 2, 3, 5, and 6). Exception:Cycle times must be 5 minutes on, 5 minutes off. Lamp will be cycled once for every two hours of rated life. At least 5 lamps must meet or exceed the minimum number of cycles.
Average Rated Lamp Life	≥ 6,000 hours as declared by the manufacturer on packaging. At 80% of rated life, statistical methods may be used to confirm lifetime claims based on sampling

Note(s): 1) Effective for products manufactured on or after January 1, 2006.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.7.6 Lighting Standards for General Service Incandescent Lamps Prescribed by EISA 2007

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.

7.7.7 Efficiency Standards for Commercial Lighting Products

Illuminated Exit Signs (1)

Exit signs must have an input power demand of 5 watts or less per face.

Mercury Vapor Lamps (2)

Mercury Vapor lamps shall not be manufactured or imported.

Metal Halide Lamp Ballasts (3)

Metal halid lamp fixutres design to be operated with lamps rated greater or equal to 150 watts but less than 500 watts:

-must have a pulse-start metal halide ballast with a minimum efficiency of 88%,
-must have a magnetic probe-start ballast with a minimum ballast efficiency of 94%, or
-must have a nonpulse-start electronic ballast with either a minimum efficiency of 92% if greater than 250 watts or 90% if less than or equal to 250 watts.

These standards do not appply to:

-metal halide lamp fixtures with regulated lab ballasts,
-metal halide lamp fixtures that use electronic ballasts that operate at 240 volts, or
-metal halide lamp fixtures that are rated only for 150 watt lamps, rated for use in wet locations, or contain a ballast rated to operate at ambient air temperatures above 50 Degrees C.

Note(s): 1) Effective for illuminated exit signs manufactured on or after January 1, 2006. 2) Effective January 1, 2008. 3) Effective for metal halide lamp ballasts January 1, 2009.

Source(s): Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart L for Illuminated Exit Signs, Subpart P for Mercury Vapor Lamps, and Subpart S for Metal Halide Lamp Ballasts. January 1, 2010.

7.8.1 Water Use Standards for Faucets, Showerheads, and Prerinse Spray Valves (1)

Faucet Type (2)	Maximum Flow Rate
Kitchen Faucets (3)	2.2 gpm
Lavatory Replacement Aerators	2.2 gpm
Kitchen Faucets	2.2 gpm
Kitchen Replacement Aerators	2.2 gpm
Metering Faucets (4)	0.25 gal/cycle
Showerheads (5)	2.5 gpm
Commercial Prerinse Spray Valves (6)	1.6 gpm

Note(s): 1) Effective for products manufactured on or after January 1, 1994. 2) When measured at a flowing water pressure of 60 psi (414 kilopascals). 3) For sprayheads with independently-controlled orifices and manual controls, the maximum flow rate of each manual on/off orifice shall not exceed the maximum flow rate for a lavatory faucet. For those with collectively controlled orifices and manual controls, the maximum flow rate of each manual on/off sprayhead shall be the product of the maximum flow rate for a lavatory faucet and the number of component lavatories. 4) For sprayheads with independently controlled orifices and metered controls, the maximum flow rate of each orifice that delivers a pre-set volume of water before gradually shutting itself off shall not exceed the maximum flow rate for a metering faucet. For sprayheads with collectively-controlled orifices and metered controls, the maximum flow rate of a sprayhead that delivers a pre-set volume of water before gradually shutting itself off shall be the product of the maximum flow rate for a metering faucet and the number of component lavatories. 5) When measured at a flowing water pressure of 80 psi (552 kilopascals). Shall also meet the requirements of ASME/ANSI Standard A112.18.1M-1996, 7.4.4(a). 6) Effective for products manufactured on or after January 1, 2006.

Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010; and Title 10, Code of Federal Regulations, Part 431 - Energy Efficiency Program for Certain Commercial and Industrial Equipment, Subpart O - Commercial Prerinse Spray Valves. January 1, 2010.

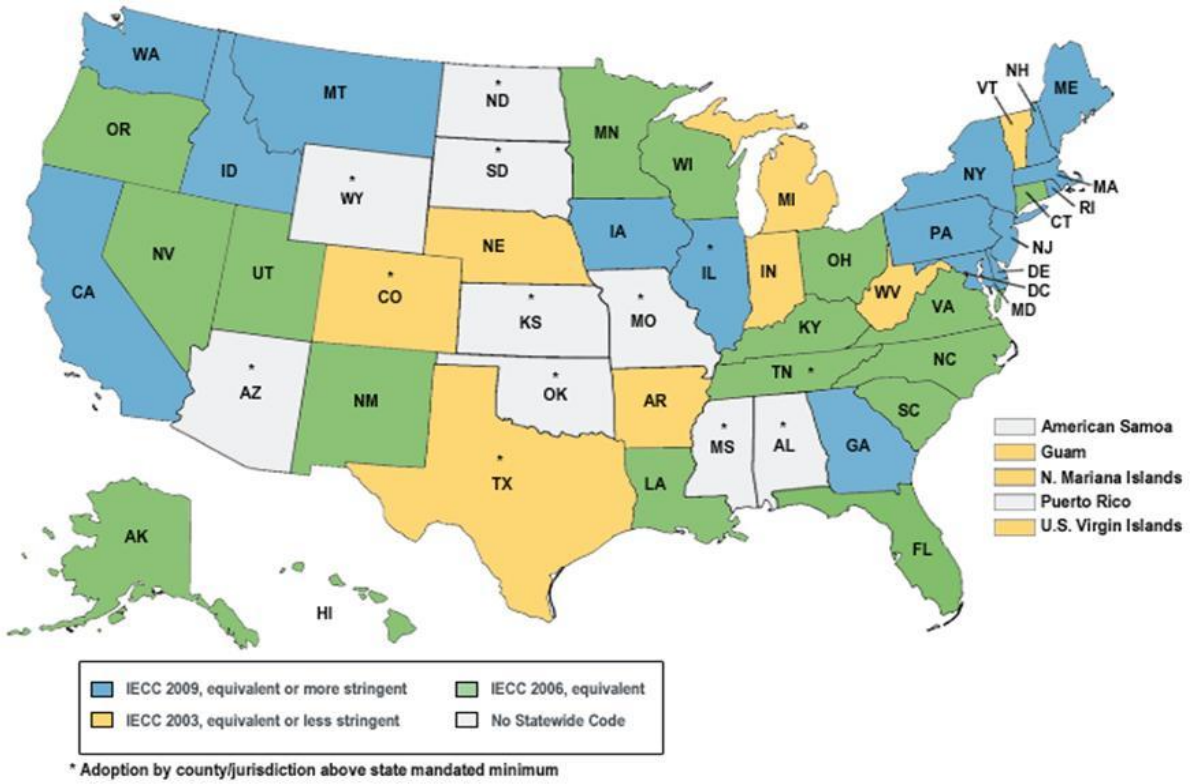
7.8.2 Water Use Standards for Water Closets (1)

Water Closet Type	Maximum Flush Rate (gpf)
Gravity Tank-Type Toilets	1.6
Flushometer Tank Toilets	1.6
Electromechanical Hydraulic Toilets	1.6
Blowout Toilets	3.5
Flushometer Valve Toilets (2)	1.6
Urinals (3)	1.0

Note(s): 1) Effective for products manufactured on or after January 1, 1994, unless otherwise noted. 2) Does not include blowout toilets. Effective for products manufactured on or after January 1, 1997. 3) Except for trough-type urinals. The maximum water use for trough-type urinals should be the product of the maximum flow rate and the length of the urinal in inches divided by 16 inches.

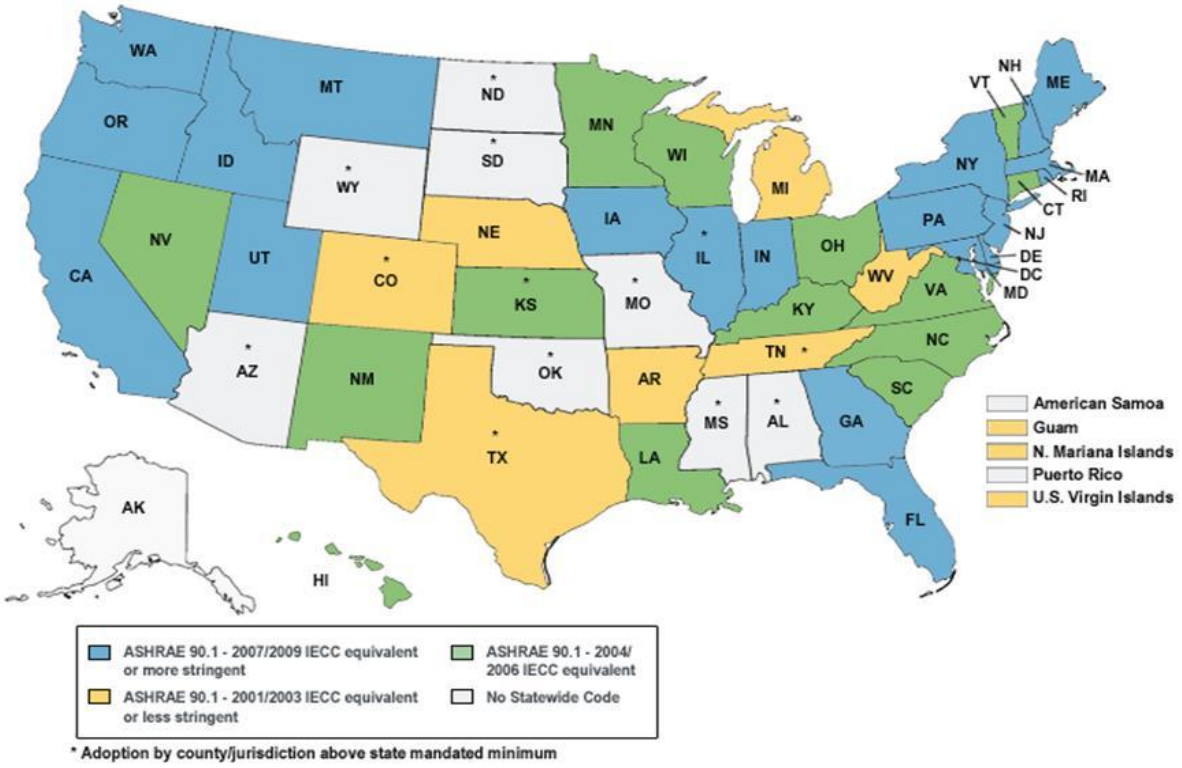
Source(s): Title 10, Code of Federal Regulations, Part 430 - Energy Conservation Program for Consumer Products, Subpart C - Energy and Water Conservation Standards and Their Effective Dates. January 1, 2010.

7.9.1 Status of State Energy Codes: Residential Sector (1)



Note(s): 1) These are the current residential codes as of February 2011.
Source(s): DOE/EERE, The Status of State Energy Codes, www.energycodes.gov/states/.

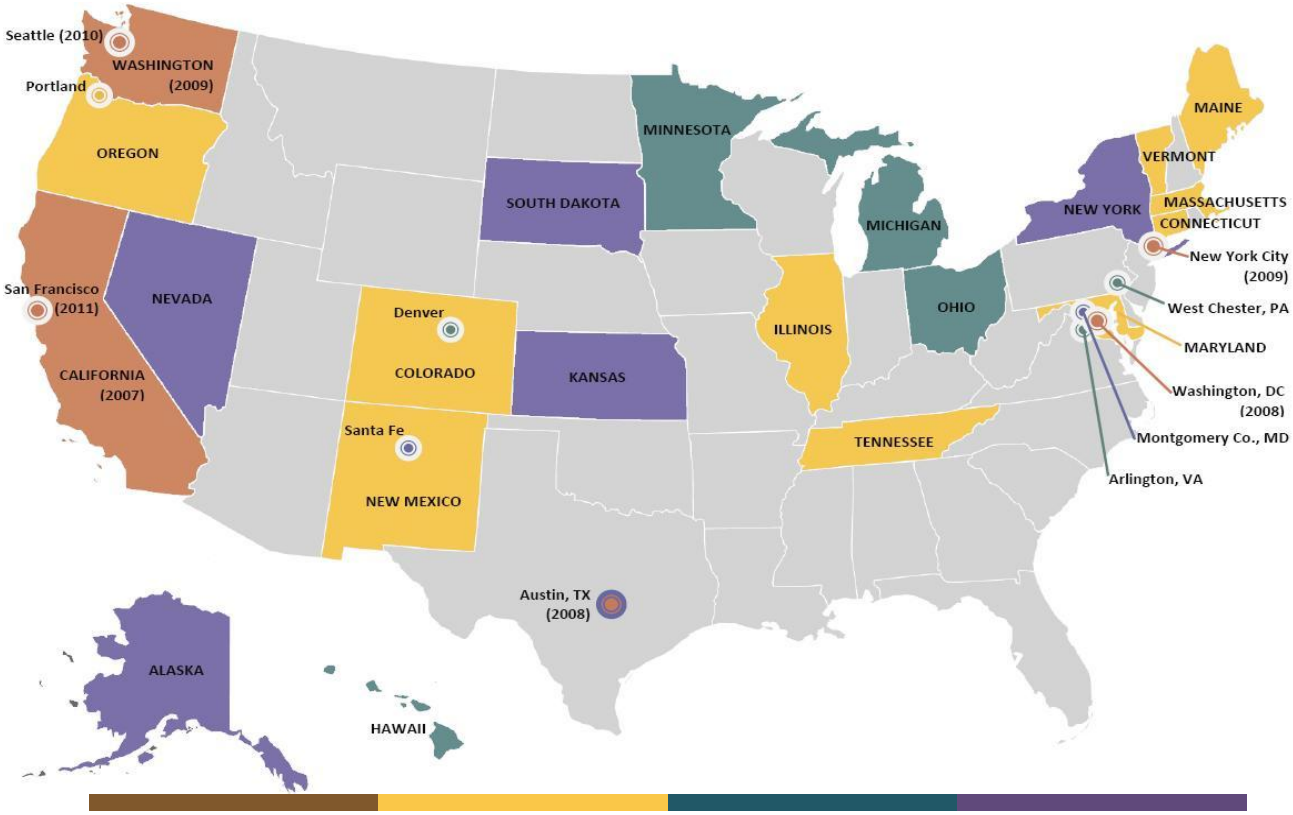
7.9.2 Status of State Energy Codes: Commercial Sector(1)



Note(s): 1) These are the current Commercial codes as of February 2011.

Source(s): DOE/EERE, The Status of State Energy Codes, http://www.energycodes.gov/states/.

7.9.3 Building Energy Rating and Disclosure Policies in the United States



Commercial Buildings Existing Policy	Commercial Buildings Policy Being Considered	Public Buildings Rating Requirement	Homes Disclosure Requirement
Austin, TX	Connecticut	Arlington County, VA	Alaska
California	Colorado	Denver, CO	Austin, TX
District of Columbia	Illinois	Hawaii	Kansas
New York, NY	Maine	Michigan	Montgomery County, MD
San Francisco, CA	Maryland	Minnesota	Nevada
Seattle, WA	Massachusetts	Ohio	New York
Washington	New Mexico	West Chester, PA	Santa Fe, NM
	Oregon		South Dakota
	Portland, OR		
	Tennessee		
	Vermont		

Note(s): Map depicts the policy landscape as of March 17, 2011. More information available at www.BuildingRating.org.

Source(s): Institute for Market Transformation, "Rating Policy Map and Timeline."

8.1.1 Total Use of Water by Buildings (Million 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	9.4%	28,028	6.9%	10,314	2.5%
2005 (3)	39,601	9.7%	29,430	7.2%	10,171	2.5%

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

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 Intensity 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 Energy Center of Wisconsin, Energy Use at Wisconsin's Drinking Water Utilities, 2003.

8.1.3 Energy Use of Wastewater Treatment Plants by Capacity and Treatment 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 (Million 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 of 15 connections. 2) Self-supply water use: Water withdrawn from a groundwater or surface-water source by a user rather than being obtained from a public supply. 3) USGS did not provide estimates of residential use from public supplies in 2000. This value was estimated based on the residential 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 Daily Water Consumption by End Use (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. Average number of residents per home: 2.6.

Source(s): Aquacraft, Inc. Residential End Uses of Hot Water in Single-Family Homes from Flow-Trace Analysis, 2000.

8.2.5 2009 Community Water Systems by Size and Type

System Size (1)	Facilities	Population Served (Millions)
Less than 500	28,804	4.8
501 - 3,300	13,820	19.8
3,301 - 10,000	4,871	28.4
10,001 - 100,000	3,746	106.9
More than 100,000	410	134.5
Total	**51,651**	**294.3**

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 2009, EPA 816-K-09-004, November 2009.

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 sum 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 charge a different price for each additional increment of usage. The prices for each increment is higher for increasing block rates and lower for decreasing block rates. Peak rates and seasonal rates charge higher prices when demand is highest. Flat fees charge a set price for water delivery, with no restrictions on use. Combined flat fees charge one fee for water and other charges, such as rental fees. Separate flat fees bill water and other 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 (Million Gallons per Day)

Year	Total Commercial 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 of 15 connections. 2) Self-supply water use: Water withdrawn from a groundwater or surface-water source by a user rather than being obtained from a 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

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
Urinals	October 2009	0.5 gpf		1.0 gpf
Shower Heads	March 2010	1.5 -2.0 gpm		2.5 gpm
Pre-Rinse Spray Valves	In Progress	1.25 gpm	(3)	1.6 gpm
Irrigation Control Equipment	In Progress	Under development	(3)	–

WaterSense Landscape Irrigation Partners as of 3/15/2011: 1,798 (4)

Note(s): 1) GPM = gallons per minute. 2) GPF = gallons per flush. 3) Final criteria for these categories 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, Showerheads Specification, March 2010; EPA, High-Efficiency Urinals Specification, October 2009; and EPA, Find a WaterSense Irrigation Partner List as of 3/15/2011, http://www.epa.gov/watersense/pp/lists/irr_partners.htm.

9.1.1 2009 ENERGY STAR Qualified New Single-Family Homes, by Selected State

	ENERGY STAR Qualified New Homes	New Single-Family Housing Permits	Market Penetration
District of Columbia	85	150	57%
Iowa	2,743	5,643	49%
Nevada	2,090	4,496	46%
Oklahoma	3,342	7,210	46%
Texas	28,646	66,340	43%
New Hampshire	686	1,644	42%
Massachusetts	1,950	5,019	39%
Utah	2,353	6,245	38%
Vermont	317	887	36%
Colorado	2,337	7,182	33%
Ohio	3,490	10,478	33%
Arizona	3,931	12,687	31%
Kansas	1,287	4,226	30%
Hawaii	584	1,980	29%
New Jersey	2,091	7,132	29%
Rhode Island	205	697	29%
Kentucky	1,637	5,913	28%
New York	2,315	9,551	24%
Nebraska	974	4,503	22%
Delaware	558	2,647	21%
United States	**>100,000**	**441,100**	**>20%**

Note(s): The States listed are the top 20 by ENERGY STAR market penetration.

Source(s): EPA, "2009 ENERGY STAR Qualified New Homes Market Indices for States" for top states, accessed November 2010 (http://www.energystar.gov/index.cfm?fuseaction=qhmi.showHomesMarketIndex); DOC/Census Bureau, "New Privately Owned Housing Units Authorized by Building Permits in Permit-Issuing Places" for housing permits (http://www.census.gov/const/bpann.pdf).

9.1.2 Home Performance with ENERGY STAR, Completed Jobs

Rank	Program Sponsor	State	2002-2005	2006	2007	2008	2009
1	NY State Energy R&D Authority	NY		4,235	4,301	5,206	6,343
2	National Grid	MA		4,852	2,536	2,351	6,259
3	Austin Energy	TX		1,700	1,950	2,223	2,773
4	Wisconsin Energy Conservation Corp.	WI		1,600	840	1,012	1,944
5	Energy Trust of Oregon	OR		12	560	1,040	932
6	Calif. Bldg. Perf. Contractors Assoc. (1)(2)	CA		-	338	417	1,194
7	Missouri Dept. of Natural Resources (2)	MO		-	37	56	1,364
8	New Jersey Board of Public Utilities	NJ		3	17	163	1,138
9	Long Island Power Authority	NY		71	43	138	703
10	Efficiency Vermont	VT		119	122	295	324
	All Other Program Sponsors			57	903	648	1,844
	Total (3)		**15,650**	**12,649**	**11,647**	**13,549**	**24,818**

Note(s): 1) Includes only homes in Northern California; homes in Southern California are included in All Other Program Sponsors. 2) The number of jobs completed in 2006 was not reported. 3) At least 23,690 jobs were completed in the first 9 months of 2010 for a total of more than 102,000 jobs completed since the program began in 2002.

Source(s): Personal communication, Chandler Von Schrader, U.S. EPA, December 2010.

9.1.3 ENERGY STAR Commercial and Institutional Buildings and Industrial Plants

	Qualified Buildings		Floorspace Million SF	Building Type	Floorspace Million SF	% of Total	Buildings
1999	87		33	Office	1,261.5	61.8%	4,551
2000	424		68	K-12 School	347.3	17.0%	3,687
2001	213		55	Retail	93.4	4.6%	1,104
2002	348		88	Supermarket/Grocery	81.9	4.0%	1,711
2003	385		84	Hospital	81.7	4.0%	115
2004	657		83	Hotel	66.9	3.3%	427
2005	590		84	Bank/Financial Institution	48.3	2.4%	199
2006	821		106	Courthouse	23.2	1.1%	86
2007	1,012		227	Warehouse (Unrefrigerated)	23.1	1.1%	89
2008	2,468		466	Medical Office	7.3	0.4%	74
2009	2,894	(1)	439	Residence Hall/Dormitory	4.9	0.2%	59
2010	2,303	(1)	309	Warehouse (Refrigerated)	2.3	0.1%	6
Total	**12,202**		**2,043**	Data Center	0.7	0.0%	6
				House of Worship	0.3	0.0%	11
				Industrial Plants	N/A	N/A	77
				Total	**2,043**	**100%**	**12,202**

Note(s): 1) Data as of November 19, 2010. Additional buildings may qualify after applications are reviewed.

Source(s): EPA, Database of ENERGY STAR Labeled Buildings and Plants, accessed November 2010 (http://www.energystar.gov/index.cfm?fuseaction=labeled_buildings.locator).

9.1.4 Market Premiums for ENERGY STAR-Labeled Commercial Buildings in Six Studies (1)

	Rental Rate Premium	Sale Price Premium	Occupancy Premium (2)
CoStar Group/USD	16%	6%	3%
CB Richard Ellis/USD	12%	1%	N/A (3)
Eichholtz/Kok/Quigley	3%	16%	6%
Fuerst/McCallister	5%	31%	3%
Pivo/Fisher	5%	9%	1%
Wiley/Johnson	8%	N/A (3)	N/A (3)

Note(s): 1) All studies were conducted in 2008 and 2009 and compared ENERGY STAR-labeled buildings in the United States with similar non-labeled buildings. More information at http://www.imt.org/rating-value. 2) Lower vacancy rates. 3) Not reported.

Source(s): Institute for Market Tranformation, "Rating and Disclosing the Energy Performance of Buildings: A Market-Based Solution to Unlock Commercial Energy Efficiency Opportunities" (undated).

9.1.5 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
Displays	1992	1995, 1998, 1999, 2005, 2006, 2009
Printers (1)	1993	1995, 2000, 2001, 2007, 2009
Fax Machines (1)	1995	1995, 2000, 2001, 2007, 2009
Copiers (1)	1995	1997, 1999, 2007, 2009
Scanners (1)	1997	2007, 2009
Multi-Function Devices (1)	1997	1999, 2007, 2009
Televisions	1998	2002, 2004, 2005, 2008, 2010, 2012
VCRs	1998-2008	2002, 2004, 2005
Consumer A/V Equipment	1999	2003, 2009, 2010, 2012
Bottled Water Coolers	2000	2004, 2010
Set-Top Boxes	2001-2005, 2009 (2)	2009
Cordless Phones	2002	2004, 2006, 2008
External Power Adapters	2005-2010	2008
Battery Charging Systems	2006	2011, 2012
Digital-to-Analog Converter Boxes	2007-2010	-

Note(s): 1) Treated together with other products as "Imaging Equipment." 2) Program relaunched in 2009.

Source(s): LBNL, Calendar Year 2007 Program Benefits for ENERGY STAR Labeled Products, October 2008; EPA, Revisions to Existing Standards, energystar.gov, October 2009; EPA, Program Requirements for each product listed, energystar.gov, November 2010.

9.1.6 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	-
Gas Boilers	1996	2002
Oil Boilers	1996	2002
Gas-Fired Heat Pumps	1995-2000	-
Geothermal Heat Pumps	2001	2009, 2011, 2012
Ventilating 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, 2008
Freezers	2004	-
Air Cleaners	2004	-
Water Heaters	2009	2010
Other Products		
Insulation	1996-2002	-
Residential Light Fixtures	1997	2001, 2002, 2003, 2005, 2007, 2008, 2011
Windows, Doors, Skylights	1997	2003, 2005, 2010
Roof Products	1999	2005, 2007, 2009
Screw base CFLs	1999	2001, 2004, 2008
Decorative Light Strings	2008	-
Residential LED Lighting	2008	2009, 2011
LED Light Bulbs	2010	-

Source(s): LBNL, Calendar Year 2007 Program Benefits for ENERGY STAR Labeled Products, October 2008; EPA, Revisions to Existing Standards, energystar.gov, October 2009; EPA, Program Requirements for each product listed, energystar.gov, November 2010.

9.1.7 Specification Dates for ENERGY STAR-Labeled Commercial and Miscellaneous Products

Commercial Products	Inception - End Date	Dates of updated specification
Commercial Refrigerators and Freezers	2001	2009/2010
Hot Food Holding Cabinets	2003	-
Commercial Steam Cookers	2003	-
Commercial Fryers	2003	2011
Cold Beverage Vending Machines	2004	2006, 2007
Solid State Lighting	2008	2009, 2011
Commercial Dishwashers	2007	-
Commercial Icemakers	2008	-
Commercial Griddles	2009	2011
Commercial Ovens	2009	-
Enterprise 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; EPA, Revisions to Existing Standards, energystar.gov, October 2009; EPA, Program Requirements for each product listed, energystar.gov, November 2010.

9.1.8 Total Appliance Shipments (Millions) and ENERGY STAR Market Share

	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%	9.5	50%	10.4	30%	8.8	42%	2.0	57%	2.5	14%
2008	6.0	67%	9.1	43%	9.3	31%	8.3	24%	1.6	75%	2.6	15%
2009	5.4	68%	5.8	36%	8.4	35%	7.9	48%	1.6	82%	2.6	19%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.

Source(s): Appliance Magazine, "U.S. Appliance Industry Statistical Review: 2000 to YTD 2010" (July 2010) and "ENERGY STAR Qualified Appliance Retail Sales Data" (2007, 2008, and 2009) for dishwashers, room AC, refrigerators, and clothes washers; LBNL, Climate Change Action Plan spreadsheet (2009) and EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary (2010) for air cleaners and dehumidifiers.

9.1.9 Total Lighting Shipments (Millions) and ENERGY STAR Market Share

	Light Fixtures		Medium Screw-Base Lamps	
1998	221.5	1%	-	N/A
1999	213.2	1%	1,328	0%
2000	210.8	2%	1,026	1%
2001	196.7	2%	1,088	5%
2002	220.5	1%	1,076	4%
2003	225.0	3%	1,161	5%
2004	237.8	2%	1,389	6%
2005	247.4	3%	1,343	7%
2006	248.6	4%	1,302	11%
2007	217.9	6%	1,518	21%
2008	194.6	10%	1,230	22%
2009	190.8	8%	1,681	15%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.1.10 Total Cooling Equipment Shipments (Thousands) and ENERGY STAR Market Share

	Central AC		Air-Source Heat Pumps		Geothermal Heat Pumps		Exhaust Fans		Ceiling Fans	
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%
2009	3,612	17%	1,622	32%	125	59%	6,511	17%	20,896	7%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.1.11 Total Heating Equipment Shipments (Thousands) and ENERGY STAR Market Share

	Gas Furnaces		Gas Boilers		Oil Boilers		Oil Furnaces	
1995	2,592	22%	109	N/A	156	N/A	146	1%
1996	2,871	24%	198	4%	161	48%	152	1%
1997	2,779	27%	206	6%	160	55%	124	1%
1998	2,977	29%	185	8%	148	67%	128	1%
1999	3,126	31%	201	10%	149	74%	125	1%
2000	3,104	35%	224	15%	144	85%	121	3%
2001	3,063	39%	221	17%	149	89%	122	4%
2002	3,202	40%	214	21%	148	98%	117	6%
2003	3,266	42%	235	21%	167	54%	127	7%
2004	3,519	47%	237	41%	162	71%	130	7%
2005	3,512	37%	224	25%	146	57%	111	7%
2006	3,197	37%	196	38%	121	90%	100	6%
2007	2,782	37%	201	38%	123	80%	84	13%
2008	2,300	43%	192	57%	122	62%	59	12%
2009	2,190	50%	192	46%	123	62%	54	24%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.1.12 Total Commercial Product Shipments (Thousands) and ENERGY STAR Market Share

	Exit Signs		Commercial 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%
2009	-	N/A	292	53%	29	75%	21	28%	246	18%	1,328	43%

	Commercial Dishwashers		Ice Machines		Commercial 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%
2009	37	78%	142	42%	91	12%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.1.13 Total Consumer Electronics Shipments (Millions) and ENERGY STAR Market Share

	TV		Telephony		TV-DVD/VCR		Audio/Video	
1998	28.2	N/A	-	N/A	3.1	17%	13.3	N/A
1999	25.1	39%	-	N/A	4.1	71%	18.3	17%
2000	25.4	46%	40.9	N/A	5.0	76%	23.9	24%
2001	22.8	45%	48.8	N/A	4.6	77%	27.6	38%
2002	23.2	45%	49.7	52%	5.7	82%	29.5	53%
2003	25.6	47%	52.0	59%	4.4	78%	25.4	59%
2004	23.1	83%	54.3	34%	7.2	64%	24.7	29%
2005	26.3	39%	56.0	26%	6.7	55%	24.2	26%
2006	32.3	54%	50.3	29%	3.2	4%	29.7	12%
2007	31.7	53%	39.6	25%	2.4	34%	31.6	33%
2008	32.7	79%	34.8	50%	1.7	67%	32.9	35%
2009	(1)	(1)	28.6	74%	(1)	(1)	35.2	73%

	External Power Supplies		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%
2009	668.5	59%	42.1	27%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist. (1) Not available.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.1.14 Total Office Equipment Shipments (Millions) and ENERGY STAR Market Share

	Computers		Monitors		Printers		Fascimile		Copiers		Scanners		Multi-Function Devices	
1992	-	N/A	-	N/A	-	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%
2009	66.5	55%	29.4	90%	6.7	67%	3.7	7%	0.2	78%	0.4	97%	19.0	47%

Note(s): N/A = Not Applicable. ENERGY STAR specification did not exist.
Source(s): LBNL, Climate Change Action Plan spreadsheet, 2009; EPA, ENERGY STAR Unit Shipment and Market Penetration Report Calendar Year 2009 Summary.

9.2.1 LEED for New Construction, by Selected States

	Certified	Bronze	Silver	Gold	Platinum	Total
California	93	0	127	204	29	453
Texas	52	0	79	65	5	201
Pennsylvania	46	0	76	64	4	191
Washington	35	0	67	77	4	183
Florida	47	0	65	66	3	181
Ilinois	37	0	62	69	9	177
Michigan	77	0	50	39	1	168
Virginia	38	0	62	43	4	147
Oregon	21	1	31	72	17	142
New York	32	0	52	45	10	139
All Other States	414	2	600	655	102	1,774
National Totals	**892**	**3**	**1,271**	**1,399**	**188**	**3,756**

Note(s): Totals include three buildings (one each in Pennsylvania, Michigan, and Massachusetts) whose certification level was not given. Pilots are

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010

9.2.2 LEED for New Construction, by Version

	v1.0	v2.0	v2.1	v2.2	v3 (2009)	Total
Platinum	3	13	66	104	2	188
Gold	2	81	384	930	2	1,399
Silver	1	82	461	725	2	1,271
Bronze	3	0	0	0	0	3
Certified	0	104	410	375	3	892
Total	**9**	**282**	**1,322**	**2,134**	**9**	**3,756**

Note(s): Includes only buildings in the United States. Totals include three buildings whose certification level was not given (two at NC 2.0 and one at

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010.

9.2.3 LEED for Core and Shell, by Version

	v2.0	v3 (2009)	Total
Platinum	25	1	26
Gold	227	0	227
Silver	176	1	177
Certified	44	0	44
Total	**472**	**2**	**474**

Note(s): Includes only buildings in the United States. Pilots are not included.

Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010.

9.2.4 LEED for Commercial Interiors, by Version

	v2.0	v3 (2009)	Total
Platinum	75	5	80
Gold	500	21	521
Silver	419	24	443
Certified	255	7	262
Total	**1,249**	**57**	**1,306**

Note(s): Includes only buildings in the United States. Pilots are not included.
Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010.

9.2.5 LEED for Existing Buildings, by Version

	EB v2.0	EB O&M	EB O&M v2009
Platinum	19	15	6
Gold	65	213	24
Silver	78	162	23
Certified	100	69	11
Total	**262**	**460**	**64**

Note(s): Includes only buildings in the United States. Total for EB O&M includes one building whose certification level was not given. Pilots are not
Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010.

9.2.6 LEED Certified Projects, by Ownership Category and Certification Level

	Platinum	Gold	Silver	Bronze	Certified	Unknown	Total
For-Profit Organization	148	1,271	1,131	0	701	1	3,252
State or Local Government	46	433	406	2	271	1	1,159
Not-for-Profit Organization	88	399	299	0	206	2	994
Federal Government	6	68	96	1	60	0	231
Individual	18	94	69	0	45	0	226
Other	28	189	155	0	101	2	475
Multiple Owner Types	6	56	36	0	21	0	119
Total	**340**	**2,510**	**2,192**	**3**	**1,405**	**6**	**6,456**

Note(s): Includes only buildings in the United States. Pilots and homes are not included.
Source(s): United States Green Building Council, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx, November 2010.

9.3.1 North American Technician Excellence Program (1)

Individuals Certified:	25,756
Number of Certificates:	91,386

Certifications	**Installation**	**Service (2)**
Air Conditioning	19,812	18,129
Air Distribution	1,758	1,429
Heat Pump (3)	14,116	13,337
Gas Furnace	10,149	8,592
Oil Furnace	842	785
Hydronics Gas	632	535
Hydronics Oil	257	238
Light Commercial Refrigeration	299	227
Commercial Refrigeration	140	109

Census Region	**Percent of**
South	40%
Midwest	26%
West	19%
Northeast	14%
Canada	1%

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) All service specialties include their installation counterparts for free. 3) Heat Pump specialties include their Air Conditioning counterparts for free.

Source(s): North American Technician Excellence Program, http://www.natex.org; Anthony Spagnoli, NATE, Personal Correspondence, November 2010.

9.3.2 Building Performance Institute (BPI) Certifications, by State

State	Certifications (1)	Thousand Residents per Cert. (2)	State	Certifications (1)	Thousand Residents per Cert. (2)
Alabama	47	102	Nebraska	10	183
Alaska	118	6	Nevada	183	15
Arizona	465	14	New Hampshire	246	5
Arkansas	43	68	New Jersey	1,550	6
California	1,014	37	New Mexico	70	29
Colorado	399	13	New York	3,793	5
Connecticut	531	7	North Carolina	604	16
Delaware	72	12	North Dakota	1	673
D.C.	51	12	Ohio	414	28
Florida	146	129	Oklahoma	27	139
Georgia	240	40	Oregon	561	7
Hawaii	1	1,360	Pennsylvania	888	14
Idaho	41	38	Rhode Island	121	9
Illinois	409	31	South Carolina	243	19
Indiana	319	20	South Dakota	9	90
Iowa	18	169	Tennessee	115	55
Kansas	85	34	Texas	604	42
Kentucky	179	24	Utah	54	51
Louisiana	42	108	Vermont	319	2
Maine	237	6	Virginia	312	26
Maryland	454	13	Washington	467	14
Massachusetts	510	13	West Virginia	46	40
Michigan	376	26	Wisconsin	105	54
Minnesota	123	43	Wyoming	25	23
Mississippi	9	330			
Missouri	363	16	United States	17,077	18
Montana	18	55	Outside U.S.	18	N/A
			Total	17,095	N/A

Note(s): 1) Counts total active certifications in each state as of December 8, 2010. An individual may hold multiple certifications. 2) Based on preliminary 2010 Census counts of resident population as of April 1, 2010.

Source(s): Personal Communication, Mathew Anderson, Building Performance Institute, December 2010.

9.3.3 Association of Energy Engineers Energy Auditor Certifications, by State

State	Certified Energy Auditors (1)	Thousand Residents per Auditor (2)	State	Certified Energy Auditors (1)	Thousand Residents per Auditor (2)
Alabama	55	87	Nebraska	4	457
Alaska	15	47	Nevada	7	386
Arizona	25	256	New Hampshire	13	101
Arkansas	3	972	New Jersey	60	147
California	100	373	New Mexico	9	229
Colorado	33	152	New York	96	202
Connecticut	30	119	North Carolina	32	298
Delaware	2	449	North Dakota	4	168
D.C.	10	60	Ohio	58	199
Florida	73	258	Oklahoma	14	268
Georgia	48	202	Oregon	12	319
Hawaii	5	272	Pennsylvania	76	167
Idaho	0	N/A	Rhode Island	6	175
Illinois	35	367	South Carolina	16	289
Indiana	26	249	South Dakota	1	814
Iowa	11	277	Tennessee	16	397
Kansas	8	357	Texas	109	231
Kentucky	12	362	Utah	8	345
Louisiana	11	412	Vermont	4	156
Maine	15	89	Virginia	55	145
Maryland	29	199	Washington	12	560
Massachusetts	68	96	West Virginia	2	926
Michigan	40	247	Wisconsin	16	355
Minnesota	37	143	Wyoming	0	N/A
Mississippi	8	371			
Missouri	35	171	Total U.S.	1,365	226
Montana	1	989	Outside U.S.	112	N/A
			Grand Total	1,477	N/A

Note(s): 1) Counts total active certifications in each state as of January 18, 2011. 2) Based on preliminary 2010 Census counts of resident population as of April 1, 2010.

Source(s): Personal Communication, Jennifer Vendola, Association of Energy Engineers, January 2011.

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*year): 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

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

	Primary 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 (Service/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)	1,134
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 facade.
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	20.213
Consumption	million Btu per short ton	19.989
Coke Plants	million Btu per short ton	26.280
Industrial	million Btu per short ton	22.360
Residential and Commercial	million Btu per short ton	21.359
Electric Power Sector	million Btu per short ton	19.726
Imports	million Btu per short ton	25.116
Exports	million Btu per short ton	25.393
Coal Coke	million Btu per short ton	24.800
Crude Oil		
Production	million Btu per barrel	5.800
Imports	million Btu per barrel	5.990
Petroleum Products		
Consumption	million Btu per barrel	5.301
Motor Gasoline	million Btu per barrel	5.128
Jet Fuel	million Btu per barrel	5.670
Distillate Fuel Oil	million Btu per barrel	5.775
Diesel Fuel	million Btu per barrel	5.766
Residual Fuel Oil	million Btu per barrel	6.287
Liquefied Petroleum Gases	million Btu per barrel	3.600
Kerosene	million Btu per barrel	5.670
Petrochemical Feedstocks	million Btu per barrel	5.565
Unfinished Oils	million Btu per barrel	6.118
Imports	million Btu per barrel	5.542
Exports	million Btu per barrel	5.840
Ethanol	million Btu per barrel	3.539
Biodiesel	million Btu per barrel	5.376
Natural Gas Plant Liquids		
Production	million Btu per barrel	3,948
Natural Gas		
Production, Dry	Btu per cubic foot	1,028
Consumption	Btu per cubic foot	1,028
End-Use Sectors	Btu per cubic foot	1,029
Electric Power Sector	Btu per cubic foot	1,027
Imports	Btu per cubic foot	1,025
Exports	Btu per cubic foot	1,009
Electricity Consumption	Btu per kilowatt hour	3,412

Note(s): Conversion factors vary from year to year.

Source(s): DOE, EIA, Annual Energy Outlook 2010, Apr. 2008, Table G1, p. 221.

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