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Preface

The Renewable Energy Annual (2009) is the fifteenth in a series of annual publications on renewable energy by the Energy Information Administration (EIA). The 2009 edition presents five chapters, accompanied with data tables, text and graphics covering various aspects of the renewable energy marketplace:

- Renewable Energy Trends in Consumption and Electricity
- Solar Thermal Collector Manufacturing Activities
- Solar Photovoltaic Cell/Module Manufacturing Activities
- Geothermal Heat Pump Manufacturing Activities
- Green Pricing and Net Metering Programs

The renewable energy sources included are biomass (wood, wood waste, municipal solid waste, landfill gas, ethanol, biodiesel and other biomass); geothermal; wind; solar (solar thermal and photovoltaic); and conventional hydropower.

Hydroelectric pumped storage facilities are excluded, because they usually use non-renewable energy sources for their operation. Since the EIA collects data only on terrestrial (land-based) solar energy systems, satellite and some military applications are also excluded.

Definitions for terms used in this report can be found in EIA's Energy Glossary: <http://www.eia.gov/glossary/>.

General information about all the EIA surveys with data related to renewable energy and referenced in this report can be found at: <http://www.eia.gov/survey/>

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1. Trends in renewable energy consumption and electricity 2009

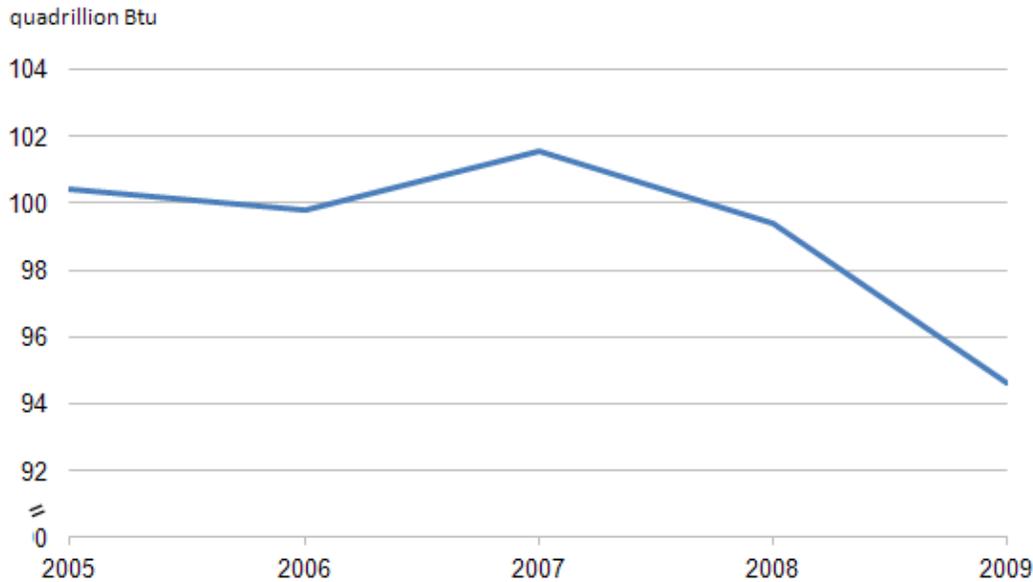
Summary

Despite an economic recession and a significant fall in overall energy demand/consumption, the use of renewable fuels grew strongly in 2009. This growth has been supported by Federal and State programs, including Federal tax credits, state renewable portfolio standards, and a Federal renewable fuels standard. This chapter details renewable energy consumption in 2009 and explains the unusual decrease in total energy consumption over the past two years.

Total U.S. energy consumption

U.S. energy consumption declined for the second year in a row in 2009, falling 4.8 percent between 2008 and 2009 to 94.6 quadrillion British Thermal Units (Btus) (Table 1.1, Figure 1.1). This follows a 2.1-percent decline between 2007 and 2008. Total energy consumption in 2009 dropped to its lowest level since 1996.¹

Figure 1.1 Total U.S. energy consumption, 2005-2009



Source: U.S. Energy Information Administration.

This is just the third time since 1949 that energy consumption has declined for two or more consecutive years. It declined between 1973 and 1974 and again in 1975. However, consumption rebounded in 1976 above the 1973 level. The longest and steepest decline occurred between 1979 and 1983, when total energy consumption dropped 9.7 percent and it did not reach the 1979 level again until 1988.

¹ U.S. Energy Information Administration, *Annual Energy Review 2009*, Table 1.1.

In both of these earlier periods, oil prices that rose steeply and remained at high levels were a major factor in slowing down the economy and hence reducing energy consumption. This time, there has been no steep oil price increase that resulted in permanently higher oil prices: the average annual price per barrel of crude oil was \$60 in 2006, \$67 in 2007, \$94 in 2008, and \$56 in 2009.² In 2009, the economy slowed down mainly due to factors outside the energy sector.

Unlike renewable, consumption of all major fuels declined between 2008 and 2009. Coal dropped the most, falling 12 percent, while petroleum consumption fell nearly 5 percent, and natural gas consumption fell 2 percent. Even nuclear fuel consumption fell by nearly 1 percent. The decline in all of these sources of energy masks the switching of coal to natural gas for electricity generation due to low natural gas prices.

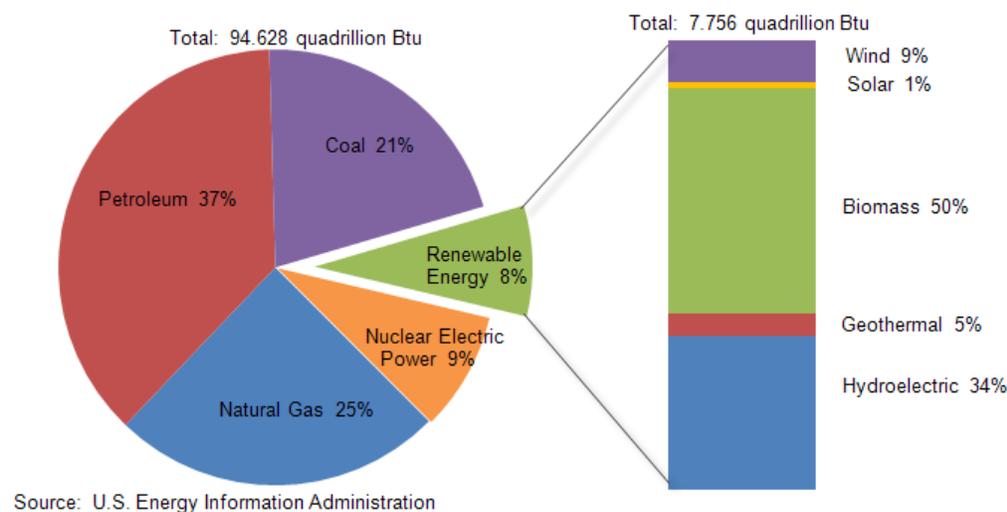
By sector, energy consumption dropped most in the industrial area (-10.1 percent), followed by electric power (-4.5 percent) and then transportation (-3.5 percent).³ The residential and commercial sectors each experienced declines of less than under 2 percent.

U.S. renewable energy consumption

Total consumption

Against this backdrop, it is noteworthy that renewable energy consumption increased by 5.4 percent in 2009 to 7.8 quadrillion Btu (Figure 1.2). This follows a 9.6-percent increase between 2007 and 2008. These two increases, coupled with the consecutive year decreases in total energy consumption, boosted renewable energy's share of total consumption from 6.6 percent in 2007 to 8.2 percent in 2009. This is renewable energy's greatest share of the U.S. energy pie since 1984 when there were near record levels of hydropower.⁴

Figure 1.2 Renewable energy consumption in the nation's energy supply, 2009



² U.S. Energy Information Administration, *Monthly Energy Review*, November 2010, Table 9.1. Prices shown reflect the crude oil domestic “first purchase” price.

³ U.S. Energy Information Administration, *Annual Energy Review 2009*, Table 2.1a.

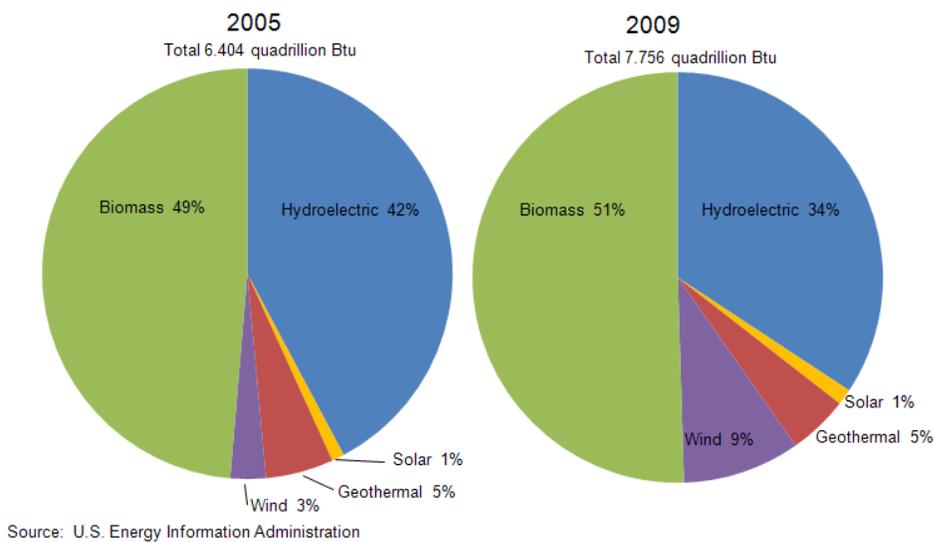
⁴ The reason the share was so high in 1984 was that in the relatively wet years of the mid-1980s, hydropower output was around the same levels that it was in the late 1990s. U.S. Energy Information Administration, *Annual Energy Review 2009*, Table 10.1.

Wind energy grew 32 percent and has more than doubled since 2007, standing at 0.7 quadrillion Btus in 2009. While the gain in 2009 was strong, capacity additions and output might have been greater still except for the collapse of natural gas prices, which made lower capital cost natural gas-fired capacity more attractive than wind. Solar energy followed a pattern similar to that of wind energy for similar reasons. Solar energy consumption in 2009 jumped by 10 percent from 2008, about 60 percent of the rate of increase for the prior year. Biomass grew just 1 percent between 2008 and 2009, when there was a 14 percent gain in biofuels (ethanol and biodiesel) consumption but an 8 percent decrease in wood and derived fuels consumption.

Hydropower consumption grew 6.3 percent in 2009. Even with the growth in output over the past 2 years, at 2.7 quadrillion Btus in 2009 hydropower energy consumption is still under the 30-year average of 2.9 quadrillion Btus.⁵ This reflects the extended drought in the western United States.⁶

The transformation in the mix of renewable energy provided between 2005 and 2009 is quite remarkable. Wind has come from a relatively minor renewable energy source to accounting for nearly 10 percent of total renewable energy consumption (Figure 1.3). Hydropower has dropped considerably, from 42 percent of renewable energy consumption in 2005 to 34 percent today, and biomass now represents over half of renewable energy consumption, the result of increased biofuel production.⁷

Figure 1.3 U.S. energy consumption, 2005-2009



⁵ The 30-year average is based on the period 1980 – 2009.

⁶ Weather Warehouse, <http://weather-warehouse.com/?gclid=CO3K3-LxnqYCFcNM4AodVTSynw>.

⁷ Hydropower's share declined because output remained static in the face of increasing overall renewable energy consumption.

The continued growth of renewable energy is linked to various financial incentives and mandates.⁸ Currently, 37 states and the District of Columbia have some sort of renewable mandates or “renewable portfolio standard,” which requires electricity providers to produce or acquire a certain share of electricity from renewable energy sources (Table 1.28).⁹ In 6 states, however, these standards are voluntary.

Consumption by end-use sector

The greatest change in recent composition of renewable energy has occurred in transportation. Due to the growth in biofuels, transportation now consumes nearly 12 percent of renewable energy, compared with just over 5 percent in 2005 (Table 1.2). The shares of renewables in all other sectors have declined. It may seem strange that the electric power sector’s share of renewable energy has decreased from 56 to 53 percent between 2005 and 2009, given the emphasis on renewables and the surge in wind generation. However, the energy source with the largest contribution to renewable electricity is hydropower—accounting for over 60 percent of renewable energy used to generate electricity. Its output fell slightly between 2005 and 2009, while most other renewable energy sources increased (Table 1.3). As a result, its share of increasing renewable energy consumption has declined, thus decreasing the electric power sector’s contribution to total renewable energy. Other relevant factors contributing to the electric power sector’s decreased contribution to total renewable energy probably include low natural gas prices and the focus on investment in wind plants with low (about 35%) capacity factors. Nonetheless, the electric power sector still consumed the majority—53 percent—of total renewable energy in 2009.

The industrial sector’s share of renewable energy consumption has also declined. Consumption of wood and derived fuels, the largest renewable fuel in the industrial sector (about 60 percent in 2009), has declined since 2005. In 2009, the industrial sector consumed 26 percent of total renewable energy.

The residential and commercial sectors used 7.1 and 1.7 percent of total renewable energy in 2009, respectively. Geothermal energy consumed by the residential sector, although small, continues to grow, reflecting the increased use of geothermal heat pumps. Although commercial sector renewable energy consumption appears to be static, there have been many commercial photovoltaic rooftop projects of 1 megawatt (MW) or more placed into service over the past two years (especially in California).¹⁰ Beginning with data collected for 2010, the Energy Information Administration’s (EIA’s) electricity data forms will collect information to enable EIA to estimate commercial sector solar consumption.

Consumption by end use

Electricity generation accounted for 56 percent of renewable energy consumed in 2009, compared with 59 percent in 2005 (Table 1.2 and Table 1.3). The decreased share is due to the rapid increase in biomass used to produce biofuels (Figure 1.4).

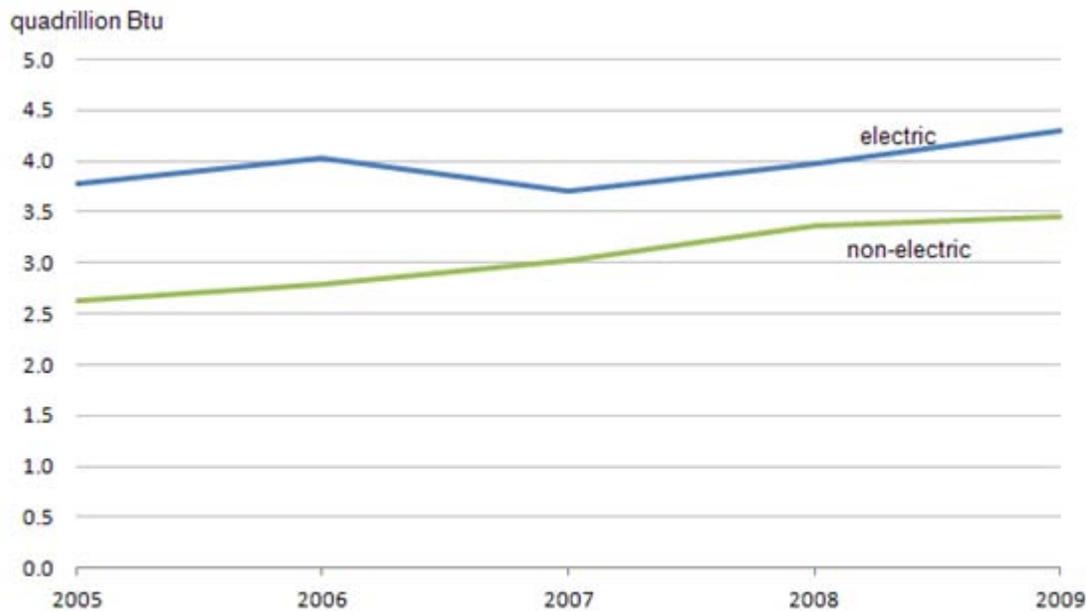
Although the electric power sector has always consumed the vast majority of renewable energy for electricity, that percentage has increased in recent years, rising from 93 percent of renewable energy for electricity generation in 2005 to 95 percent in 2009.

⁸ U.S. Energy Information Administration, *Annual Energy Outlook 2011*, Executive Summary.

⁹ See the Database for State Incentives for Renewables and Efficiency, www.dsireusa.org, for a description of each state’s renewable portfolio standard or mandate.

¹⁰ Data for some commercial PV rooftop projects greater than 1 MW were not available as of the time of this writing.

Figure 1.4 Renewable energy consumption by end-use, 2005-2009



Source: U.S. Energy Information Administration

This is due to wind energy’s rapid rise and use almost entirely within the electric power sector, coupled with slowly decreased electrical output in the industrial sector using biomass. Older paper and pulp plants are closing rather than refurbishing due to environmental regulations.¹¹ Others have chosen to upgrade, while still others are converting to merchant biomass facilities.¹² Some plants are refurbishing to produce electricity, others plan to become bio- refineries with no electricity output.¹³

Renewable energy consumption for non-electric purposes increased by a net of 0.8 quadrillion Btus between 2005 and 2009. All of the increase was due to biofuels; the energy content of ethanol produced rose 0.6 quadrillion Btus, and another 0.4-quadrillion Btus increase was required by the industrial sector to produce biofuels. Biomass consumed for other non-electric purposes, principally process heat at paper and pulp plants, actually decreased by 0.2 quadrillion Btus between 2005 and 2009. Residential solar energy, though small, has increased consistently since 2005 but still represents less than 0.1 quadrillion Btus.

¹¹ See http://www.iaes.org/conferences/future/philadelphia_52/prelim_program/k10-1/shadbegian-akofio.htm.

¹² For a comprehensive overview of the paper and pulp industry and the energy/environment issues it faces, see U.S. Department of Energy, *Energy and Environmental Profile of the Pulp and Paper Industry*, December 2005.

¹³ An example of paper pulp mills converting to biorefineries may be found at <http://www.environmentalleader.com/2010/02/22/pulp-mills-invest-in-energy-efficiency-biorefinery-projects/>. Although the projects discussed are Canadian, the pulp and paper industry is essentially the same across North America.

Long-term historical view of renewable energy consumption

Table 1.5 presents renewable energy consumption from 1989 through 2009. The beginning year 1989 was chosen because that was the first year that EIA began surveying “non-utilities” for electricity information. Highlights:

- Waste energy appears to have declined substantially in 2001.¹⁴ This is an artifact of EIA’s decision to split municipal solid waste (MSW) data into two components beginning in 2001, biogenic (renewable) and nonbiogenic (non-renewable), as well as remove tire-derived fuels from renewables. If non-biogenic MSW data is added to the 2002 waste values shown in Table 1.5, the waste series increases between 2001 and 2002 (Table 1.A1).¹⁵ Waste energy increased steadily except during 1996-2000. During that period, some mass-burn MSW plants ceased operating, and landfill gas (LFG) use for energy was minimal.
- Residential renewable energy decreased from 1.0 quadrillion Btus in 1989 to 0.4 quadrillion Btu in 2002 before beginning to increase steadily through 2009. This reflects decreased wood use throughout the time period and increased photovoltaic rooftop installations during the past decade.¹⁶
- Increases in biomass for biofuels have essentially offset decreases in wood and derived fuel use in the industrial sector.
- Hydropower average output from 1989-1999 was over 0.5 quadrillion Btus greater than from 2001-2009.
- Wind increased seven-fold from less than 0.1 quadrillion Btus in 1989 to 0.7 quadrillion Btus in 2009.

Biomass overview

Biofuels

The total energy consumed in producing ethanol and biodiesel during 2009 was 1.6 quadrillion Btus (Table 1.6). Of that amount, 1.0 quadrillion Btus represents the energy value of biofuels consumed.¹⁷ The remaining 0.6 quadrillion Btus represents the energy used to produce biofuels, losses and coproducts, and the denaturant added to ethanol. The apparent major decrease between 2008 and 2009 in biofuels consumed for biodiesel is due to counting “splash and dash” biodiesel “production” as U.S. consumption in 2008 rather than as exports.¹⁸

Waste energy

Most biomass waste was consumed by the industrial sector and by independent power producers (IPPs) in 2009 (Table 1.7). IPPs operate almost all of the MSW energy facilities, while the industrial sector and IPPs operate most LFG facilities. Other biomass waste (mostly food waste and waste from wastewater treatment facilities) are largely in the industrial sector.

¹⁴ Waste energy includes MSW, LFG, sludge waste from wastewater treatment plants, food processing wastes, and other minor biomass wastes used to product energy.

¹⁵ See also U.S. Energy Information Administration, “Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy,” May 2007.

¹⁶ As mentioned previously, some of the residential energy consumption may actually belong to the commercial or other sectors.

¹⁷ See Table 1.10 for information on the heat content of various biomass fuels.

¹⁸ Prior to 2009, U.S. law made eligible for the \$1.00-per-gallon blenders tax credit any pure biodiesel that was imported, “splash”-blended with conventional diesel, then re-exported. With European subsidies encouraging the use of biodiesel, this import/re-export process surged in 2008. Subsequently, U.S. law changed to make such “production” ineligible for the blenders tax credit.

Industrial biomass energy

The industrial sector used 2.0 quadrillion Btus of biomass in 2009 to produce 26 billion kilowatt-hours (kWh) of electricity (Table 1.8). Around 90 percent of biomass energy went for useful thermal output (e.g., process heat and steam, space heating).

Biomass/coal cofiring

Sixty-seven plants had the capability to cofire biomass with coal. These plants had a cofiring capacity of over 4,400 MW (Table 1.9). This is a substantial jump from 3,800 MW in 2008. Wisconsin led the Nation with the most plants—13—having 448 MW capacity.¹⁹

Renewable electricity

U.S. generation

Renewable electricity generation increased 9.7 percent in 2009, led by a one-third increase in wind and a 7.3 percent increase in hydropower (Table 1.11). Even in absolute terms, wind-generated electricity accounted for almost as many kWh of increased generation as did hydropower. Generation from LFG increased 10.7 percent, while electricity from wood and derived fuels dropped 3.4 percent.

The decline in biomass power is consistent with the decrease in consumption data, owing to the status of the domestic pulp and paper business discussed earlier. Wind power appeared in the commercial sector for the first time in 2009 at a wastewater treatment plant in Massachusetts.²⁰

U.S. electricity capacity²¹

Renewable electricity capacity rose by 10.7 gigawatts (GW) in 2009 to 127.1 GW, up 9.2 percent from 2008 (Table 1.12).²² By comparison, total U.S. electricity capacity rose only 1.5 percent, or 15.2 GW. Of the 10.7 GW renewable capacity increase, 9.6 GW came from wind.

Regional electricity generation

The Pacific Contiguous Census Division (PC), California, Washington, and Oregon, leads the Nation in producing renewable electricity, with 40 percent of the total in 2009 (Table 1.13 and Figure 1.5). Nearly 80 percent of the PC Census Division's 169 billion kilowatthours of renewable electricity generation came from hydropower electricity.

¹⁹ Kentucky however, had more cofiring capacity in 2009, 536 MW, but only at a single plant.

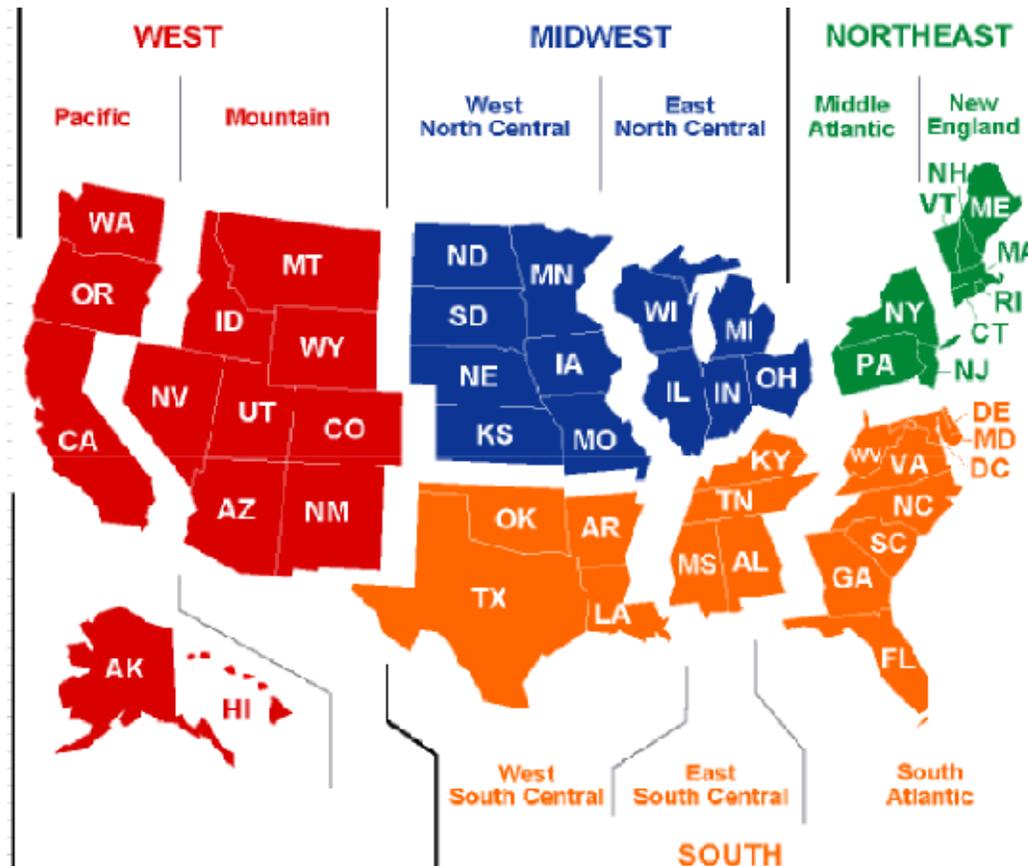
²⁰ See <http://www.mwra.state.ma.us/03sewer/html/renewableenergydi.htm>.

²¹ The capacity data refer to net summer capacity.

²² 1 Gigawatt = 1,000 megawatts.

Also, the PC division produced over 85 percent of the Nation’s geothermal power and provided 8 percent of the PC division’s renewable energy. Nonhydroelectric generation increased almost as much as hydroelectric generation between 2008 and 2009, but from a smaller base.²³ The largest increases were for wind generation in the West North Central and West South Central Census Divisions.

Figure 1.5 U.S. Census Regions and Divisions



Source: U.S. Energy Information Administration

Excluding hydropower, the distribution of renewable generation was much more even. While the PC division still led, its share was only 24 percent, and several regions were close behind: West South Central (WSC, 19 percent) and West North Central (WNC, 15 percent). The latter two regions have substantial wind power. In fact, WSC led among all regions in wind power during 2009 (23 gWh), followed by WNC (20 gWh).

Generation from wood and derived fuels is fairly well spread out across many regions. LFG and MSW, however, are largely concentrated in 3 regions each. Both fuels have substantial generation in the Middle Atlantic region, while LFG has sizable generation in the East North Central and PC regions, and MSW has sizable output in New England and the South Atlantic. The concentration of MSW and LFG in these regions probably has more to do with state policies regarding trash management and trash disposal cost than with resource availability. State renewables data shown in Table 1.20, discussed later, indicates that MSW/LFG generation in 4 of the above-mentioned regions is highly concentrated in a single state—California (PC), Massachusetts (New England), New York (Middle Atlantic), and Florida (South Atlantic).

²³ U.S. Energy Information Administration, *Renewable Energy Annual 2008*, Table 1.13.

Table 1.14 shows biomass electricity generation by energy source and Census Division. Black liquor and wood waste solids, primarily in the South, provided 66 percent of biomass electricity generation.

State electricity generation

Washington, California, and Oregon were the three leading states generating renewable electricity within the electric power sector in 2009 (Table 1.18). Combined, they produced 43 percent of the Nation's renewable electric power sector generation. This is a decreased concentration from 2008, when these 3 states produced 47 percent of the electric power sector's renewable electricity (Table 1.15). The states with the greatest increases in hydropower between 2008 and 2009 were 3 southern states—Alabama, Tennessee, and North Carolina—as well as California.

Excluding hydropower, however, the picture changes. California, Texas, and Minnesota were the leading states for electric power sector non-hydro renewable generation, accounting for 47 percent in 2008. In 2009, however, Iowa replaced Minnesota as the third-largest non-hydro renewable generator in the electric power sector, due to a major increase in wind generation. The 3 largest states' share of non-hydro renewables declined to 45 percent. The decreased 2009 share represents an increase in the diversity of wind power, dominated by Texas, Iowa, California, and Minnesota (50 percent). Generation from wood and derived fuels continues to be diverse state-wise, but the southern United States accounts for nearly half of generation from these sources.²⁴

Generation from the industrial and commercial sectors is tiny compared to the electric power sector—about 8 percent in 2008 and 7 percent in 2009 (Tables 1.16 and 1.19, respectively). While no state dominates generation in these sectors, six of the top seven States are in the southeastern region of the United States. The other state, Maine, consumed a relatively large amount of wood for industrial and commercial electricity generation. It also has a large portion of the Nation's commercial hydropower generation (39 percent in 2009).

All sectors combined, the generation picture is quite similar to the dominant electric power sector, except that the concentration of non-hydro renewables is not quite as great (35 percent in 2009, Table 1.20).

State electricity capacity

Tables 1.21 through 1.23 present renewable energy capacity by sector and state for 2008, while Tables 1.24 through 1.26 do so for 2009. Texas led the Nation in increased renewables capacity, adding 1,974 MW between 2008 and 2009. Most of this was increased wind capacity, 1,951 MW, which led all states by a wide margin. The data indicates that Idaho added 336 MW of hydropower, but this was an up-rating of existing capacity due to increased water levels.

Renewable electricity market share

Idaho, Washington, Oregon, and South Dakota had the greatest market share of total renewable electricity generation in 2009 (Table 1.27). All generated over half of total electricity from renewables. In each case, the vast majority of renewable generation came from hydropower. Excluding hydropower, Maine, Iowa, California, and Minnesota had the greatest renewable electricity market shares, all exceeding 10 percent. Maine's renewable electricity is largely wood-based. Iowa and Minnesota rely mainly on wind, while California has a diversity of non-hydro renewable sources. The shares for Iowa and, to a lesser extent, Minnesota, rose sizably from 2008 due to increased wind penetration.

²⁴ The "southern United States" includes states in the East South Central and South Atlantic Census divisions, plus Virginia.

Other non-renewable energy: classification change for certain biomass fuels

Until 2007, EIA included classified all MSW energy as renewable, as well as tire-derived fuel (TDF). Beginning with EIA's 2006 data reporting, however, renewables include only the biogenic portion of MSW and categorize TDF as non-renewable. Appendix Tables 1. A1 and 1.A2 show the energy consumption and electricity generation associated with non-biogenic MSW, TDF, and other minor fuels specified in those tables.²⁵

Data revisions

Residential solar energy consumption was revised downward for 1989-2009 to account for losses in roof top PV installations when converting from DC to AC electric power. Geothermal energy in the electric power sector was revised downward due to a misclassification of some geothermal facilities in Montana as geothermal when they were consuming waste heat. As a result, geothermal electric capacity was revised downward slightly for 2008 and 2009. Geothermal electric generation and consumption were revised downwards for 2008, while electric power sector other non-biogenic generation and consumption were revised upwards.

²⁵ Data from 2001 through 2005 were revised to reflect this reclassification.

Table 1.1 U.S. energy consumption by energy source, 2005 - 2009

(quadrillion Btu)

Energy Source¹	2005	2006	2007	2008	2009
Total	100.440	99.624	101.362	99.270	94.485
Fossil Fuels	85.790	84.687	86.251	83.540	78.426
Coal	22.797	22.447	22.749	22.385	19.703
Coal Coke Net Imports	0.045	0.061	0.025	0.040	-0.023
Natural Gas ²	22.561	22.224	23.702	23.834	23.343
Petroleum ³	40.388	39.955	39.774	37.280	35.403
Electricity Net Imports	0.084	0.063	0.106	0.113	0.116
Nuclear Electric Power	8.161	8.215	8.455	8.427	8.356
Renewable Energy	6.242	6.659	6.551	7.191	7.587
Biomass ⁴	3.117	3.277	3.503	3.852	3.899
Biofuels	0.577	0.771	0.991	1.372	1.567
Waste	0.403	0.397	0.413	0.436	0.452
Wood and Derived Fuels	2.136	2.109	2.098	2.044	1.881
Geothermal Energy	0.181	0.181	0.186	0.192	0.200
Hydroelectric Conventional	2.703	2.869	2.446	2.512	2.669
Solar Thermal/PV Energy	0.063	0.068	0.076	0.089	0.098
Wind Energy	0.178	0.264	0.341	0.546	0.721

¹Biodiesel primarily derived from soybean oil and ethanol primarily derived from corn.

²Includes supplemental gaseous fuels.

³Petroleum products supplied, including natural gas plant liquids and crude oil burned as fuel.

⁴Biomass includes: biofuels, waste (landfill gas, MSW biogenic, and other biomass), wood and wood derived fuels.

PV = Photovoltaic.

Notes: Data revisions are discussed in the Highlights section.

Totals may not equal sum of components due to independent rounding.

Sources: Non-renewable energy: U.S. Energy Information Administration (EIA), Monthly Energy Review (MER) November 2010, DOE/EIA-0035 (2010/11) (Washington, DC, November 2010), Tables 1.3, 1.4a and 1.4b; Renewable Energy: Table 1.2 of this report.

Table 1.2 Renewable energy consumption by energy-use sector and energy source, 2005 – 2009

(quadrillion Btu)

Sector and Source	2005	2006	2007	2008	2009
Total	6.242	6.659	6.551	7.191	7.587
Biomass	3.117	3.277	3.503	3.852	3.899
Biofuels	0.577	0.771	0.991	1.372	1.567
Biodiesel ¹	0.012	0.033	0.046	0.040	0.040
Ethanol ²	0.335	0.453	0.569	0.800	0.910
Losses and Coproducts	0.230	0.285	0.377	0.532	0.617
Biodiesel Feedstock ³	*	*	0.001	0.001	0.001
Ethanol Feedstock ⁴	0.230	0.285	0.376	0.531	0.616
Waste	0.403	0.397	0.413	0.436	0.452
Landfill Gas	0.148	0.157	0.173	0.187	0.204
MSW Biogenic ⁵	0.168	0.171	0.165	0.169	0.168
Other Biomass ⁶	0.088	0.069	0.075	0.079	0.079
Wood and Derived Fuels ⁷	2.136	2.109	2.098	2.044	1.881
Geothermal	0.181	0.181	0.186	0.192	0.200
Hydroelectric Conventional	2.703	2.869	2.446	2.512	2.669
Solar Thermal/PV	0.063	0.068	0.076	0.089	0.098
Wind	0.178	0.264	0.341	0.546	0.721
Residential	0.504	0.472	0.522	0.556	0.552
Biomass	0.430	0.390	0.430	0.450	0.430
Wood and Derived Fuels ⁸	0.430	0.390	0.430	0.450	0.430
Geothermal	0.016	0.018	0.022	0.026	0.033
Solar Thermal/PV ⁹	0.058	0.063	0.070	0.080	0.089
Commercial	0.119	0.117	0.118	0.125	0.129
Biomass	0.105	0.102	0.102	0.109	0.112
Biofuels	0.001	0.001	0.002	0.002	0.003
Ethanol ²	0.001	0.001	0.002	0.002	0.003
Waste	0.034	0.036	0.031	0.034	0.036
Landfill Gas	0.003	0.004	0.003	0.003	0.003
MSW Biogenic ⁵	0.025	0.026	0.021	0.026	0.028
Other Biomass ⁶	0.007	0.007	0.007	0.005	0.005
Wood and Derived Fuels ⁷	0.070	0.065	0.069	0.073	0.072
Geothermal	0.014	0.014	0.014	0.015	0.017
Hydroelectric Conventional	0.001	0.001	0.001	0.001	0.001
Solar Thermal/PV	-	-	-	*	-
Wind	-	-	-	-	*
Industrial	1.873	1.930	1.964	2.053	2.005
Biomass	1.837	1.897	1.944	2.031	1.982
Biofuels	0.237	0.295	0.387	0.544	0.630
Ethanol ²	0.007	0.010	0.010	0.012	0.013
Losses and Coproducts	0.230	0.285	0.377	0.532	0.617
Biodiesel Feedstock ³	*	*	0.001	0.001	0.001

See footnotes at end of table.

Table 1.2 Renewable energy consumption by energy-use sector and energy source, 2005 – 2009 (cont.)

Sector and Source	2005	2006	2007	2008	2009
Ethanol Feedstock ⁴	0.230	0.285	0.376	0.531	0.616
Waste	0.148	0.130	0.144	0.144	0.154
Landfill Gas	0.081	0.081	0.093	0.093	0.104
MSW Biogenic ⁵	0.007	0.006	0.006	0.003	0.004
Other Biomass ⁶	0.061	0.043	0.046	0.048	0.047
Wood and Derived Fuels ⁷	1.452	1.472	1.413	1.344	1.198
Geothermal	0.004	0.004	0.005	0.005	0.004
Hydroelectric Conventional	0.032	0.029	0.016	0.017	0.018
Solar Thermal/PV	-	-	-	-	-
Wind	-	-	-	-	-
Transportation	0.339	0.475	0.603	0.827	0.934
Biomass	0.339	0.475	0.603	0.827	0.934
Biofuels	0.339	0.475	0.603	0.827	0.934
Biodiesel ¹	0.012	0.033	0.046	0.040	0.040
Ethanol ²	0.328	0.442	0.557	0.786	0.894
Electric Power ¹⁰	3.407	3.665	3.345	3.630	3.967
Biomass	0.406	0.412	0.423	0.435	0.441
Waste	0.221	0.231	0.237	0.258	0.261
Landfill Gas	0.065	0.073	0.077	0.092	0.097
MSW Biogenic ⁵	0.136	0.139	0.138	0.141	0.137
Other Biomass ⁶	0.020	0.019	0.022	0.026	0.027
Wood and Derived Fuels ⁷	0.185	0.182	0.186	0.177	0.180
Geothermal	0.147	0.145	0.145	0.146	0.146
Hydroelectric Conventional	2.670	2.839	2.430	2.495	2.650
Solar Thermal/PV	0.006	0.005	0.006	0.009	0.009
Wind	0.178	0.264	0.341	0.546	0.721

¹Biodiesel primarily derived from soybean oil.

²Ethanol primarily derived from corn minus denaturant.

³Losses and co-products from the production of biodiesel. Does not include natural gas, electricity, and other non-biomass energy used in the production of biodiesel.

include natural gas, electricity, and other non-biomass energy used in the production of fuel ethanol.

⁵Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

⁶Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

⁷Black liquor, and wood/wood waste solids and liquids.

⁸Wood and wood pellet fuels.

⁹Includes small amounts of distributed solar thermal and photovoltaic energy used in the commercial, industrial and electric power sectors.

American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity

MSW = Municipal Solid Waste.

PV = Photovoltaic.

* = Less than 500 billion Btu.

- = No data reported.

Table 1.2 Renewable energy consumption by energy-use sector and energy source, 2005 – 2009 (cont.)

Notes: Totals may not equal sum of components due to independent rounding.

Data revisions are discussed in the Highlights section.

Energy consumption for the noncombustible renewable energy sources (hydroelectric conventional, solar thermal, PV and wind) used in electricity generation is determined by multiplying generation times the fossil fuel equivalent heat rate. Energy consumption for geothermal energy used in electricity generation is determined by multiplying generation times the geothermal heat rate. See U.S. Energy Information Administration (EIA), Annual Energy Review (AER) 2009, DOE/EIA-0384 (2009) (Washington, DC, August 2010), Table A6. Sources: Analysis conducted by U.S. Energy Information Administration (EIA), Office of Electricity, Coal, Nuclear and Renewables Analysis and specific sources described as follows. Residential: U.S. Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and U.S. Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." Commercial: U.S. Energy Information Administration, Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center. Industrial: U.S. Energy Information Administration, Form EIA-846 (A, B, C) "Manufacturing Energy Consumption Survey," Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center;

Sources: Analysis conducted by U.S. Energy Information Administration (EIA), Office of Electricity, Coal, Nuclear and Renewables Analysis and specific sources described as follows. Residential: U.S. Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and U.S. Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." Commercial: U.S. Energy Information Administration, Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center. Industrial: U.S. Energy Information Administration, Form EIA-846 (A, B, C) "Manufacturing Energy Consumption Survey," Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center;

U.S. Environmental Protection Agency, Landfill Methane Outreach Program estimates; and losses and coproducts from the production of biodiesel calculated as the difference between energy in feedstocks and production and from the production of ethanol calculated as the difference between energy feedstocks and production less denaturants. Biofuels for Transportation: Biodiesel: Consumption: 2005-2008: Calculated as biodiesel production plus net imports, 2009: January and February: EIA, Petroleum Supply Monthly, Table 1, data for refinery and blender net inputs of renewable fuels except ethanol. March through December: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change; Production: 2001-2005: U.S. Department of Agriculture (USDA), Commodity Credit Corporation, Bioenergy Program, 2006: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for soybean oil in methyl esters (biodiesel), 2007: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for fats and oils in methyl esters, and 2008: U.S. Energy Information Administration, Form EIA-22S, "Supplement to the Monthly Biodiesel Production Survey," 2009: U.S. Energy Information Administration, "Form EIA-22M, Monthly Biodiesel Production Survey;" Trade: USDA imports data for Harmonized Tariff Schedule code 3824.90.40.20 (Fatty Esters Animal/Vegetable Mixture) and exports data for Schedule B code 3824.90.40.00 (Fatty Substances Animal/ Vegetable Mixture; Stock Change: EIA Petroleum Supply Annual (PSA) various reports. Table 1 data for renewable fuels except ethanol; and Ethanol: 2005-2008: EIA Petroleum Supply Annual (Various Issues), Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery and blender net inputs (Table 15). 2009: EIA Petroleum Supply Annual 2009, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments. Small amounts of ethanol consumption are distributed to the commercial and industrial sectors according to those sector's shares of U.S. motor gasoline supplied. Electric Power: U.S. Energy Information Administration, Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report."

Table 1.3 Renewable energy consumption for electricity generation by energy-use sector and energy source, 2005 – 2009

(quadrillion Btu)

Sector and Source	2005	2006	2007	2008	2009
Total	3.619	3.873	3.536	3.818	4.137
Biomass	0.585	0.591	0.598	0.606	0.592
Waste	0.230	0.241	0.245	0.267	0.272
Landfill Gas	0.068	0.076	0.080	0.094	0.100
MSW Biogenic ¹	0.144	0.147	0.146	0.148	0.147
Other Biomass ²	0.018	0.018	0.019	0.024	0.025
Wood and Derived Fuels ³	0.355	0.350	0.353	0.339	0.320
Geothermal	0.147	0.145	0.145	0.146	0.146
Hydroelectric Conventional	2.703	2.869	2.446	2.512	2.669
Solar Thermal/PV	0.006	0.005	0.006	0.009	0.009
Wind	0.178	0.264	0.341	0.546	0.721
Commercial	0.021	0.022	0.020	0.021	0.024
Biomass	0.020	0.021	0.020	0.021	0.023
Waste	0.020	0.021	0.019	0.020	0.023
Landfill Gas	0.002	0.003	0.002	0.003	0.003
MSW Biogenic ¹	0.013	0.013	0.013	0.014	0.016
Other Biomass ²	0.005	0.004	0.004	0.004	0.004
Wood and Derived Fuels ³	*	*	*	*	*
Geothermal	-	-	-	-	-
Hydroelectric Conventional	0.001	0.001	0.001	0.001	0.001
Solar Thermal/PV	-	-	-	*	-
Wind	-	-	-	-	*
Industrial	0.226	0.219	0.208	0.200	0.182
Biomass	0.194	0.190	0.193	0.184	0.164
Waste	0.005	0.003	0.004	0.005	0.004
Landfill Gas	0.001	*	*	*	*
MSW Biogenic ¹	*	*	0.001	-	-
Other Biomass ²	0.003	0.003	0.003	0.004	0.004
Wood and Derived Fuels ³	0.189	0.187	0.188	0.179	0.160
Geothermal	-	-	-	-	-
Hydroelectric Conventional	0.032	0.029	0.016	0.017	0.018
Solar Thermal/PV	-	-	-	-	-
Wind	-	-	-	-	-
Electric Power ⁴	3.372	3.632	3.307	3.596	3.931
Biomass	0.371	0.379	0.386	0.401	0.405
Waste	0.205	0.216	0.221	0.242	0.244
Landfill Gas	0.064	0.072	0.077	0.091	0.097
MSW Biogenic ¹	0.131	0.134	0.132	0.135	0.131
Other Biomass ²	0.010	0.010	0.012	0.016	0.017
Wood and Derived Fuels ³	0.166	0.163	0.165	0.159	0.160
Geothermal	0.147	0.145	0.145	0.146	0.146
Hydroelectric Conventional	2.670	2.839	2.430	2.495	2.650
Solar Thermal/PV	0.006	0.005	0.006	0.009	0.009
Wind	0.178	0.264	0.341	0.546	0.721

See footnotes at end of table.

Table 1.3 Renewable energy consumption for electricity generation by energy-use sector and energy source, 2005 – 2009 (cont.)

¹Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

⁴The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

* = Less than 500 billion Btu.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding. Starting with 2004 EIA adopted a new method of allocating fuel consumption between electric power generation and useful thermal out put (UTO) for combined heat and power (CHP) plants. The new method proportionately distributes a CHP plant's losses between the two output products (electric power and UTO) assuming the same efficiency for production of electricity as UTO.

Energy consumption for the noncombustible renewable energy sources (hydroelectric conventional, solar thermal, PV and wind) used in electricity generation is determined by multiplying generation times the fossil fuel equivalent heat rate. Energy consumption for geothermal energy used in electricity generation is determined by multiplying generation times the geothermal heat rate. See U.S. Energy Information Administration (EIA), Annual Energy Review (AER) 2009, DOE/EIA-0384 (2009) (Washington, DC, August 2010), Table A6.

Data revisions are discussed in the Highlights section.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report," and predecessor forms: Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report."

Table 1.4 Renewable energy consumption for nonelectric use by energy-use sector and energy source, 2005 – 2009

(quadrillion Btu)

Sector and Source	2005	2006	2007	2008	2009
Total	2.623	2.786	3.015	3.373	3.450
Biomass	2.531	2.686	2.904	3.247	3.307
Biofuels	0.577	0.771	0.991	1.372	1.567
Biodiesel ¹	0.012	0.033	0.046	0.040	0.040
Ethanol ²	0.335	0.453	0.569	0.800	0.910
Losses and Coproducts	0.230	0.285	0.377	0.532	0.617
Biodiesel Feedstock ³	*	*	0.001	0.001	0.001
Ethanol Feedstock ⁴	0.230	0.285	0.376	0.531	0.616
Waste	0.173	0.156	0.168	0.169	0.180
Landfill Gas	0.080	0.081	0.093	0.093	0.104
MSW Biogenic ⁵	0.023	0.024	0.019	0.021	0.021
Other Biomass ⁶	0.070	0.051	0.056	0.055	0.055
Wood and Derived Fuels ⁷	1.781	1.759	1.745	1.705	1.560
Geothermal	0.034	0.037	0.041	0.046	0.054
Solar Thermal/PV	0.058	0.063	0.070	0.080	0.089
Residential	0.504	0.472	0.522	0.556	0.552
Biomass	0.430	0.390	0.430	0.450	0.430
Wood and Derived Fuels ⁸	0.430	0.390	0.430	0.450	0.430
Geothermal	0.016	0.018	0.022	0.026	0.033
Solar Thermal/PV	0.058	0.063	0.070	0.080	0.089
Commercial	0.098	0.095	0.097	0.104	0.105
Biomass	0.085	0.081	0.083	0.089	0.088
Biofuels	0.001	0.001	0.002	0.002	0.003
Ethanol ²	0.001	0.001	0.002	0.002	0.003
Waste	0.014	0.016	0.012	0.014	0.013
Landfill Gas	*	0.001	0.001	*	*
MSW Biogenic ⁵	0.012	0.013	0.008	0.012	0.012
Other Biomass ⁶	0.002	0.002	0.003	0.002	0.002
Wood and Derived Fuels ⁷	0.069	0.064	0.069	0.073	0.072
Geothermal	0.014	0.014	0.014	0.015	0.017
Solar Thermal/PV	-	-	-	-	-
Industrial	1.647	1.711	1.756	1.852	1.822
Biomass	1.643	1.706	1.751	1.847	1.818
Biofuels	0.237	0.295	0.387	0.544	0.630
Ethanol ²	0.007	0.010	0.010	0.012	0.013
Losses and Coproducts	0.230	0.285	0.377	0.532	0.617
Biodiesel Feedstock ³	*	*	0.001	0.001	0.001
Ethanol Feedstock ⁴	0.230	0.285	0.376	0.531	0.616
Waste	0.143	0.126	0.140	0.139	0.150
Landfill Gas	0.079	0.080	0.093	0.092	0.104
MSW Biogenic ⁵	0.007	0.006	0.005	0.003	0.004
Other Biomass ⁶	0.057	0.040	0.043	0.044	0.043
Wood and Derived Fuels ⁷	1.262	1.286	1.225	1.165	1.038

See footnotes at end of table.

Table 1.4 Renewable energy consumption for nonelectric use by energy-use sector and energy source, 2005 – 2009 (cont.)

(quadrillion Btu)

Sector and Source	2005	2006	2007	2008	2009
Geothermal	0.004	0.004	0.005	0.005	0.004
Solar Thermal/PV	-	-	-	-	-
Transportation	0.339	0.475	0.603	0.827	0.934
Biomass	0.339	0.475	0.603	0.827	0.934
Biofuels ¹	0.339	0.475	0.603	0.827	0.934
Biodiesel	0.012	0.033	0.046	0.040	0.040
Ethanol ²	0.328	0.442	0.557	0.786	0.894
Electric Power ⁹	0.035	0.033	0.038	0.034	0.036
Biomass	0.035	0.033	0.038	0.034	0.036
Waste	0.015	0.014	0.016	0.016	0.017
Landfill Gas	0.001	*	*	*	*
MSW Biogenic ⁵	0.005	0.005	0.006	0.006	0.006
Other Biomass ⁶	0.010	0.009	0.010	0.010	0.010
Wood and Derived Fuels ⁷	0.019	0.019	0.021	0.018	0.020
Geothermal	-	-	-	-	-
Solar Thermal/PV	-	-	-	-	-

¹Biodiesel primarily derived from soybean oil.

²Ethanol primarily derived from corn minus denaturant.

³Losses and co-products from the production of biodiesel. Does not include natural gas, electricity, and other non-biomass energy used in the production of biodiesel.

⁴Losses and co-products from the production of fuel ethanol. Does not include natural gas, electricity, and other non-biomass energy used in the production of fuel ethanol.

⁵Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

⁶Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

⁷Black liquor, and wood/wood waste solids and liquids.

⁸Wood and wood pellet fuels.

⁹The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

* = Less than 500 billion Btu.

- = No data reported.

Table 1.4 Renewable energy consumption for nonelectric use by energy-use sector and energy source, 2005 – 2009 (cont.)

Notes: Totals may not equal sum of components due to independent rounding. Starting with 2004 EIA adopted a new method of allocating fuel consumption between electric power generation and useful thermal output (UTO) for combined heat and power (CHP) plants. The new method proportionately distributes a CHP plant's losses between the two output products (electric power and UTO) assuming the same efficiency for production of electricity as UTO.

Data revisions are discussed in the Highlights section.

Sources: Analysis conducted by U.S. Energy Information Administration, Office of Electricity, Coal, Nuclear, and Renewables Analysis and specific sources described as follows. Residential: U.S. Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and U.S. Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." Commercial: U.S. Energy Information Administration, Form EIA-920, "Combined Heat and Power Plant Report" and Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center. Industrial: U.S. Energy Information Administration, Form EIA-846 (A, B, C) "Manufacturing Energy Consumption Survey," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report;" Oregon Institute of Technology, Geo-Heat Center;

U.S. Environmental Protection Agency, Landfill Methane Outreach Program estimates; and losses and coproducts from the production of biodiesel calculated as the difference between energy in feedstocks and production and from the production of ethanol calculated as the difference between energy feedstocks and production less denaturants. Biofuels for Transportation: Biodiesel: Consumption: 2005-2008: Calculated as biodiesel production plus net imports, 2009: January and February: EIA, Petroleum Supply Monthly, Table 1, data for refinery and blender net inputs of renewable fuels except ethanol. March through December: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change; Production: 2001-2005: U.S. Department of Agriculture (USDA), Commodity Credit Corporation, Bioenergy Program, 2006: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for soybean oil in methyl esters (biodiesel), 2007: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for fats and oils in methyl esters, and 2008: U.S. Energy Information Administration, Form EIA-22S, "Supplement to the Monthly Biodiesel Production Survey," 2009: U.S. Energy Information Administration, "Form EIA-22M, Monthly Biodiesel Production Survey;" Trade: USDA imports data for Harmonized Tariff Schedule code 3824.90.40.20 (Fatty Esters Animal/ Vegetable Mixture) and exports data for Schedule B code 3824.90.40.00 (Fatty Substances Animal/ Vegetable Mixture; Stock Change: EIA Petroleum Supply Annual (PSA) various reports. Table 1 data for renewable fuels except ethanol; and Ethanol: 2005-2008: EIA Petroleum Supply Annual (Various Issues), Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery and blender net inputs (Table 15). 2009: EIA Petroleum Supply Annual 2009, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments. Small amounts of ethanol consumption are distributed to the commercial and industrial sectors according to those sector's shares of U.S. motor gasoline supplied. Electric Power: U.S. Energy Information Administration, Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report."

Table 1.5 Historical renewable energy consumption by sector and energy source, 1989 – 2009

(quadrillion Btu)

Sector and Source	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Total	6.235	6.041	6.069	5.821	6.083	5.988	6.561	7.014	7.016	6.493	6.516
Biomass	3.159	2.735	2.782	2.932	2.908	3.028	3.101	3.157	3.105	2.928	2.963
Biofuels ¹	0.125	0.111	0.128	0.145	0.169	0.188	0.200	0.143	0.184	0.201	0.209
Waste ²	0.354	0.408	0.440	0.473	0.479	0.515	0.531	0.577	0.551	0.542	0.540
Wood and Derived Fuels ³	2.680	2.216	2.214	2.313	2.260	2.324	2.370	2.437	2.371	2.184	2.214
Geothermal	0.162	0.171	0.178	0.179	0.186	0.173	0.152	0.163	0.167	0.168	0.171
Hydroelectric Conventional	2.837	3.046	3.016	2.617	2.892	2.683	3.205	3.590	3.640	3.297	3.268
Solar Thermal/PV ⁴	0.055	0.059	0.062	0.064	0.066	0.068	0.069	0.070	0.070	0.069	0.068
Wind	0.022	0.029	0.031	0.030	0.031	0.036	0.033	0.033	0.034	0.031	0.046
Residential	0.977	0.641	0.673	0.706	0.618	0.589	0.591	0.612	0.502	0.452	0.461
Biomass	0.920	0.580	0.610	0.640	0.550	0.520	0.520	0.540	0.430	0.380	0.390
Wood and Derived Fuels	0.920	0.580	0.610	0.640	0.550	0.520	0.520	0.540	0.430	0.380	0.390
Geothermal	0.005	0.006	0.006	0.006	0.007	0.006	0.007	0.007	0.008	0.008	0.009
Solar Thermal/PV ⁴	0.052	0.056	0.057	0.059	0.061	0.063	0.064	0.065	0.064	0.064	0.063
Commercial	0.102	0.098	0.100	0.109	0.114	0.112	0.118	0.135	0.138	0.127	0.129
Biomass	0.099	0.094	0.095	0.105	0.109	0.106	0.113	0.129	0.131	0.118	0.121
Biofuels ⁵	0.001	*	*	*	*	*	*	*	*	*	*
Waste ²	0.022	0.028	0.026	0.032	0.033	0.035	0.040	0.053	0.058	0.054	0.054
Wood and Derived Fuels ³	0.076	0.066	0.068	0.072	0.076	0.072	0.072	0.076	0.073	0.064	0.067
Geothermal	0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.005	0.006	0.007	0.007
Hydroelectric Conventional	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Solar Thermal/PV	-	-	-	-	-	-	-	-	-	-	-
Wind	-	-	-	-	-	-	-	-	-	-	-
Industrial	1.871	1.717	1.684	1.737	1.773	1.927	1.992	2.033	2.057	1.929	1.934
Biomass	1.841	1.684	1.652	1.705	1.741	1.862	1.934	1.969	1.996	1.872	1.882
Biofuels ⁶	0.057	0.050	0.057	0.065	0.075	0.083	0.087	0.062	0.081	0.088	0.091
Waste ²	0.200	0.192	0.185	0.179	0.181	0.199	0.195	0.224	0.184	0.180	0.171
Wood and Derived Fuels ³	1.584	1.442	1.410	1.461	1.484	1.580	1.652	1.683	1.731	1.603	1.620
Geothermal	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004
Hydroelectric Conventional	0.028	0.031	0.030	0.031	0.030	0.062	0.055	0.061	0.058	0.055	0.049
Solar Thermal/PV	-	-	-	-	-	-	-	-	-	-	-
Wind	-	-	-	-	-	-	-	-	-	-	-
Transportation	0.068	0.060	0.070	0.080	0.094	0.105	0.113	0.081	0.102	0.113	0.118
Biomass	0.068	0.060	0.070	0.080	0.094	0.105	0.113	0.081	0.102	0.113	0.118
Biofuels ⁷	0.068	0.060	0.070	0.080	0.094	0.105	0.113	0.081	0.102	0.113	0.118
Electric Power ⁸	3.217	3.524	3.542	3.189	3.484	3.255	3.747	4.153	4.216	3.872	3.874
Electric Utilities	2.883	3.059	3.029	2.626	2.873	2.641	3.122	3.498	3.562	3.223	3.105
Biomass	0.020	0.022	0.021	0.022	0.021	0.021	0.017	0.020	0.020	0.021	0.020
Waste ²	0.010	0.013	0.014	0.013	0.011	0.013	0.010	0.012	0.013	0.013	0.013
Wood and Derived Fuels ³	0.010	0.008	0.008	0.008	0.009	0.008	0.007	0.008	0.008	0.007	0.007
Geothermal	0.097	0.089	0.084	0.084	0.078	0.072	0.049	0.054	0.056	0.053	0.017
Hydroelectric Conventional	2.765	2.948	2.923	2.521	2.774	2.549	3.056	3.423	3.485	3.149	3.067
Solar Thermal/PV	*	*	*	*	*	*	*	*	*	*	*
Wind	*	*	*	*	*	*	*	*	*	*	*
Independent Power Producers	0.333	0.465	0.513	0.563	0.612	0.614	0.624	0.655	0.655	0.650	0.769
Biomass	0.211	0.295	0.333	0.381	0.394	0.413	0.405	0.418	0.426	0.424	0.433
Waste ²	0.122	0.175	0.215	0.249	0.253	0.269	0.286	0.288	0.296	0.294	0.302
Wood and Derived Fuels ³	0.089	0.120	0.118	0.132	0.141	0.144	0.119	0.130	0.129	0.129	0.131
Geothermal	0.055	0.071	0.082	0.083	0.095	0.089	0.089	0.094	0.095	0.098	0.134
Hydroelectric Conventional	0.043	0.066	0.062	0.065	0.087	0.072	0.093	0.104	0.096	0.092	0.151
Solar Thermal/PV	0.003	0.004	0.005	0.004	0.005	0.005	0.005	0.005	0.005	0.005	0.005
Wind	0.022	0.029	0.031	0.030	0.031	0.036	0.033	0.033	0.034	0.031	0.046

See footnotes at end of table.

Table 1.5 Historical renewable energy consumption by sector and energy source, 1989 – 2009 (cont.)

(quadrillion Btu)

Sector and Source	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Total	6.106	5.163	5.729	5.983	6.082	6.242	6.659	6.551	7.191	7.587
Biomass	3.008	2.622	2.701	2.807	3.010	3.117	3.277	3.503	3.852	3.899
Biofuels ¹	0.236	0.253	0.303	0.404	0.500	0.577	0.771	0.991	1.372	1.567
Waste ²	0.511	0.364	0.402	0.401	0.389	0.403	0.397	0.413	0.436	0.452
Wood and Derived Fuels ³	2.262	2.006	1.995	2.002	2.121	2.136	2.109	2.098	2.044	1.881
Geothermal	0.164	0.164	0.171	0.175	0.178	0.181	0.181	0.186	0.192	0.200
Hydroelectric Conventional	2.811	2.242	2.689	2.825	2.690	2.703	2.869	2.446	2.512	2.669
Solar Thermal/PV ⁴	0.065	0.064	0.063	0.062	0.063	0.063	0.068	0.076	0.089	0.098
Wind	0.057	0.070	0.105	0.115	0.142	0.178	0.264	0.341	0.546	0.721
Residential	0.489	0.438	0.448	0.470	0.481	0.504	0.472	0.522	0.556	0.552
Biomass	0.420	0.370	0.380	0.400	0.410	0.430	0.390	0.430	0.450	0.430
Wood and Derived Fuels	0.420	0.370	0.380	0.400	0.410	0.430	0.390	0.430	0.450	0.430
Geothermal	0.009	0.009	0.010	0.013	0.014	0.016	0.018	0.022	0.026	0.033
Solar Thermal/PV ⁴	0.060	0.059	0.057	0.057	0.057	0.058	0.063	0.070	0.080	0.089
Commercial	0.128	0.101	0.104	0.113	0.118	0.119	0.117	0.118	0.125	0.129
Biomass	0.119	0.092	0.095	0.101	0.105	0.105	0.102	0.102	0.109	0.112
Biofuels ⁵	*	*	*	0.001	0.001	0.001	0.001	0.002	0.002	0.003
Waste ²	0.047	0.025	0.026	0.029	0.034	0.034	0.036	0.031	0.034	0.036
Wood and Derived Fuels ³	0.071	0.067	0.069	0.071	0.070	0.070	0.065	0.069	0.073	0.072
Geothermal	0.008	0.008	0.009	0.011	0.012	0.014	0.014	0.014	0.015	0.017
Hydroelectric Conventional	0.001	0.001	*	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Solar Thermal/PV	-	-	-	-	-	-	-	-	*	-
Wind	-	-	-	-	-	-	-	-	-	*
Industrial	1.928	1.719	1.720	1.726	1.853	1.873	1.930	1.964	2.053	2.005
Biomass	1.881	1.681	1.676	1.679	1.817	1.837	1.897	1.944	2.031	1.982
Biofuels ⁶	0.100	0.110	0.133	0.173	0.209	0.237	0.295	0.387	0.544	0.630
Waste ²	0.145	0.129	0.146	0.142	0.132	0.148	0.130	0.144	0.144	0.154
Wood and Derived Fuels ³	1.636	1.443	1.396	1.363	1.476	1.452	1.472	1.413	1.344	1.198
Geothermal	0.004	0.005	0.005	0.003	0.004	0.004	0.004	0.005	0.005	0.004
Hydroelectric Conventional	0.042	0.033	0.039	0.043	0.033	0.032	0.029	0.016	0.017	0.018
Solar Thermal/PV	-	-	-	-	-	-	-	-	-	-
Wind	-	-	-	-	-	-	-	-	-	-
Transportation	0.135	0.142	0.170	0.230	0.290	0.339	0.475	0.603	0.827	0.934
Biomass	0.135	0.142	0.170	0.230	0.290	0.339	0.475	0.603	0.827	0.934
Biofuels ⁷	0.135	0.142	0.170	0.230	0.290	0.339	0.475	0.603	0.827	0.934
Electric Power ⁸	3.427	2.763	3.288	3.445	3.340	3.407	3.665	3.345	3.630	3.967
Electric Utilities	2.605	2.061	2.514	2.602	2.509	2.518	2.675	2.343	2.391	2.573
Biomass	0.021	0.014	0.033	0.029	0.031	0.040	0.042	0.048	0.047	0.047
Waste ²	0.014	0.008	0.022	0.012	0.011	0.013	0.015	0.016	0.018	0.017
Wood and Derived Fuels ³	0.007	0.006	0.011	0.017	0.020	0.027	0.027	0.032	0.029	0.030
Geothermal	0.002	0.002	0.014	0.013	0.013	0.011	0.012	0.011	0.012	0.012
Hydroelectric Conventional	2.582	2.044	2.465	2.556	2.461	2.455	2.598	2.241	2.263	2.413
Solar Thermal/PV	*	*	*	*	*	*	*	*	*	*
Wind	*	0.001	0.002	0.004	0.004	0.010	0.023	0.043	0.068	0.101
Independent Power Producers	0.821	0.702	0.774	0.844	0.832	0.889	0.990	1.001	1.239	1.395
Biomass	0.432	0.323	0.347	0.368	0.357	0.365	0.370	0.376	0.388	0.394
Waste ²	0.305	0.202	0.208	0.218	0.212	0.208	0.216	0.221	0.240	0.244
Wood and Derived Fuels ³	0.127	0.121	0.140	0.151	0.145	0.158	0.154	0.154	0.148	0.150
Geothermal	0.142	0.140	0.133	0.135	0.136	0.136	0.133	0.133	0.134	0.135
Hydroelectric Conventional	0.185	0.165	0.185	0.224	0.196	0.215	0.242	0.189	0.231	0.237
Solar Thermal/PV	0.005	0.006	0.006	0.005	0.006	0.005	0.005	0.006	0.008	0.008
Wind	0.057	0.068	0.103	0.111	0.138	0.168	0.240	0.297	0.478	0.620

See footnotes at end of table.

Table 1.5 Historical renewable energy consumption by sector and energy source, 1989– 2009 (cont.)

¹Biofuels and biofuel losses and coproducts.

²Municipal solid waste biogenic, landfill gases, agriculture byproducts/crops, sludge waste, and other biomass solids,

³Black liquor, and wood/wood waste solids and liquids.

⁴Includes small amounts of distributed solar thermal and photovoltaic energy used in the commercial, industrial and

⁵Ethanol primarily derived from corn minus denaturant.

⁶Ethanol primarily derived from corn and losses and coproducts from production of biodiesel and ethanol.

⁷Biodiesel primarily derived from soybean oil and ethanol primarily derived from corn.

⁸The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American PV = Photovoltaic.

* = Less than 500 billion Btu.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

Energy consumption for the noncombustible renewable energy sources (hydroelectric conventional, solar thermal, PV and wind) used in electricity generation is determined by multiplying generation times the fossil fuel equivalent heat rate.

Energy consumption for geothermal energy used in electricity generation is determined by multiplying generation times the geothermal heat rate. See U.S. Energy Information Administration (EIA), Annual Energy Review (AER) 2009, DOE/EIA-0384 (2009) (Washington, DC, August 2010), Table A6.

Sources: Analysis conducted by U.S. Energy Information Administration, Office of Electricity, Coal, Nuclear, and Renewables Analysis and specific sources described as follows. Residential: U.S. Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center and U.S. Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." Commercial: U.S. Energy Information Administration, Form EIA-867, "Annual Nonutility Power Producer Report," Form EIA-860B, "Annual Electric Generator Report - Nonutility," Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," Form EIA-923, "Power Plant Operations Report;" and Oregon Institute of Technology, Geo-Heat Center. Industrial: U.S. Energy Information Administration, Form EIA-846 (A,B,C) "Manufacturing Energy Consumption Survey," Form EIA-867, "Annual Nonutility Power Producer Report," Form EIA-860B, "Annual Electric Generator Report - Nonutility," Form EIA-906, "Power Plant Report," Form EIA-920, "Combined Heat and Power Report," Form EIA-923, "Power Plant Operations Report;" Oregon Institute of Technology, Geo-Heat Center; Government Advisory Associates, Resource Recovery Yearbook and Methane Recovery Yearbook;

U.S. Environmental Protection Agency, Landfill Methane Outreach Program estimates; and losses and coproducts from the production of biodiesel calculated as the difference between energy in feedstocks and production and from the production of ethanol calculated as the difference between energy feedstocks and production less denaturants. Biofuels for Transportation: Biodiesel Consumption: 2001-2008: Calculated as biodiesel production plus net imports, 2009: January and February: EIA, Petroleum Supply Monthly, Table 1, data for refinery and blender net inputs of renewable fuels except ethanol. March through December: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change; Production: 2001-2005: U.S. Department of Agriculture (USDA), Commodity Credit Corporation, Bioenergy Program, 2006: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for soybean oil in methyl esters (biodiesel), 2007: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for fats and oils in methyl esters, and 2008: U.S. Energy Information Administration, Form EIA-22S, "Supplement to the Monthly Biodiesel Production Survey," 2009: U.S. Energy Information Administration, "Form EIA-22M, Monthly Biodiesel Production Survey;" Trade: USDA imports data for Harmonized Tariff Schedule code 3824.90.40.20 (Fatty Esters Animal/ Vegetable Mixture) and exports data for Schedule B code 3824.90.40.00 (Fatty Substances Animal/ Vegetable Mixture; Stock Change: EIA Petroleum Supply Annual (PSA) various reports. Table 1 data for renewable fuels except ethanol; and Ethanol: 1989: EIA, Estimates of U.S. Biofuels Consumption 1990, Table 10, 1990-1992: EIA, Estimates of U.S. Biomass Energy Consumption 1992, Table D2, 1993-2004: EIA, Petroleum Supply Monthly, Tables 2 and 16. Calculated as ten percent of oxygenated finished motor gasoline field production (Table 2) plus fuel ethanol refinery input (Table 16). 2005-2008: EIA Petroleum Supply Annual (Various Issues), Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery and blender net inputs (Table 15). 2009: EIA Petroleum Supply Annual 2009, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments.

Small amounts of ethanol consumption are distributed to the commercial and industrial sectors according to those sector's shares of U.S. motor gasoline supplied. Electric Power: U.S. Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," Form EIA-867, "Annual Nonutility Power Producer Report," Form EIA-860B, "Annual Electric Generator Report - Nonutility," Form EIA-906, "Monthly Power Plant Report," Form EIA-920, "Combined Heat and Power Plant Report," and Form EIA-923, "Power Plant Operations Report."

Table 1.6 Biofuels overview, 2005 - 2009

(trillion Btu)

Type	2005	2006	2007	2008	2009
Ethanol					
Feedstock ¹	552	688	914	1,300	1,517
Losses and Coproducts ²	230	285	376	531	616
Denaturant	9	11	14	21	26
Production ³	331	414	553	790	928
Net Imports ⁴	12	62	37	45	17
Stock Change ⁵	-2	11	6	13	8
Consumption	344	465	584	821	936
Consumption minus Denaturant	335	453	569	800	910
Biodiesel					
Feedstock ⁶	12	32	63	88	65
Losses and Coproducts ⁷	*	*	1	1	1
Production ⁸	12	32	62	87	65
Net Imports	*	1	-17	-46	-24
Stock Change	-	-	-	-	4
Balancing Item	-	-	-	-	4
Consumption	12	33	46	40	40

¹Total corn and other biomass inputs to the production of undenatured ethanol used for fuel ethanol.

²Losses and co-products from the production of fuel ethanol. Does not include natural gas, electricity, and other non-biomass energy used in the production of fuel ethanol.

³Fuel ethanol production. Includes denaturant.

⁴Fuel ethanol imports. There are no exports.

⁵Fuel ethanol stock change. A negative number indicates a decrease in stocks and a positive number indicates an increase.

⁶Total soy bean oil and other biomass inputs to the production of biodiesel.

⁷Losses and co-products from the production of biodiesel. Does not include natural gas, electricity, and other non-biomass energy used in the production of biodiesel.

⁸Production of biofuels for use as diesel fuel substitutes or additives. Biodiesel consumption equals biodiesel production.

* = Less than 0.5 trillion Btu.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Sources: (Note: For ethanol and biodiesel heat contents, see Table 1.10. For feedstock factors, see U.S. Energy Information Administration (EIA) Annual Energy Review 2009, Table A3.) Ethanol Feedstock: Calculated as fuel ethanol production multiplied by the feedstock factor for fuel ethanol. Ethanol Losses and Co-products: Calculated as ethanol feedstock plus denaturant minus fuel ethanol production. Denaturant: 2005-2008: Estimated as 2 percent of fuel ethanol production. 2009: EIA, Petroleum Supply Annual, Table 1. Ethanol Production: 2005-2008: U.S. Energy Information Administration (EIA), Form EIA-819, "Monthly Oxygenate Report." 2009: EIA, Petroleum Supply Annual, Table 1 data for net production of fuel ethanol at renewable fuels and oxygenate plants. Ethanol Net Imports, Stocks and Stock Change: 2005-2009: EIA, Petroleum Supply Annual (PSA), annual reports, Table 1. Ethanol Consumption: 2005-2008: EIA, Petroleum Supply Annual annual reports, Tables 1 and 15. Calculated as motor gasoline blending components adjustments (Table 1), plus finished motor gasoline adjustments (Table 1), plus fuel ethanol refinery blender net inputs (Table 15). 2009: EIA, Petroleum Supply Annual, Table 1. Calculated as fuel ethanol refinery and blender net inputs minus fuel ethanol adjustments. Biodiesel Feedstock: Calculated as biodiesel production multiplied by the biodiesel feedstock factor. Biodiesel Losses and Co-products: Calculated as biodiesel feedstock minus biodiesel production. Biodiesel Production: 2005: U.S. Department of Agriculture, Commodity Credit Corporation, Bioenergy Program records, 2006: U.S. Department of Commerce, Bureau of Census, Current Industrial Reports, Fats and Oils - Production, Consumption and Stocks, data for soy bean oil consumed in methyl esters, 2007: U.S. Department of Commerce, Bureau of Census, "M311K-Fats and Oils: Production, Consumption, and Stocks, data for all fats and oils consumed in methyl esters, 2008 and 2009: EIA, Monthly Biodiesel Production Report, December 2009, and analysis conducted by the EIA, Office of Electricity, Coal, Nuclear, and Renewables Analysis. Balancing Item: Calculated as biodiesel consumption and biodiesel stock change minus biodiesel production and biodiesel net imports. Consumption: 2001-2008: Calculated biodiesel production plus biodiesel net imports, January and February 2009: EIA, Petroleum Supply Annual, Table 1, data for refinery and blender net inputs of renewable fuels except fuel ethanol, March 2009 and forward: Calculated as biodiesel production plus biodiesel net imports minus biodiesel stock change.

Table 1.7 Waste energy consumption by type of waste and energy-use sector, 2009

(trillion Btu)

Type	Sector					Total
	Commercial	Industrial	Electric Power			
			Electric Utilities	Independent Power Producers		
Total	36	154	17	244	452	
Landfill Gas	3	104	10	87	204	
MSW Biogenic ¹	28	4	4	133	168	
Other Biomass ²	5	47	4	24	79	

¹Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

MSW = Municipal Solid Waste.

Note: Totals may not equal sum of components due to independent rounding.

Source: Analysis conducted by the U.S. Energy Information Administration, Office of Electricity, Coal, Nuclear, and Renewables Analysis and the following specific sources: Form EIA-923, "Power Plant Operations Report" and U.S. Environmental Protection Agency, Landfill Methane Outreach Program estimates.

Table 1.8 Industrial biomass energy consumption and electricity net generation by industry and energy source, 2009

Biomass Energy Consumption (Trillion Btu)

Industry	Energy Source	Total	Net Generation (Million Kilowatthours)		
			For Electricity	For Useful Thermal Output	
Total	Total	1,982.521	164.189	1,818.332	
Agriculture, Forestry and Mining	Total	15.508	1.258	14.250	
	Agricultural Byproducts/Crops	15.340	1.089	14.250	
	Other Biomass Solids	0.169	0.169	-	
Manufacturing	Total	1,847.485	162.932	1,684.553	
	Food and Kindred Products	Total	22.901	0.779	22.122
		Agricultural Byproducts/Crops	15.070	0.184	14.886
		Other Biomass Gases	0.207	0.060	0.147
		Other Biomass Liquids	0.071	0.071	-
		Sludge Waste	0.800	0.175	0.625
		Wood/Wood Waste Solids	6.753	0.289	6.465
	Lumber	Total	210.715	10.218	200.496
Sludge Waste		0.030	0.002	0.027	
Wood/Wood Waste Solids		210.685	10.216	200.469	
Paper and Allied Products	Total	984.914	151.415	833.499	
	Agricultural Byproducts/Crops	1.316	0.049	1.267	
	Black Liquor	686.588	101.040	585.548	
	Other Biomass Gases	0.176	0.014	0.162	
	Other Biomass Liquids	0.128	0.018	0.110	
	Other Biomass Solids	9.419	1.532	7.887	
	Sludge Waste	3.459	0.689	2.770	
	Wood/Wood Waste Liquids	2.601	0.387	2.215	
	Wood/Wood Waste Solids	281.226	47.687	233.540	
Chemicals and Allied Products	Total	2.810	0.100	2.710	
	Other Biomass Liquids	0.022	0.001	0.021	
	Sludge Waste	0.238	0.035	0.203	
	Wood/Wood Waste Solids	2.550	0.064	2.486	
Biorefineries	Total	616.844	-	616.844	
	Biofuel Losses and Coproducts ³	616.844	-	616.844	
	Biodiesel Feedstock	0.892	-	0.892	
	Ethanol Feedstock	615.952	-	615.952	
Other ¹	Total	9.301	0.420	8.881	
Nonspecified ²	Total	119.528	-	119.528	
	Ethanol ⁴	13.247	-	13.247	
	Landfill Gas	103.739	-	103.739	
	Municipal Solid Waste Biogenic ⁵	2.542	-	2.542	

See footnotes at end of table.

Table 1.8 Industrial biomass energy consumption and electricity net generation by industry and energy source, 2009 (cont.)

¹Other includes Apparel; Petroleum Refining; Rubber and Misc. Plastic Products; Transportation Equipment; Stone, Clay, Glass, and Concrete Products; Furniture and Fixtures; and related industries.

²Primary purpose of business is not specified.

³Losses and coproducts from production of biodiesel and ethanol calculated as the difference between energy in feedstocks and production.

⁴Ethanol primarily derived from corn minus denaturant.

⁵Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding. Starting with 2004 EIA adopted a new method of allocating fuel consumption between electric power generation and useful thermal out put (UTO) for combined heat and power (CHP) plants. The new method proportionately distributes a CHP plant's losses between the two output products (electric power and UTO) assuming the same efficiency for production of electricity as UTO.

Sources: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report;" Government Advisory Associates, Resource Recovery Yearbook and Methane Recovery Yearbook; U.S. Environmental Protection Agency, Landfill Methane Outreach Program estimates; ethanol and biofuel losses and coproducts: table 1.2 of this report; and analysis conducted by the U.S. Energy Information Administration, Office of Electricity, Coal, Nuclear, and and Renewables analysis.

Table 1.9 Net summer capacity of plants with the capability to cofire biomass and coal, 2008 and 2009

(megawatts)

State	Company Name	Plant I.D.	Plant Name	County	2008		2009	
					Biomass/Coal Cofiring Capacity	Total Plant Capacity	Biomass/Coal Cofiring Capacity	Total Plant Capacity
AL	DTE Energy Services	50407	Mobile Energy Services LLC	Mobile	73	73	73	73
AL	Georgia-Pacific Corp	10699	Georgia Pacific Naheola Mill	Choctaw	29	73	29	73
AL	International Paper Co	52140	International Paper Prattville Mill	Autauga	43	78	46	84
AR	Domtar Industries Inc	54104	Ashdown	Little River	128	128	128	128
AZ	Tucson Electric Power Co	126	H Wilson Sundt Generating Station	Pima	156	472	156	472
CA	Air Products Energy Enterprise	10640	Stockton Cogen	San Joaquin	54	54	-	-
CA	Air Products Energy Enterprises LP	10640	Stockton Cogen	San Joaquin	-	-	54	54
CA	Mt Poso Cogeneration Co	54626	Mt Poso Cogeneration	Kern	-	-	52	52
DE	Conectiv Delmarva Gen Inc	593	Edge Moor	New Castle	260	718	260	718
FL	International Paper Co-Pensacola	50250	International Paper Pensacola	Escambia	76	76	76	76
FL	Jefferson Smurfit Corp	10202	Jefferson Smurfit Fernandina Beach	Nassau	50	80	50	80
FL	Stone Container Corp-Panama Ci	50807	Stone Container Panama City Mill	Bay	22	36	22	36
GA	Georgia Pacific CSO LLC	54101	Georgia Pacific Cedar Springs	Early	90	90	90	90
GA	International Paper Co-Augusta	54358	International Paper Augusta Mill	Richmond	79	79	79	79
GA	Riverwood Intl USA Inc	54464	Riverwood International Macon Mill	Bibb	35	40	35	40
GA	SP Newsprint Company	54004	Dublin Mill	Laurens	44	84	44	84
HI	Hawaiian Com & Sugar Co Ltd	10604	Hawaiian Comm & Sugar Puunene Mill	Maui	46	46	46	46
IA	Ames City of	1122	Ames Electric Services Power Plant	Story	105	105	105	105
IA	Archer Daniels Midland Co	10860	Archer Daniels Midland Clinton	Clinton	-	-	180	180
IA	University of Iowa	54775	University of Iowa Main Power Plant	Johnson	21	23	21	23
KY	East Kentucky Power Coop, Inc	6041	H L Spurlock	Mason	268	1,103	536	1,346
LA	International Paper Co	54090	International Paper Louisiana Mill	Morehouse	63	63	63	63
MD	NewPage Corporation	50282	Luke Mill	Allegany	60	60	60	60
ME	NewPage Corporation	10495	Rumford Cogeneration	Oxford	85	85	85	85
ME	S D Warren Co.- Westbrook	50447	S D Warren Westbrook	Cumberland	56	65	56	65
ME	Verso Bucksport LLC	50243	Verso Paper	Hancock	93	250	93	250
MI	Decorative Panels International, Inc.	10149	Decorative Panels Intl	Alpena	7	7	7	7
MI	Michigan State University	10328	T B Simon Power Plant	Ingham	-	-	21	97
MI	NewPage Corporation	10208	Escanaba Paper Company	Delta	77	100	77	100
MI	S D Warren Co	50438	S D Warren Muskegon	Muskegon	37	37	37	37
MI	TES Filer City Station LP	50835	TES Filer City Station	Manistee	60	60	60	60
MN	Willmar Municipal Utilities	2022	Willmar	Kandiyohi	16	23	-	-
MN	Minnesota Power Inc	10686	Rapids Energy Center	Itasca	29	29	27	27
MN	Minnesota Power Inc	1897	M L Hibbard	St Louis	59	59	67	67
MN	Willmar Municipal Utilities	2022	Willmar	Kandiyohi	-	-	16	26
MO	Anheuser-Busch Inc	10430	Anheuser Busch St Louis	St Louis City	26	26	26	26
MO	City of Marshall	2144	Marshall	Saline	-	-	6	55
MO	University of Missouri-Columbia	50969	University of Missouri Columbia	Boone	18	77	51	77
MS	Weyerhaeuser Co	50184	Weyerhaeuser Columbus MS	Lowndes	123	123	123	123
NC	CPI USA NC LLC	10378	Primary Energy Southport	Brunswick	-	-	54	107
NC	CPI USA NC LLC	10379	Primary Energy Roxboro	Person	-	-	56	56
NC	Carlyle/Riverstone Renewable Energy	10381	Coastal Carolina Clean Power	Duplin	27	27	27	27
NC	Corn Products Intl Inc	54618	Corn Products Winston Salem	Forsyth	7	7	7	7
NC	Domtar Paper Company LLC	50189	Domtar Paper Co LLC Plymouth NC	Martin	146	146	146	146
NC	Primary Energy of North Carolina LLC	10379	Primary Energy Roxboro	Person	56	56	-	-

See footnotes at end of table.

Table 1.9 Net summer capacity of plants with the capability to cofire biomass and coal, 2008 and 2009 (cont.)

(megawatts)

State	Company Name	Plant I.D.	Plant Name	County	2008		2009	
					Biomass/ Coal Cofiring Capacity	Total Plant Capacity	Biomass/ Coal Cofiring Capacity	Total Plant Capacity
NY	AES Greenidge	2527	AES Greenidge LLC	Yates	104	156	108	108
NY	Black River Generation LLC	10464	Black River Generation	Jefferson	55	55	55	55
NY	Niagara Generation LLC	50202	WPS Power Niagara	Niagara	50	50	-	-
PA	Domtar LLC	54638	Johnsonburg Mill	Elk	49	49	49	49
SC	International Paper Co-Eastovr	52151	International Paper Eastover Facility	Richland	46	103	46	103
SC	Smurfit-Stone Container Enterprises Ir	50806	Stone Container Florence Mill	Florence	75	103	75	103
SC	South Carolina Electric&Gas Co	7737	Cogen South	Charleston	90	90	90	90
TN	Bowater Newsprint Calhoun Ops	50956	Bowater Newsprint Calhoun Operation	McMinn	-	-	66	66
VA	GP Big Island LLC	50479	Georgia Pacific Big Island	Bedford	7	7	7	7
VA	International Paper	52152	International Paper Franklin Mill	Isle of Wight	89	108	81	106
VA	MeadWestvaco Corp	50900	Covington Facility	Covington	102	102	97	97
VA	Smurfit-Stone Container Enterprises Ir	50813	Stone Container Hopewell Mill	Hopewell City	41	41	41	41
WA	Weyerhaeuser Co	50187	Weyerhaeuser Longview WA	Cowlitz	-	-	29	57
WI	Flambeau River Papers	50620	Flambeau River Papers	Price	5	5	5	5
WI	Fox Valley Energy Center LLC	56037	Fox Valley Energy Center	Winnebago	7	7	7	7
WI	Madison Gas & Electric Co	3992	Blount Street	Dane	97	187	101	188
WI	Manitowoc Public Utilities	4125	Manitowoc	Manitowoc	116	126	116	121
WI	NewPage Corporation	10234	Biron Mill	Wood	22	62	22	62
WI	NewPage Corporation	10476	Whiting Mill	Portage	4	4	4	4
WI	NewPage Corporation	10477	Wisconsin Rapids Pulp Mill	Wood	67	67	67	67
WI	NewPage Corporation	54857	Niagara Mill	Marinette	12	25	12	25
WI	Northern States Power Co - Minnesotz	3982	Bay Front	Ashland	-	-	44	73
WI	Northern States Power Co	3982	Bay Front	Ashland	44	73	-	-
WI	State of Wisconsin	54407	Waupun Correctional Central Heating Pl	Dodge	1	1	1	1
WI	State of Wisconsin	54408	Univ of Wisc Madison Charter Sreet Plar	Dane	6	6	6	6
WI	Thilmany LLC	54098	International Paper Kaukauna Mill	Outagamie	45	45	45	45
WI	Wausau Paper Specialty Products LLC	50614	Mosinee Paper	Marathon	18	21	18	21
Total					3,772	6,147	4,434	6,911

- = No data reported.

Note: State abbreviations are documented on the United States Postal Service website: http://www.usps.com/ncsc/lookups/usps_abbreviations.htm.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report," Schedule 3, Part B.

Table 1.10 Average heat content of selected biomass fuels

Fuel Type	Heat Content	Units
Agricultural Byproducts	8.248	Million Btu/Short Ton
Biodiesel	5.359	Million Btu/Barrel
Black Liquor	11.758	Million Btu/Short Ton
Digester Gas	0.619	Million Btu/Thousand Cubic Feet
Ethanol	3.563	Million Btu/Barrel
Landfill Gas	0.490	Million Btu/Thousand Cubic Feet
MSW Biogenic	9.696	Million Btu/Short Ton
Methane	0.841	Million Btu/Thousand Cubic Feet
Paper Pellets	13.029	Million Btu/Short Ton
Peat	8.000	Million Btu/Short Ton
Railroad Ties	12.618	Million Btu/Short Ton
Sludge Waste	7.512	Million Btu/Short Ton
Sludge Wood	10.071	Million Btu/Short Ton
Solid Byproducts	25.830	Million Btu/Short Ton
Spent Sulfite Liquor	12.720	Million Btu/Short Ton
Utility Poles	12.500	Million Btu/Short Ton
Waste Alcohol	3.800	Million Btu/Barrel

MSW = Municipal Solid Waste.

Note: For detailed characteristics of biomass feedstocks, see the U.S. Department of Energy, Office of Energy Efficiency and Renewable Office of Energy Efficiency and Renewable Energy, website here: http://www1.eere.energy.gov/biomass/for_researchers.html.

Sources: Biodiesel and ethanol: U.S. Energy Information Administration, Monthly Energy Review, November 2010, DOE/EIA-0035 (2010/11) (Washington, DC, November 2010), Table A3; MSW Biogenic: U.S. Energy Information Administration, Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy (Washington, DC, May 2007); and all other fuel types: U.S. Energy Information Administration, Form EIA-860B (1999), "Annual Electric Generator Report - Nonutility 1999."

Table 1.11 Electricity net generation from renewable energy by energy-use sector and energy source, 2005 – 2009

(thousand kilowatthours)

Sector/Source	2005	2006	2007	2008	2009
Total	357,650,653	385,771,908	352,747,486	380,932,388	417,723,797
Biomass	54,276,810	54,860,621	55,538,578	55,033,612	54,492,734
Waste	15,420,393	16,098,525	16,524,554	17,733,759	18,442,596
Landfill Gas	5,142,111	5,677,040	6,157,750	7,156,340	7,924,211
MSW Biogenic ¹	8,330,471	8,477,571	8,303,838	8,096,801	8,057,613
Other Biomass ²	1,947,810	1,943,913	2,062,966	2,480,617	2,460,771
Wood and Derived Fuels ³	38,856,417	38,762,096	39,014,024	37,299,853	36,050,138
Geothermal	14,691,745	14,568,029	14,637,213	14,839,977	15,008,658
Hydroelectric Conventional	270,321,255	289,246,416	247,509,974	254,831,385	273,445,094
Solar Thermal/PV	550,294	507,706	611,793	864,315	891,179
Wind	17,810,549	26,589,137	34,449,927	55,363,100	73,886,132
Commercial	1,758,789	1,712,691	1,691,439	1,614,986	1,839,466
Biomass	1,672,752	1,619,245	1,614,160	1,554,948	1,768,350
Waste	1,656,755	1,598,646	1,598,799	1,533,645	1,748,284
Landfill Gas	217,632	172,590	202,547	233,636	317,508
MSW Biogenic ¹	953,093	955,910	962,496	910,908	1,044,576
Other Biomass ²	486,031	470,146	433,756	389,101	386,200
Wood and Derived Fuels ³	15,997	20,599	15,361	21,303	20,066
Hydroelectric Conventional	86,037	93,446	77,279	59,957	70,866
Solar Thermal/PV	-	-	-	80	43
Wind	-	-	-	-	208
Industrial	32,198,528	31,871,511	30,508,807	29,138,172	27,900,961
Biomass	29,003,087	28,972,463	28,918,826	27,462,283	26,032,625
Waste	732,553	572,447	631,452	821,394	740,469
Landfill Gas	113,155	28,786	27,087	21,494	22,365
MSW Biogenic ¹	34,441	34,541	39,782	-	-
Other Biomass ²	584,957	509,120	564,583	799,900	718,103
Wood and Derived Fuels ³	28,270,534	28,400,016	28,287,374	26,640,889	25,292,157

See footnotes at end of table.

Table 1.11 Electricity net generation from renewable energy by energy-use sector and energy source, 2005 – 2009 (cont.)

(thousand kilowatthours)

Sector/Source	2005	2006	2007	2008	2009
Hydroelectric Conventional	3,195,441	2,899,048	1,589,981	1,675,889	1,868,336
Solar Thermal/PV	-	-	-	-	-
Electric Power⁴	323,693,336	352,187,707	320,547,239	350,179,231	387,983,371
Biomass	23,600,971	24,268,913	25,005,592	26,016,380	26,691,759
Waste	13,031,084	13,927,432	14,294,304	15,378,719	15,953,844
Landfill Gas	4,811,325	5,475,664	5,928,117	6,901,211	7,584,338
MSW Biogenic ¹	7,342,938	7,487,120	7,301,560	7,185,893	7,013,037
Other Biomass ²	876,822	964,648	1,064,627	1,291,615	1,356,468
Wood and Derived Fuels ³	10,569,886	10,341,481	10,711,288	10,637,661	10,737,915
Geothermal	14,691,745	14,568,029	14,637,213	14,839,977	15,008,658
Hydroelectric Conventional	267,039,777	286,253,922	245,842,714	253,095,539	271,505,893
Solar Thermal/PV	550,294	507,706	611,793	864,235	891,137
Wind	17,810,549	26,589,137	34,449,927	55,363,100	73,885,924

¹Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

⁴The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

Data revisions are discussed in the Highlights section.

Source: Electric Power: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report," and predecessor forms: Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report."

Table 1.12 U.S. electric net summer capacity, 2005 – 2009

(megawatts)

Source	2005	2006	2007	2008	2009
Total	978,020	986,215	994,888	1,010,171	1,025,400
Renew able Total	98,746	101,934	107,954	116,396	127,070
Biomass	9,802	10,100	10,839	11,050	11,256
Waste	3,609	3,727	4,134	4,186	4,317
Landfill Gas	887	978	1,319	1,429	1,418
MSW ¹	2,167	2,188	2,218	2,215	2,227
Other Biomass ²	554	561	598	542	671
Wood and Derived Fuels	6,193	6,372	6,704	6,864	6,939
Geothermal	2,285	2,274	2,214	2,229	2,382
Hydroelectric Conventioe	77,541	77,821	77,885	77,930	78,518
Solar Thermal/PV	411	411	502	536	619
Wind	8,706	11,329	16,515	24,651	34,296
Nonrenew able Total	879,274	884,281	886,934	893,775	898,331

¹Includes total capacity w hose primary energy source is MSW.

²Agriculture byproducts/crops, sludge w aste and other biomass solids, liquids and gases. Does not include tires.

³Black liquor, and w ood/w ood w aste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

Notes: Totals may not equal sum of components due to independent rounding.

Data revisions are discussed in the Highlights section.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.13 Renewable electricity net generation by energy source and Census Divisions, 2009

(thousand kilowatthours)

Census Division	Biomass				Geothermal	Hydroelectric Conventional	Solar Thermal/PV	Wind	Total
	Landfill Gas	Waste		Wood and Derived Fuels ³					
		MSW Biogenic ¹	Other Biomass ²						
Total	7,924,211	8,057,613	2,460,771	36,050,138	15,008,658	273,445,094	891,179	73,886,132	417,723,797
New England	428,002	1,986,423	44,498	4,860,203	-	9,093,354	43	378,645	16,791,167
Middle Atlantic	1,581,813	2,584,252	6,294	1,230,095	-	30,330,053	14,269	3,362,045	39,108,820
East North Central	2,285,274	242,623	47,286	2,668,303	-	3,933,510	16	5,588,975	14,765,988
West North Central	292,176	282,736	637,159	798,615	-	9,951,136	-	19,637,330	31,599,152
South Atlantic	935,630	2,415,013	584,827	9,950,445	-	15,984,472	14,033	742,439	30,626,861
East South Central	125,284	-	33,333	5,577,775	-	26,064,976	-	51,747	31,853,114
West South Central	432,630	-	283,691	4,542,635	-	10,010,287	-	22,724,302	37,993,546
Mountain	78,037	5,603	76,056	710,510	1,988,284	32,786,660	214,039	8,260,182	44,119,371
Pacific Contiguous	1,765,364	360,895	636,756	5,711,558	12,852,783	133,854,253	647,390	12,882,012	168,711,012
Pacific Noncontiguous	-	180,067	110,871	-	167,591	1,436,393	1,390	258,454	2,154,766

¹Includes paper and paper board, wood, food, leather, textiles and yard trimmings.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.14 Total biomass electricity net generation by Census Division and energy source, 2009

(thousand kilowatthours)

Energy Source	Census Division										
	New England	Middle Atlantic	East North Central	West North Central	South Atlantic	East South Central	West South Central	Mountain	Pacific Contiguous	Pacific Noncontiguous	Total
Total	7,319,126	5,402,453	5,243,486	2,010,686	13,885,916	5,736,391	5,258,957	870,206	8,474,574	290,938	54,492,734
Agricultural Byproducts/Crops	-	-	-	93,215	390,236	9,010	82,985	-	193,658	10,376	779,480
Black Liquor	1,067,781	559,235	994,699	318,054	5,900,988	3,802,734	2,905,986	358,453	627,023	-	16,534,952
Landfill Gases	428,002	1,581,813	2,285,274	292,176	935,630	125,284	432,630	78,037	1,765,364	-	7,924,211
MSW Biogenic	1,986,423	2,584,252	242,623	282,736	2,415,013	-	-	5,603	360,895	180,067	8,057,613
Other Biomass Gases	3,880	3,535	9,593	39,193	40,384	-	34,753	76,056	432,143	-	639,537
Other Biomass Liquids	91	-	1,187	-	179	8	1,255	-	-	9,788	12,508
Other Biomass Solids	-	-	22,167	475,121	137,169	-	163,010	-	-	90,706	888,173
Sludge Waste	40,526	2,759	14,340	29,631	16,859	24,314	1,689	-	10,954	-	141,073
Wood/Wood Waste Liquids	-	73,801	-	-	-	-	-	-	-	-	73,801
Wood/Wood Waste Solids	3,792,422	597,059	1,673,604	480,561	4,049,457	1,775,040	1,636,649	352,057	5,084,535	-	19,441,385

MSW = Municipal Solid Waste.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.15 Renewable electric power sector net generation by energy source and State, 2008

(thousand kilowatthours)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind		
		Gas/MSW Biogenic ¹	Other Biomass ²	Wood and Derived Fuels ³		Thermal/	PV			
Alabama	6,136,148	-	3,882	163,097	-	-	-	-	166,979	6,303,127
Alaska	1,171,801	-	-	-	-	-	68	-	68	1,171,869
Arizona	7,285,902	19,050	-	75,947	-	14,724	-	-	109,721	7,395,623
Arkansas	4,660,297	35,751	6,092	-	-	-	-	-	41,843	4,702,140
California	24,127,810	1,583,714	369,659	2,820,899	12,883,000	670,481	5,384,955	-	23,712,708	47,840,517
Colorado	2,039,327	8,366	36,753	135	-	18,354	3,220,843	-	3,284,451	5,323,778
Connecticut	556,177	731,881	-	1,633	-	-	-	-	733,514	1,289,691
Delaware	-	163,375	-	-	-	-	-	-	163,375	163,375
District of Columbia	-	-	-	-	-	-	-	-	-	-
Florida	206,158	1,725,470	233,611	368,795	-	-	-	-	2,327,877	2,534,035
Georgia	2,122,606	31,427	-	-	-	-	-	-	31,427	2,154,033
Hawaii	45,073	-	112,273	-	234,333	18	240,023	-	586,647	631,720
Idaho	9,362,501	-	-	69,395	85,547	-	207,472	-	362,414	9,724,915
Illinois	138,549	697,186	34	-	-	-	2,336,996	-	3,034,215	3,172,764
Indiana	436,780	229,247	-	-	-	-	238,356	-	467,603	904,383
Iowa	819,047	98,298	35,194	49	-	-	4,083,787	-	4,217,327	5,036,374
Kansas	10,574	-	-	-	-	-	1,759,412	-	1,759,412	1,769,986
Kentucky	1,917,470	105,094	-	-	-	-	-	-	105,094	2,022,564
Louisiana	1,064,373	-	69,878	-	-	-	-	-	69,878	1,134,251
Maine	3,695,396	108,042	7,702	1,779,596	-	-	131,621	-	2,026,961	5,722,357
Maryland	1,974,078	391,349	-	-	-	-	-	-	391,349	2,365,427
Massachusetts	1,142,180	1,127,529	-	122,580	-	-	3,672	-	1,253,781	2,395,961
Michigan	1,338,568	613,778	63	1,004,059	-	-	141,182	-	1,759,081	3,097,649
Minnesota	609,428	389,752	364,492	259,120	-	-	4,354,620	-	5,367,984	5,977,412
Mississippi	-	-	-	44	-	-	-	-	44	44
Missouri	2,046,773	29,899	3,704	-	-	-	203,313	-	236,916	2,283,689
Montana	9,999,557	-	-	-	-	-	593,138	-	593,138	10,592,695
Nebraska	346,456	44,559	3,508	-	-	-	214,184	-	262,251	608,707
Nevada	1,750,620	-	-	-	1,382,820	156,013	-	-	1,538,833	3,289,453
New Hampshire	1,625,546	155,025	-	1,009,322	-	-	10,319	-	1,174,666	2,800,212
New Jersey	25,773	878,731	-	-	-	2,669	20,885	-	902,285	928,058
New Mexico	312,288	-	18,885	-	-	-	1,642,787	-	1,661,672	1,973,960
New York	26,654,569	1,384,394	-	316,021	-	-	1,250,700	-	2,951,115	29,605,684
North Carolina	3,023,577	101,952	18,530	399,357	-	1,801	-	-	521,639	3,545,217
North Dakota	1,252,790	-	-	-	-	-	1,693,458	-	1,693,458	2,946,248
Ohio	386,435	182,666	-	29,076	-	-	15,084	-	226,826	613,261
Oklahoma	3,811,273	5,443	-	-	-	-	2,358,080	-	2,363,523	6,174,796
Oregon	33,805,024	108,945	-	216,278	-	-	2,575,234	-	2,900,458	36,705,482
Pennsylvania	2,548,858	1,303,110	-150	206,096	-	175	729,425	-	2,238,656	4,787,514
Rhode Island	4,977	158,407	-	-	-	-	-	-	158,407	163,384
South Carolina	1,122,544	86,942	-	291,448	-	-	-	-	378,390	1,500,934

See footnotes at end of table.

Table 1.15 Renewable electric power sector net generation by energy source and State, 2008 (cont.)

(thousand kilowatthours)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind	Total	Total
		Waste		Wood and Derived Fuels ³		Thermal/ PV				
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²							
South Dakota	2,993,107	-	1,665	-	-	-	145,136	146,801	3,139,908	
Tennessee	5,646,073	27,351	-	-	-	-	50,117	77,468	5,723,541	
Texas	1,039,467	384,736	3,083	-	-	-	16,225,022	16,612,841	17,652,308	
Utah	668,084	23,685	-	-	254,277	-	23,900	301,862	969,946	
Vermont	1,471,808	-	-	415,103	-	-	10,235	425,338	1,897,146	
Virginia	1,002,083	560,856	41	506,781	-	-	-	1,067,678	2,069,761	
Washington	77,588,810	155,960	-	377,996	-	-	3,657,484	4,191,440	81,780,251	
West Virginia	820,765	-	-	-390	-	-	391,910	391,520	1,212,285	
Wisconsin	1,452,763	435,133	2,719	205,223	-	-	487,141	1,130,216	2,582,979	
Wyoming	835,275	-	-	-	-	-	962,542	962,542	1,797,817	
U.S. Total	253,095,539	14,087,104	1,291,615	10,637,661	14,839,977	864,235	55,363,100	97,083,692	350,179,231	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.16 Renewable commercial and industrial sector net generation by energy source and State, 2008

(thousand kilowatthours)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind		
		Gas/MSW Biogenic ¹	Other Biomass ²	Wood and Derived Fuels ³		/PV	Thermal			
Alabama	-	-	29,816	3,160,519	-	-	-	3,190,335	3,190,335	
Alaska	-	-	4,682	-	-	-	-	4,682	4,682	
Arizona	-	-	3,936	-	-	-	-	3,936	3,936	
Arkansas	-	-	4,927	1,466,063	-	-	-	1,470,990	1,470,990	
California	-	133,332	275,241	662,656	-	-	-	1,071,229	1,071,229	
Colorado	-	-	-	-	-	-	-	-	-	
Connecticut	-	-	-	-	-	-	-	-	-	
Delaware	-	-	-	-	-	-	-	-	-	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	-	814	374,232	1,599,946	-	-	-	1,974,991	1,974,991	
Georgia	22,012	-	90,258	2,660,285	-	-	-	2,750,543	2,772,555	
Hawaii	39,270	184,005	6,146	-	-	-	-	190,151	229,421	
Idaho	-	-	-	385,998	-	-	-	385,998	385,998	
Illinois	-	-	150	611	-	-	-	761	761	
Indiana	-	43,790	-	-	-	-	-	43,790	43,790	
Iowa	-	-	33,772	-	-	-	-	33,772	33,772	
Kansas	-	-	-	-	-	-	-	-	-	
Kentucky	-	-	3,786	350,740	-	-	-	354,525	354,525	
Louisiana	-	-	1,008	2,638,789	-	-	-	2,639,797	2,639,797	
Maine	762,009	97,565	44,485	1,888,973	-	-	-	2,031,023	2,793,033	
Maryland	-	23,432	-	197,704	-	-	-	221,137	221,137	
Massachusetts	13,631	-	1,517	-	-	80	-	1,597	15,228	
Michigan	25,810	124,389	1,307	706,364	-	-	-	832,060	857,870	
Minnesota	117,633	9,251	7,547	466,100	-	-	-	482,898	600,531	
Mississippi	-	-	5,051	1,386,231	-	-	-	1,391,281	1,391,281	
Missouri	-	-	7,496	1,613	-	-	-	9,109	9,109	
Montana	-	-	-	110,958	-	-	-	110,958	110,958	
Nebraska	-	-	12,861	-	-	-	-	12,861	12,861	
Nevada	-	-	-	-	-	-	-	-	-	
New Hampshire	7,678	-	-	318	-	-	-	318	7,996	
New Jersey	-	-	3,004	-	-	-	-	3,004	3,004	
New Mexico	-	-	-	-	-	-	-	-	-	
New York	68,562	128,467	-	239,075	-	-	-	367,542	436,104	
North Carolina	10,065	-	-	1,400,573	-	-	-	1,400,573	1,410,638	
North Dakota	-	-	12,927	-	-	-	-	12,927	12,927	
Ohio	-	-	7,509	389,041	-	-	-	396,549	396,549	
Oklahoma	-	-	164,175	23,006	-	-	-	187,181	187,181	
Oregon	-	21,802	-	500,839	-	-	-	522,641	522,641	
Pennsylvania	-	110,854	2,387	451,879	-	-	-	565,120	565,120	
Rhode Island	-	-	-	-	-	-	-	-	-	
South Carolina	571	32,817	-	1,404,618	-	-	-	1,437,435	1,438,006	

See footnotes at end of table.

Table 1.16 Renewable commercial and industrial sector net generation by energy source and State, 2008 (cont.)

(thousand kilowatthours)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar Thermal /PV	Wind	Total		
		Waste		Wood and Derived Fuels ³						
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²							
South Dakota	-	-	-	-	-	-	-	-	-	
Tennessee	-	-	8,549	879,293	-	-	-	887,842	887,842	
Texas	-	16,043	34,611	975,599	-	-	-	1,026,254	1,026,254	
Utah	-	-	-	-	-	-	-	-	-	
Vermont	21,096	-	-	-	-	-	-	-	21,096	
Virginia	8,910	200,451	20,824	1,409,507	-	-	-	1,630,782	1,639,692	
Washington	47,948	-	11,921	735,077	-	-	-	746,998	794,945	
West Virginia	427,272	-	-	-	-	-	-	-	427,272	
Wisconsin	163,379	39,026	14,876	569,817	-	-	-	623,719	787,098	
Wyoming	-	-	-	-	-	-	-	-	-	
U.S. Total	1,735,846	1,166,038	1,189,002	26,662,192	-	80	-	29,017,312	30,753,158	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.17 Total renewable net generation by energy source and State, 2008

(thousand kilowatthours)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind		
		Waste		Wood and Derived Fuels ³		Thermal/ PV				
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²							
Alabama	6,136,148	-	33,698	3,323,616	-	-	-	-	3,357,313	9,493,461
Alaska	1,171,801	-	4,682	-	-	-	68	-	4,750	1,176,551
Arizona	7,285,902	19,050	3,936	75,947	-	14,724	-	-	113,658	7,399,560
Arkansas	4,660,297	35,751	11,019	1,466,063	-	-	-	-	1,512,833	6,173,130
California	24,127,810	1,717,046	644,900	3,483,555	12,883,000	670,481	5,384,955	-	24,783,937	48,911,746
Colorado	2,039,327	8,366	36,753	135	-	18,354	3,220,843	-	3,284,451	5,323,778
Connecticut	556,177	731,881	-	1,633	-	-	-	-	733,514	1,289,691
Delaware	-	163,375	-	-	-	-	-	-	163,375	163,375
District of Columbia	-	-	-	-	-	-	-	-	-	-
Florida	206,158	1,726,284	607,843	1,968,741	-	-	-	-	4,302,868	4,509,026
Georgia	2,144,618	31,427	90,258	2,660,285	-	-	-	-	2,781,970	4,926,588
Hawaii	84,343	184,005	118,418	-	234,333	18	240,023	-	776,797	861,140
Idaho	9,362,501	-	-	455,393	85,547	-	207,472	-	748,412	10,110,913
Illinois	138,549	697,186	184	611	-	-	2,336,996	-	3,034,977	3,173,526
Indiana	436,780	273,038	-	-	-	-	238,356	-	511,393	948,173
Iowa	819,047	98,298	68,966	49	-	-	4,083,787	-	4,251,099	5,070,146
Kansas	10,574	-	-	-	-	-	1,759,412	-	1,759,412	1,769,986
Kentucky	1,917,470	105,094	3,786	350,740	-	-	-	-	459,619	2,377,089
Louisiana	1,064,373	-	70,886	2,638,789	-	-	-	-	2,709,675	3,774,048
Maine	4,457,405	205,608	52,187	3,668,569	-	-	131,621	-	4,057,985	8,515,390
Maryland	1,974,078	414,781	-	197,704	-	-	-	-	612,485	2,586,563
Massachusetts	1,155,811	1,127,529	1,517	122,580	-	80	3,672	-	1,255,378	2,411,189
Michigan	1,364,378	738,167	1,370	1,710,423	-	-	141,182	-	2,591,141	3,955,519
Minnesota	727,061	399,003	372,039	725,220	-	-	4,354,620	-	5,850,882	6,577,943
Mississippi	-	-	5,051	1,386,275	-	-	-	-	1,391,326	1,391,326
Missouri	2,046,773	29,899	11,200	1,613	-	-	203,313	-	246,026	2,292,799
Montana	9,999,557	-	-	110,958	-	-	593,138	-	704,096	10,703,653
Nebraska	346,456	44,559	16,370	-	-	-	214,184	-	275,113	621,569
Nevada	1,750,620	-	-	-	1,382,820	156,013	-	-	1,538,833	3,289,453
New Hampshire	1,633,224	155,025	-	1,009,640	-	-	10,319	-	1,174,984	2,808,208
New Jersey	25,773	878,731	3,004	-	-	2,669	20,885	-	905,290	931,063
New Mexico	312,288	-	18,885	-	-	-	1,642,787	-	1,661,672	1,973,960
New York	26,723,131	1,512,860	-	555,097	-	-	1,250,700	-	3,318,657	30,041,788
North Carolina	3,033,642	101,952	18,530	1,799,930	-	1,801	-	-	1,922,213	4,955,855
North Dakota	1,252,790	-	12,927	-	-	-	1,693,458	-	1,706,385	2,959,175
Ohio	386,435	182,666	7,509	418,117	-	-	15,084	-	623,376	1,009,811
Oklahoma	3,811,273	5,443	164,175	23,006	-	-	2,358,080	-	2,550,704	6,361,977
Oregon	33,805,024	130,747	-	717,117	-	-	2,575,234	-	3,423,099	37,228,123
Pennsylvania	2,548,858	1,413,963	2,237	657,976	-	175	729,425	-	2,803,776	5,352,634
Rhode Island	4,977	158,407	-	-	-	-	-	-	158,407	163,384
South Carolina	1,123,115	119,759	-	1,696,067	-	-	-	-	1,815,825	2,938,940

See footnotes at end of table.

Table 1.17 Total renewable net generation by energy source and State, 2008 (cont.)

(thousand kilowatthours)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass				Geothermal	Solar Thermal/ PV	Wind	Total	Total
		Waste		Wood and Derived Fuels ³	Other Biomass ²					
		Landfill Gas/MSW Biogenic ¹	Other							
South Dakota	2,993,107	-	1,665	-	-	-	145,136	146,801	3,139,908	
Tennessee	5,646,073	27,351	-	-	-	-	50,117	77,468	5,723,541	
Texas	1,039,467	384,736	3,083	-	-	-	16,225,022	16,612,841	17,652,308	
Utah	668,084	23,685	-	-	254,277	-	23,900	301,862	969,946	
Vermont	1,471,808	-	-	415,103	-	-	10,235	425,338	1,897,146	
Virginia	1,002,083	560,856	41	506,781	-	-	-	1,067,678	2,069,761	
Washington	77,588,810	155,960	-	377,996	-	-	3,657,484	4,191,440	81,780,251	
West Virginia	820,765	-	-	-390	-	-	391,910	391,520	1,212,285	
Wisconsin	1,452,763	435,133	2,719	205,223	-	-	487,141	1,130,216	2,582,979	
Wyoming	835,275	-	-	-	-	-	962,542	962,542	1,797,817	
U.S. Total	253,095,539	14,087,104	1,291,615	10,637,661	14,839,977	864,235	55,363,100	97,083,692	350,179,231	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.18 Renewable electric power sector net generation by energy source and State, 2009

(thousand kilowatthours)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar Thermal/ PV			Total	Total
		Waste		Wood and Derived Fuels ³		Wind	Solar Thermal/ PV			
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²							
Alabama	12,535,373	-	2,050	245,980	-	-	-	248,030	12,783,403	
Alaska	1,323,744	-	-	-	-	-	7,027	7,027	1,330,771	
Arizona	6,427,345	18,299	-	136,641	-	14,145	29,545	198,630	6,625,975	
Arkansas	4,192,706	34,371	17,645	-	-	-	-	52,016	4,244,722	
California	27,887,707	1,636,022	353,959	3,051,079	12,852,783	647,390	5,839,813	24,381,046	52,268,752	
Colorado	1,885,724	17,463	38,701	388	-	25,585	3,163,836	3,245,973	5,131,697	
Connecticut	509,546	758,108	-	622	-	-	-	758,730	1,268,276	
Delaware	-	125,611	-	-	-	-	-	125,611	125,611	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	208,202	1,846,339	187,079	325,226	-	9,470	-	2,368,115	2,576,317	
Georgia	3,252,094	29,737	-	-	-	-	-	29,737	3,281,831	
Hawaii	77,259	-	93,983	-	167,591	1,390	251,427	514,391	591,650	
Idaho	10,434,264	-	-	75,613	75,950	-	313,418	464,981	10,899,245	
Illinois	136,380	709,136	44	-	-	16	2,819,532	3,528,728	3,665,108	
Indiana	503,470	259,483	-	-	-	-	1,403,192	1,662,674	2,166,144	
Iowa	971,165	93,417	27,388	194	-	-	7,420,520	7,541,518	8,512,683	
Kansas	12,798	-	-	-	-	-	2,863,267	2,863,267	2,876,065	
Kentucky	3,317,641	96,393	-	-	-	-	-	96,393	3,414,034	
Louisiana	1,236,351	-	66,166	-	-	-	-	66,166	1,302,517	
Maine	3,454,424	131,422	3,632	1,734,756	-	-	298,623	2,168,433	5,622,857	
Maryland	1,888,769	359,553	-	-	-	-	-	359,553	2,248,322	
Massachusetts	1,185,836	1,103,995	-	115,384	-	-	5,748	1,225,126	2,410,963	
Michigan	1,347,406	678,429	11	871,994	-	-	300,172	1,850,606	3,198,012	
Minnesota	675,103	376,490	495,419	319,243	-	-	5,053,022	6,244,174	6,919,276	
Mississippi	-	-	-	-	-	-	-	-	-	
Missouri	1,816,693	49,808	18,790	-	-	-	499,377	567,975	2,384,668	
Montana	9,505,940	-	-	-	-	-	820,924	820,924	10,326,864	
Nebraska	433,690	47,449	4,623	-	-	-	382,634	434,706	868,396	
Nevada	2,460,595	-	-	890	1,633,213	174,309	-	1,808,412	4,269,007	
New Hampshire	1,671,475	151,278	-	983,501	-	-	62,477	1,197,256	2,868,731	
New Jersey	32,081	756,459	-	-	-	10,707	20,918	788,084	820,165	
New Mexico	270,963	-	33,664	-	-	-	1,546,718	1,580,382	1,851,345	
New York	27,490,361	1,549,036	-	249,926	-	-	2,266,339	4,065,301	31,555,662	
North Carolina	5,155,366	120,191	7,840	495,163	-	4,563	-	627,758	5,783,123	
North Dakota	1,475,251	-	-	-	-	-	2,997,530	2,997,530	4,472,781	
Ohio	527,746	198,144	-	23,041	-	-	14,114	235,299	763,045	
Oklahoma	3,552,573	-	-	-	-	-	2,698,199	2,698,199	6,250,772	
Oregon	33,033,513	109,965	-	218,833	-	-	3,469,714	3,798,512	36,832,025	
Pennsylvania	2,682,866	1,469,614	-	199,742	-	3,562	1,074,788	2,747,705	5,430,571	
Rhode Island	4,736	144,600	-	-	-	-	-	144,600	149,336	
South Carolina	2,330,770	115,050	-	281,612	-	-	-	396,662	2,727,432	

See footnotes at end of table.

Table 1.18 Renewable electric power sector net generation by energy source and State, 2009 (cont.)

(thousand kilowatthours)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Total		
		Gas/MSW Biogenic ¹	Other Biomass ²	Wood and Derived Fuels ³		PV	Wind			
South Dakota	4,432,451	-	5,775	-	-	-	420,981	426,756	4,859,207	
Tennessee	10,211,962	28,891	8	-	-	-	51,747	80,646	10,292,608	
Texas	1,028,657	378,278	-	-	-	-	20,026,103	20,404,381	21,433,038	
Utah	835,257	47,878	-	-	279,121	-	159,537	486,536	1,321,793	
Vermont	1,460,853	24,190	-	393,266	-	-	11,589	429,045	1,889,899	
Virginia	1,468,406	523,284	-	440,576	-	-	-	963,860	2,432,265	
Washington	72,885,620	156,068	-	358,563	-	-	3,572,486	4,087,117	76,972,737	
West Virginia	1,027,360	-	-149	-689	-	-	742,439	741,602	1,768,962	
Wisconsin	1,280,831	452,924	-161	216,371	-	-	1,051,965	1,721,098	3,001,929	
Wyoming	966,572	-	-	-	-	-	2,226,205	2,226,205	3,192,777	
U.S. Total	271,505,893	14,597,376	1,356,468	10,737,915	15,008,658	891,137	73,885,924	116,477,478	387,983,371	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.19 Renewable commercial and industrial sector net generation by energy source and State, 2009

(thousand kilowatthours)

State	NonHydroelectric								Total	Total	
	Hydroelectric Conventional	Biomass			Wood and Derived Fuels ³	Geothermal	Solar				Total
		Waste		Other Biomass ²			Thermal/ PV	Wind			
		Landfill Gas/MSW Biogenic ¹									
Alabama	-	-	12,432	2,789,395	-	-	-	2,801,827	2,801,827		
Alaska	-	-	6,511	-	-	-	-	6,511	6,511		
Arizona	-	-	3,691	-	-	-	-	3,691	3,691		
Arkansas	-	-	5,034	1,528,501	-	-	-	1,533,534	1,533,534		
California	330	205,837	271,843	680,936	-	-	-	1,158,616	1,158,946		
Colorado	-	-	-	-	-	-	-	-	-		
Connecticut	-	-	-	-	-	-	-	-	-		
Delaware	-	-	-	-	-	-	-	-	-		
District of Columbia	-	-	-	-	-	-	-	-	-		
Florida	-	-	343,319	1,628,898	-	-	-	1,972,217	1,972,217		
Georgia	7,589	20,982	28,881	2,745,569	-	-	-	2,795,433	2,803,022		
Hawaii	35,390	180,067	10,376	-	-	-	-	190,443	225,833		
Idaho	-	-	-	402,335	-	-	-	402,335	402,335		
Illinois	-	-	563	461	-	-	-	1,024	1,024		
Indiana	-	43,161	-	-	-	-	-	43,161	43,161		
Iowa	-	-	47,082	-	-	-	-	47,082	47,082		
Kansas	-	-	-	-	-	-	-	-	-		
Kentucky	-	-	4,481	262,660	-	-	-	267,141	267,141		
Louisiana	-	-	1,020	2,296,773	-	-	-	2,297,793	2,297,793		
Maine	757,255	100,832	36,986	1,631,994	-	-	-	1,769,811	2,527,066		
Maryland	-	16,169	-	175,057	-	-	-	191,227	191,227		
Massachusetts	15,240	-	3,880	-	-	43	208	4,131	19,371		
Michigan	24,520	150,449	5,123	617,006	-	-	-	772,578	797,098		
Minnesota	133,985	7,748	7,647	477,088	-	-	-	492,484	626,469		
Mississippi	-	-	6,960	1,417,319	-	-	-	1,424,279	1,424,279		
Missouri	-	-	4,740	2,090	-	-	-	6,830	6,830		
Montana	-	-	-	94,642	-	-	-	94,642	94,642		
Nebraska	-	-	14,123	-	-	-	-	14,123	14,123		
Nevada	-	-	-	-	-	-	-	-	-		
New Hampshire	9,017	-	-	680	-	-	-	680	9,697		
New Jersey	-	168,212	3,535	-	-	-	-	171,747	171,747		
New Mexico	-	-	-	-	-	-	-	-	-		
New York	124,746	115,780	-	285,926	-	-	-	401,707	526,452		
North Carolina	15,891	-	3,459	1,262,187	-	-	-	1,265,646	1,281,537		
North Dakota	-	-	11,572	-	-	-	-	11,572	11,572		
Ohio	-	-	11,467	386,645	-	-	-	398,111	398,111		
Oklahoma	-	-	163,010	68,064	-	-	-	231,074	231,074		
Oregon	-	18,367	-	455,548	-	-	-	473,915	473,915		
Pennsylvania	-	106,964	2,759	494,500	-	-	-	604,223	604,223		
Rhode Island	-	-	-	-	-	-	-	-	-		
South Carolina	1,235	22,204	-	1,329,106	-	-	-	1,351,310	1,352,545		

See footnotes at end of table.

Table 1.19 Renewable commercial and industrial sector net generation by energy source and State, 2009 (cont.)

(thousand kilowatthours)

State	NonHydroelectric								Total	Total	
	Hydroelectric Conventional	Biomass				Geothermal	Solar				Total
		Waste		Wood and Derived Fuels ³	Thermal/ PV		Wind				
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²								
South Dakota	-	-	-	-	-	-	-	-	-	-	
Tennessee	-	-	7,401	862,421	-	-	-	869,822	869,822	869,822	
Texas	-	19,981	30,816	649,298	-	-	-	700,095	700,095	700,095	
Utah	-	-	-	-	-	-	-	-	-	-	
Vermont	24,972	-	-	-	-	-	-	-	-	24,972	
Virginia	10,224	171,523	14,396	1,267,740	-	-	-	1,453,659	1,463,883	1,463,883	
Washington	47,084	-	10,954	946,599	-	-	-	957,553	1,004,637	1,004,637	
West Virginia	618,567	-	-	-	-	-	-	-	-	618,567	
Wisconsin	113,158	36,171	30,241	552,785	-	-	-	619,197	732,355	732,355	
Wyoming	-	-	-	-	-	-	-	-	-	-	
U.S. Total	1,939,201	1,384,449	1,104,304	25,312,223	-	43	208	27,801,226	29,740,427	29,740,427	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.20 Total renewable net generation by energy source and State, 2009

(thousand kilowatthours)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar			Total	Total
		Waste		Wood and Derived Fuels ³		Thermal/ PV	Wind			
		Gas/MSW Biogenic ¹	Other Biomass ²							
Alabama	12,535,373	-	14,482	3,035,375	-	-	-	3,049,857	15,585,230	
Alaska	1,323,744	-	6,511	-	-	-	7,027	13,538	1,337,283	
Arizona	6,427,345	18,299	3,691	136,641	-	14,145	29,545	202,321	6,629,666	
Arkansas	4,192,706	34,371	22,679	1,528,501	-	-	-	1,585,550	5,778,256	
California	27,888,036	1,841,859	625,802	3,732,016	12,852,783	647,390	5,839,813	25,539,662	53,427,698	
Colorado	1,885,724	17,463	38,701	388	-	25,585	3,163,836	3,245,973	5,131,697	
Connecticut	509,546	758,108	-	622	-	-	-	758,730	1,268,276	
Delaware	-	125,611	-	-	-	-	-	125,611	125,611	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	208,202	1,846,339	530,398	1,954,125	-	9,470	-	4,340,332	4,548,534	
Georgia	3,259,683	50,719	28,881	2,745,569	-	-	-	2,825,170	6,084,853	
Hawaii	112,649	180,067	104,359	-	167,591	1,390	251,427	704,835	817,483	
Idaho	10,434,264	-	-	477,948	75,950	-	313,418	867,316	11,301,580	
Illinois	136,380	709,136	607	461	-	16	2,819,532	3,529,752	3,666,132	
Indiana	503,470	302,644	-	-	-	-	1,403,192	1,705,836	2,209,306	
Iowa	971,165	93,417	74,471	194	-	-	7,420,520	7,588,601	8,559,766	
Kansas	12,798	-	-	-	-	-	2,863,267	2,863,267	2,876,065	
Kentucky	3,317,641	96,393	4,481	262,660	-	-	-	363,534	3,681,175	
Louisiana	1,236,351	-	67,186	2,296,773	-	-	-	2,363,959	3,600,310	
Maine	4,211,679	232,254	40,618	3,366,750	-	-	298,623	3,938,244	8,149,923	
Maryland	1,888,769	375,722	-	175,057	-	-	-	550,780	2,439,549	
Massachusetts	1,201,076	1,103,995	3,880	115,384	-	43	5,956	1,229,257	2,430,334	
Michigan	1,371,926	828,878	5,133	1,489,001	-	-	300,172	2,623,184	3,995,110	
Minnesota	809,088	384,238	503,066	796,331	-	-	5,053,022	6,736,657	7,545,745	
Mississippi	-	-	6,960	1,417,319	-	-	-	1,424,279	1,424,279	
Missouri	1,816,693	49,808	23,530	2,090	-	-	499,377	574,805	2,391,498	
Montana	9,505,940	-	-	94,642	-	-	820,924	915,566	10,421,506	
Nebraska	433,690	47,449	18,746	-	-	-	382,634	448,829	882,519	
Nevada	2,460,595	-	-	890	1,633,213	174,309	-	1,808,412	4,269,007	
New Hampshire	1,680,492	151,278	-	984,181	-	-	62,477	1,197,936	2,878,428	
New Jersey	32,081	924,671	3,535	-	-	10,707	20,918	959,831	991,912	
New Mexico	270,963	-	33,664	-	-	-	1,546,718	1,580,382	1,851,345	
New York	27,615,106	1,664,816	-	535,853	-	-	2,266,339	4,467,008	32,082,114	
North Carolina	5,171,257	120,191	11,300	1,757,350	-	4,563	-	1,893,404	7,064,660	
North Dakota	1,475,251	-	11,572	-	-	-	2,997,530	3,009,102	4,484,353	
Ohio	527,746	198,144	11,467	409,685	-	-	14,114	633,410	1,161,156	
Oklahoma	3,552,573	-	163,010	68,064	-	-	2,698,199	2,929,273	6,481,846	
Oregon	33,033,513	128,332	-	674,381	-	-	3,469,714	4,272,427	37,305,940	
Pennsylvania	2,682,866	1,576,577	2,759	694,242	-	3,562	1,074,788	3,351,928	6,034,794	
Rhode Island	4,736	144,600	-	-	-	-	-	144,600	149,336	
South Carolina	2,332,005	137,254	-	1,610,717	-	-	-	1,747,971	4,079,977	

See footnotes at end of table.

Table 1.20 Total renewable net generation by energy source and State, 2009 (cont.)

(thousand kilowatthours)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar Thermal/ PV			Total	Total
		Waste		Wood and Derived Fuels ³		Wind	Total			
		Landfill Gas/MSW Biogenic ¹	Other Biomass ²							
South Dakota	4,432,451	-	5,775	-	-	-	420,981	426,756	4,859,207	
Tennessee	10,211,962	28,891	7,409	862,421	-	-	51,747	950,468	11,162,430	
Texas	1,028,657	398,259	30,816	649,298	-	-	20,026,103	21,104,476	22,133,134	
Utah	835,257	47,878	-	-	279,121	-	159,537	486,536	1,321,793	
Vermont	1,485,825	24,190	-	393,266	-	-	11,589	429,045	1,914,871	
Virginia	1,478,630	694,807	14,396	1,708,316	-	-	-	2,417,519	3,896,149	
Washington	72,932,704	156,068	10,954	1,305,162	-	-	3,572,486	5,044,670	77,977,375	
West Virginia	1,645,927	-	-149	-689	-	-	742,439	741,602	2,387,529	
Wisconsin	1,393,988	489,095	30,079	769,156	-	-	1,051,965	2,340,295	3,734,284	
Wyoming	966,572	-	-	-	-	-	2,226,205	2,226,205	3,192,777	
U.S. Total	273,445,094	15,981,824	2,460,771	36,050,138	15,008,658	891,179	73,886,132	144,278,703	417,723,797	

¹Includes landfill gas and MSW biogenic (paper and paper board, wood, food, leather, textiles and yard trimmings).

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.21 Renewable electric power sector net summer capacity by energy source and State, 2008

(megawatts)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar			Total	Total
		Waste		Wood and Derived Fuels ³		Thermal/ PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²							
Alabama	3,272	-	-	-	-	-	-	-	3,272	
Alaska	400	-	-	-	-	-	3	3	403	
Arizona	2,720	4	-	29	-	9	-	42	2,762	
Arkansas	1,321	5	4	-	-	-	-	9	1,330	
California	10,117	362	47	456	1,940	416	2,368	5,588	15,705	
Colorado	666	3	10	-	-	11	1,063	1,087	1,753	
Connecticut	122	166	-	-	-	-	-	166	287	
Delaware	-	7	-	-	-	-	-	7	7	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	55	470	105	67	-	-	-	642	697	
Georgia	2,034	7	-	4	-	-	-	11	2,045	
Hawaii	18	-	46	-	31	1	64	142	161	
Idaho	2,346	-	-	12	10	-	117	138	2,484	
Illinois	34	150	-	-	-	-	962	1,112	1,145	
Indiana	60	30	-	-	-	-	131	161	220	
Iowa	142	11	-	-	-	-	2,635	2,646	2,788	
Kansas	3	-	-	-	-	-	812	812	815	
Kentucky	824	15	-	-	-	-	-	15	839	
Louisiana	192	-	11	-	-	-	-	11	203	
Maine	610	30	36	220	-	-	47	332	942	
Maryland	590	126	-	-	-	-	-	126	716	
Massachusetts	252	263	-	26	-	-	2	290	542	
Michigan	246	102	-	178	-	-	124	404	650	
Minnesota	164	126	55	121	-	-	1,460	1,762	1,926	
Mississippi	-	-	-	-	-	-	-	-	-	
Missouri	566	5	-	-	-	-	163	168	734	
Montana	2,660	-	-	-	-	-	255	255	2,915	
Nebraska	278	6	2	-	-	-	25	32	310	
Nevada	1,051	-	-	-	215	88	-	303	1,354	
New Hampshire	500	29	-	139	-	-	24	192	692	
New Jersey	4	184	19	-	-	4	8	214	218	
New Mexico	82	-	6	-	-	-	496	502	584	
New York	4,284	307	-	87	-	-	707	1,101	5,384	
North Carolina	1,947	20	-	75	-	3	-	99	2,046	
North Dakota	486	-	-	-	-	-	776	776	1,262	
Ohio	101	41	-	7	-	-	7	56	157	
Oklahoma	851	-	-	-	-	-	708	708	1,559	
Oregon	8,364	17	3	34	-	-	1,059	1,113	9,477	
Pennsylvania	751	369	-	28	-	2	361	759	1,510	
Rhode Island	3	24	-	-	-	-	-	24	26	
South Carolina	1,336	26	-	-	-	-	-	26	1,361	

See footnotes at end of table.

Table 1.21 Renewable electric power sector net summer capacity by energy source and State, 2008 (cont.)

(megawatts)

State	NonHydroelectric								Total	Total
	Biomass				Geothermal	Solar		Total		
	Hydroelectric Conventional	Waste		Wood and Derived Fuels ³		Thermal/ PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²							
South Dakota	1,463	-	-	-	-	-	193	193	1,656	
Tennessee	2,639	8	2	-	-	-	29	39	2,678	
Texas	673	73	13	50	-	-	7,427	7,562	8,235	
Utah	256	5	-	-	34	-	19	57	313	
Vermont	317	3	-	72	-	-	5	80	398	
Virginia	674	194	-	83	-	-	-	277	951	
Washington	21,198	36	-	86	-	1	1,365	1,487	22,685	
West Virginia	163	-	-	-	-	-	330	330	493	
Wisconsin	441	66	-	73	-	-	231	369	810	
Wyoming	303	-	-	-	-	-	680	680	983	
U.S. Total	77,575	3,288	357	1,846	2,229	535	24,651	32,906	110,480	

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.22 Renewable commercial and industrial sector net summer capacity by energy source and State, 2008

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Total		
		Waste		Wood and Derived Fuels ³		Thermal/ PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²							
Alabama	-	-	-	593	-	-	-	593	593	
Alaska	-	-	-	-	-	-	-	-	-	
Arizona	-	-	-	-	-	-	-	-	-	
Arkansas	-	-	1	312	-	-	-	313	313	
California	6	12	62	160	-	-	-	234	240	
Colorado	-	-	-	-	-	-	-	-	-	
Connecticut	-	-	-	-	-	-	-	-	-	
Delaware	-	-	-	-	-	-	-	-	-	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	-	-	66	284	-	-	-	350	350	
Georgia	7	3	-	587	-	-	-	590	597	
Hawaii	5	60	3	-	-	-	-	63	68	
Idaho	-	-	-	51	-	-	-	51	51	
Illinois	-	-	-	-	-	-	-	-	-	
Indiana	-	9	-	-	-	-	-	9	9	
Iowa	-	-	3	-	-	-	-	3	3	
Kansas	-	-	-	-	-	-	-	-	-	
Kentucky	-	-	-	47	-	-	-	47	47	
Louisiana	-	-	3	380	-	-	-	383	383	
Maine	120	24	-	392	-	-	-	416	536	
Maryland	-	7	-	3	-	-	-	9	9	
Massachusetts	6	-	9	-	-	-	-	9	15	
Michigan	4	67	-	52	-	-	-	119	122	
Minnesota	30	4	-	49	-	-	-	53	83	
Mississippi	-	-	-	229	-	-	-	229	229	
Missouri	-	-	-	-	-	-	-	-	-	
Montana	-	-	-	17	-	-	-	17	17	
Nebraska	-	-	3	-	-	-	-	3	3	
Nevada	-	-	-	-	-	1	-	1	1	
New Hampshire	1	-	-	1	-	-	-	1	2	
New Jersey	-	-	1	-	-	-	-	1	1	
New Mexico	-	-	-	-	-	-	-	-	-	
New York	15	33	-	-	-	-	-	33	49	
North Carolina	5	-	-	243	-	-	-	243	248	
North Dakota	-	-	10	-	-	-	-	10	10	
Ohio	-	-	-	58	-	-	-	58	58	
Oklahoma	-	16	-	63	-	-	-	78	78	
Oregon	-	3	-	196	-	-	-	199	199	
Pennsylvania	-	28	-	80	-	-	-	108	108	
Rhode Island	-	-	-	-	-	-	-	-	-	
South Carolina	1	10	-	220	-	-	-	230	231	

See footnotes at end of table.

Table 1.22 Renewable commercial and industrial sector net summer capacity by energy source and State, 2008 (cont.)

(megawatts)

State	NonHydroelectric								Total	Total	
	Hydroelectric Conventional	Biomass				Geothermal	Solar				Total
		Waste		Wood and Derived Fuels ³	Thermal/ PV		Wind				
		Landfill Gas/MSW ¹	Other Biomass ²								
South Dakota	-	-	-	-	-	-	-	-	-	-	
Tennessee	-	-	-	165	-	-	-	165	165	165	
Texas	-	-	16	130	-	-	-	145	145	145	
Utah	-	-	-	-	-	-	-	-	-	-	
Vermont	5	-	-	4	-	-	-	4	8	8	
Virginia	3	76	-	339	-	-	-	415	417	417	
Washington	5	-	-	228	-	-	-	228	233	233	
West Virginia	101	-	-	-	-	-	-	-	101	101	
Wisconsin	44	7	8	135	-	-	-	149	194	194	
Wyoming	-	-	-	-	-	-	-	-	-	-	
U.S. Total	356	357	184	5,018	-	1	-	5,560	5,916	5,916	

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

s = Less than 500 kilowatts.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.23 Total renewable net summer capacity by energy source and State, 2008

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar Thermal		Wind		
		Landfill Gas/MSW ¹	Other Biomass ²	Wood and Derived Fuels ³		/PV				
Alabama	3,272	-	-	593	-	-	-	593	3,865	
Alaska	400	-	-	-	-	-	3	3	403	
Arizona	2,720	4	-	29	-	9	-	42	2,762	
Arkansas	1,321	5	5	312	-	-	-	322	1,643	
California	10,122	374	109	616	1,940	416	2,368	5,822	15,945	
Colorado	666	3	10	-	-	11	1,063	1,087	1,753	
Connecticut	122	166	-	-	-	-	-	166	287	
Delaware	-	7	-	-	-	-	-	7	7	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	55	470	171	351	-	-	-	992	1,046	
Georgia	2,041	10	-	591	-	-	-	601	2,642	
Hawaii	24	60	49	-	31	1	64	205	228	
Idaho	2,346	-	-	63	10	-	117	189	2,535	
Illinois	34	150	-	-	-	-	962	1,112	1,145	
Indiana	60	39	-	-	-	-	131	170	229	
Iowa	142	11	3	-	-	-	2,635	2,650	2,791	
Kansas	3	-	-	-	-	-	812	812	815	
Kentucky	824	15	-	47	-	-	-	63	886	
Louisiana	192	-	14	380	-	-	-	394	586	
Maine	730	53	36	612	-	-	47	748	1,478	
Maryland	590	132	-	3	-	-	-	135	725	
Massachusetts	258	263	9	26	-	2	2	299	557	
Michigan	250	169	-	230	-	-	124	523	773	
Minnesota	194	130	55	170	-	-	1,460	1,815	2,008	
Mississippi	-	-	-	229	-	-	-	229	229	
Missouri	566	5	-	-	-	-	163	168	734	
Montana	2,660	-	-	17	-	-	255	272	2,932	
Nebraska	278	6	5	-	-	-	25	35	313	
Nevada	1,051	-	-	-	215	89	-	304	1,355	
New Hampshire	500	29	-	140	-	-	24	193	694	
New Jersey	4	184	20	-	-	4	8	215	219	
New Mexico	82	-	6	-	-	-	496	502	584	
New York	4,299	340	-	87	-	-	707	1,134	5,433	
North Carolina	1,952	20	-	318	-	3	-	342	2,294	
North Dakota	486	-	10	-	-	-	776	786	1,272	
Ohio	101	41	-	65	-	-	7	113	214	
Oklahoma	851	16	-	63	-	-	708	786	1,637	
Oregon	8,364	20	3	230	-	-	1,059	1,312	9,676	
Pennsylvania	751	397	-	108	-	2	361	868	1,619	
Rhode Island	3	24	-	-	-	-	-	24	26	
South Carolina	1,337	35	-	220	-	-	-	256	1,592	

See footnotes at end of table.

Table 1.23 Total renewable net summer capacity by energy source and State, 2008 (cont.)

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind		
		Landfill Gas/MSW ¹	Other Biomass ²	Wood and Derived Fuels ³		/PV	Thermal			
South Dakota	1,463	-	-	-	-	-	193	193	1,656	
Tennessee	2,639	8	2	165	-	-	29	203	2,842	
Texas	673	73	29	180	-	-	7,427	7,708	8,380	
Utah	256	5	-	-	34	-	19	57	313	
Vermont	322	3	-	76	-	-	5	84	406	
Virginia	677	269	-	422	-	-	-	691	1,368	
Washington	21,203	36	-	314	-	1	1,365	1,716	22,919	
West Virginia	264	-	-	-	-	-	330	330	594	
Wisconsin	485	72	8	208	-	-	231	518	1,003	
Wyoming	303	-	-	-	-	-	680	680	983	
U.S. Total	77,930	3,644	542	6,864	2,229	536	24,651	38,466	116,396	

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

s = Less than 500 kilowatts.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.24 Renewable electric power sector net summer capacity by energy source and State, 2009

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Total		
		Waste		Wood and Derived Fuels ³		Thermal /PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²							
Alabama	3,272	-	-	-	-	-	-	-	-	3,272
Alaska	414	-	-	-	-	-	7	7	7	422
Arizona	2,720	4	-	29	-	11	63	106	106	2,826
Arkansas	1,337	5	4	-	-	-	-	9	9	1,346
California	10,138	292	33	489	2,004	450	2,650	5,918	5,918	16,056
Colorado	666	3	10	-	-	14	1,238	1,265	1,265	1,931
Connecticut	122	166	-	-	-	-	-	166	166	287
Delaware	-	7	-	-	-	-	-	7	7	7
District of Columbia	-	-	-	-	-	-	-	-	-	-
Florida	55	492	105	67	-	25	-	689	689	743
Georgia	2,039	12	-	-	-	-	-	12	12	2,050
Hawaii	18	-	159	-	31	1	64	255	255	274
Idaho	2,682	-	5	12	7	-	146	170	170	2,852
Illinois	34	139	-	-	-	9	1,596	1,744	1,744	1,777
Indiana	60	36	-	-	-	-	1,037	1,072	1,072	1,132
Iowa	144	11	-	-	-	-	3,352	3,363	3,363	3,507
Kansas	3	-	-	-	-	-	1,011	1,011	1,011	1,014
Kentucky	824	17	-	-	-	-	-	17	17	841
Louisiana	192	-	11	-	-	-	-	11	11	203
Maine	613	33	36	214	-	-	170	452	452	1,065
Maryland	590	128	-	-	-	-	-	128	128	718
Massachusetts	255	264	-	26	-	-	3	293	293	548
Michigan	247	101	-	178	-	-	143	422	422	670
Minnesota	164	129	75	127	-	-	1,615	1,946	1,946	2,110
Mississippi	-	-	-	-	-	-	-	-	-	-
Missouri	564	8	-	-	-	-	309	316	316	880
Montana	2,692	-	-	-	-	-	369	369	369	3,060
Nebraska	278	6	2	-	-	-	105	112	112	390
Nevada	1,051	-	-	-	306	88	-	394	394	1,445
New Hampshire	497	29	-	138	-	-	24	192	192	689
New Jersey	6	137	19	-	-	13	8	177	177	183
New Mexico	82	-	6	-	-	-	597	604	604	686
New York	4,294	310	-	86	-	-	1,274	1,670	1,670	5,965
North Carolina	1,947	20	-	75	-	3	-	99	99	2,046
North Dakota	508	-	-	-	-	-	1,202	1,202	1,202	1,710
Ohio	101	41	-	7	-	-	7	56	56	157
Oklahoma	854	-	-	-	-	-	1,130	1,130	1,130	1,984
Oregon	8,430	23	3	48	-	-	1,659	1,733	1,733	10,163
Pennsylvania	747	391	-	28	-	2	696	1,116	1,116	1,863
Rhode Island	3	24	-	-	-	-	-	24	24	26
South Carolina	1,336	23	-	-	-	-	-	23	23	1,359

See footnotes at end of table.

Table 1.24 Renewable electric power sector net summer capacity by energy source and State, 2009 (cont.)

(megawatts)

State	NonHydroelectric								Total	Total
	Biomass				Geothermal	Solar				
	Hydroelectric Conventional	Waste		Wood and Derived Fuels ³		/PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²					Thermal		
South Dakota	1,594	-	-	-	-	-	320	320	1,914	
Tennessee	2,614	8	2	-	-	-	29	39	2,653	
Texas	689	79	-	50	-	-	9,378	9,508	10,197	
Utah	256	9	-	-	34	-	222	265	521	
Vermont	317	3	-	72	-	-	5	80	398	
Virginia	713	202	-	83	-	-	-	285	999	
Washington	21,083	41	-	86	-	1	2,006	2,133	23,216	
West Virginia	163	-	-	-	-	-	330	330	493	
Wisconsin	450	66	-	73	-	-	430	568	1,018	
Wyoming	304	-	-	-	-	-	1,104	1,104	1,408	
U.S. Total	78,159	3,259	469	1,889	2,382	617	34,295	42,910	121,070	

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.25 Renewable commercial and industrial sector net summer capacity by energy source and State, 2009

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Wind		
		Landfill Gas/MSW ¹	Other Biomass ²	Wood and Derived Fuels ³		Thermal	/PV			
Alabama	-	-	-	591	-	-	-	-	591	591
Alaska	-	-	-	-	-	-	-	-	-	-
Arizona	-	-	-	-	-	-	-	-	-	-
Arkansas	-	-	2	312	-	-	-	-	314	314
California	6	13	64	156	-	-	-	-	233	239
Colorado	-	-	-	-	-	-	-	-	-	-
Connecticut	-	-	-	-	-	-	-	-	-	-
Delaware	-	-	-	-	-	-	-	-	-	-
District of Columbia	-	-	-	-	-	-	-	-	-	-
Florida	-	-	66	284	-	-	-	-	350	350
Georgia	7	3	-	587	-	-	-	-	590	597
Hawaii	5	60	3	-	-	-	-	-	63	68
Idaho	-	-	-	57	-	-	-	-	57	57
Illinois	-	-	-	-	-	-	-	-	-	-
Indiana	-	9	-	-	-	-	-	-	9	9
Iowa	-	-	3	-	-	-	-	-	3	3
Kansas	-	-	-	-	-	-	-	-	-	-
Kentucky	-	-	-	52	-	-	-	-	52	52
Louisiana	-	-	3	373	-	-	-	-	376	376
Maine	125	24	-	392	-	-	-	-	416	541
Maryland	-	7	-	3	-	-	-	-	9	9
Massachusetts	6	-	9	-	-	s	1	-	10	16
Michigan	4	67	-	52	-	-	-	-	119	122
Minnesota	30	4	-	49	-	-	-	-	53	83
Mississippi	-	-	-	229	-	-	-	-	229	229
Missouri	-	-	-	-	-	-	-	-	-	-
Montana	-	-	-	17	-	-	-	-	17	17
Nebraska	-	-	3	-	-	-	-	-	3	3
Nevada	-	-	-	-	-	-	1	-	1	1
New Hampshire	1	-	-	1	-	-	-	-	1	2
New Jersey	-	38	1	-	-	-	-	-	38	38
New Mexico	-	-	-	-	-	-	-	-	-	-
New York	15	33	-	-	-	-	-	-	33	49
North Carolina	5	-	-	243	-	-	-	-	243	248
North Dakota	-	-	10	-	-	-	-	-	10	10
Ohio	-	-	1	58	-	-	-	-	59	59
Oklahoma	-	16	-	58	-	-	-	-	73	73
Oregon	-	3	-	193	-	-	-	-	196	196
Pennsylvania	-	28	-	80	-	-	-	-	108	108
Rhode Island	-	-	-	-	-	-	-	-	-	-
South Carolina	1	-	-	220	-	-	-	-	220	221

See footnotes at end of table.

Table 1.25 Renewable commercial and industrial sector net summer capacity by energy source and State, 2009 (cont.)

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar Thermal /PV	Wind	Total		
		Waste		Wood and Derived Fuels ³						
		Landfill Gas/MSW ¹	Other Biomass ²							
South Dakota	-	-	-	-	-	-	-	-	-	-
Tennessee	-	-	-	165	-	-	-	-	165	165
Texas	-	-	28	130	-	-	-	-	157	157
Utah	-	-	-	-	-	-	-	-	-	-
Vermont	4	-	-	4	-	-	-	-	4	8
Virginia	3	76	-	326	-	-	-	-	402	404
Washington	5	-	-	283	-	-	-	-	283	288
West Virginia	101	-	-	-	-	-	-	-	-	101
Wisconsin	42	7	11	135	-	-	-	-	152	194
Wyoming	-	-	-	-	-	-	-	-	-	-
U.S. Total	358	386	203	5,051	-	1	1	1	5,642	6,000

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

s = Less than 500 kilowatts.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.26 Total renewable net summer capacity by energy source and State, 2009

(megawatts)

State	NonHydroelectric								Total	Total
	Hydroelectric Conventional	Biomass			Geothermal	Solar		Total		
		Landfill Gas/MSW ¹	Other Biomass ²	Wood and Derived Fuels ³		Thermal/ PV	Wind			
Alabama	3,272	-	-	591	-	-	-	591	3,863	
Alaska	414	-	-	-	-	-	7	7	422	
Arizona	2,720	4	-	29	-	11	63	106	2,826	
Arkansas	1,337	5	6	312	-	-	-	323	1,659	
California	10,144	306	96	646	2,004	450	2,650	6,152	16,295	
Colorado	666	3	10	-	-	14	1,238	1,265	1,931	
Connecticut	122	166	-	-	-	-	-	166	287	
Delaware	-	7	-	-	-	-	-	7	7	
District of Columbia	-	-	-	-	-	-	-	-	-	
Florida	55	492	171	351	-	25	-	1,038	1,093	
Georgia	2,046	15	-	587	-	-	-	602	2,648	
Hawaii	24	60	162	-	31	1	64	318	341	
Idaho	2,682	-	5	68	7	-	146	227	2,909	
Illinois	34	139	-	-	-	9	1,596	1,744	1,777	
Indiana	60	45	-	-	-	-	1,037	1,081	1,141	
Iowa	144	11	3	-	-	-	3,352	3,367	3,511	
Kansas	3	-	-	-	-	-	1,011	1,011	1,014	
Kentucky	824	17	-	52	-	-	-	69	893	
Louisiana	192	-	14	373	-	-	-	387	579	
Maine	738	57	36	606	-	-	170	868	1,606	
Maryland	590	135	-	3	-	-	-	137	727	
Massachusetts	261	264	9	26	-	5	-	304	564	
Michigan	251	168	-	230	-	-	143	541	792	
Minnesota	194	132	75	177	-	-	1,615	1,999	2,192	
Mississippi	-	-	-	229	-	-	-	229	229	
Missouri	564	8	-	-	-	-	309	316	880	
Montana	2,692	-	-	17	-	-	369	386	3,078	
Nebraska	278	6	5	-	-	-	105	115	393	
Nevada	1,051	-	-	-	306	89	-	395	1,446	
New Hampshire	498	29	-	140	-	-	24	193	691	
New Jersey	6	175	20	-	-	13	8	215	221	
New Mexico	82	-	6	-	-	-	597	604	686	
New York	4,310	344	-	86	-	-	1,274	1,704	6,013	
North Carolina	1,952	20	-	318	-	3	-	342	2,294	
North Dakota	508	-	10	-	-	-	1,202	1,212	1,720	
Ohio	101	41	1	65	-	-	7	115	216	
Oklahoma	854	16	-	58	-	-	1,130	1,203	2,057	
Oregon	8,430	26	3	241	-	-	1,659	1,929	10,359	
Pennsylvania	747	419	-	108	-	2	696	1,224	1,971	
Rhode Island	3	24	-	-	-	-	-	24	26	
South Carolina	1,337	23	-	220	-	-	-	244	1,580	

See footnotes at end of table.

Table 1.26 Total renewable net summer capacity by energy source and State, 2009 (cont.)

(megawatts)

State	NonHydroelectric									
	Hydroelectric Conventional	Biomass			Geothermal	Solar			Total	Total
		Waste		Wood and Derived Fuels ³		Thermal/ PV	Wind			
		Landfill Gas/MSW ¹	Other Biomass ²							
South Dakota	1,594	-	-	-	-	-	320	320	1,914	
Tennessee	2,614	8	2	165	-	-	29	203	2,817	
Texas	689	79	28	180	-	-	9,378	9,665	10,354	
Utah	256	9	-	-	34	-	222	265	521	
Vermont	322	3	-	76	-	-	5	84	406	
Virginia	716	278	-	409	-	-	-	687	1,403	
Washington	21,088	41	-	369	-	1	2,006	2,416	23,504	
West Virginia	264	-	-	-	-	-	330	330	594	
Wisconsin	492	72	11	208	-	-	430	720	1,212	
Wyoming	304	-	-	-	-	-	1,104	1,104	1,408	
U.S. Total	78,518	3,645	671	6,939	2,382	619	34,296	48,552	127,070	

¹Total capacity whose primary energy source is landfill gas or MSW.

²Agriculture byproducts/crops, sludge waste, and other biomass solids, liquids and gases.

³Black liquor, and wood/wood waste solids and liquids.

MSW = Municipal Solid Waste.

PV = Photovoltaic.

s = Less than 500 kilowatts.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-860, "Annual Electric Generator Report."

Table 1.27 Renewable market share of net generation by State, 2008 and 2009

(thousand kilowatthours)

State	2008			2009		
	Total Generation	Percent Renewable	Percent NonHydro Renewable	Total Generation	Percent Renewable	Percent NonHydro Renewable
Alabama	145,869,895	6.5	2.3	143,255,556	10.9	2.1
Alaska	6,774,834	17.4	0.1	6,702,159	20.0	0.2
Arizona	119,459,172	6.2	0.1	111,971,250	5.9	0.2
Arkansas	55,050,528	11.2	2.7	57,457,739	10.1	2.8
California	207,984,263	23.5	11.9	204,776,132	26.1	12.5
Colorado	53,441,594	10.0	6.1	50,565,952	10.1	6.4
Connecticut	30,409,473	4.2	2.4	31,206,222	4.1	2.4
Delaware	7,523,839	2.2	2.2	4,841,563	2.6	2.6
District of Columbia	72,316	-	-	35,499	-	-
Florida	219,636,818	2.1	2.0	217,952,308	2.1	2.0
Georgia	136,173,395	3.6	2.0	128,698,376	4.7	2.2
Hawaii	11,376,385	7.6	6.8	11,010,533	7.4	6.4
Idaho	11,970,553	84.5	6.3	13,100,152	86.3	6.6
Illinois	199,475,178	1.6	1.5	193,864,357	1.9	1.8
Indiana	129,510,294	0.7	0.4	116,670,280	1.9	1.5
Iowa	53,086,786	9.6	8.0	51,860,063	16.5	14.6
Kansas	46,630,321	3.8	3.8	46,677,308	6.2	6.1
Kentucky	97,863,340	2.4	0.5	90,630,427	4.1	0.4
Louisiana	92,453,141	4.1	2.9	90,993,676	4.0	2.6
Maine	17,094,919	49.8	23.7	16,349,849	49.8	24.1
Maryland	47,360,953	5.5	1.3	43,774,832	5.6	1.3
Massachusetts	42,505,478	5.7	3.0	38,966,651	6.2	3.2
Michigan	114,989,806	3.4	2.3	101,202,605	3.9	2.6
Minnesota	54,763,360	12.0	10.7	52,491,849	14.4	12.8
Mississippi	48,205,711	2.9	2.9	48,701,484	2.9	2.9
Missouri	91,028,795	2.5	0.3	88,354,272	2.7	0.7
Montana	29,637,137	36.1	2.4	26,712,735	39.0	3.4
Nebraska	32,373,522	1.9	0.8	34,001,892	2.6	1.3
Nevada	35,089,974	9.4	4.4	37,705,133	11.3	4.8
New Hampshire	22,876,992	12.3	5.1	20,164,122	14.3	5.9
New Jersey	63,674,789	1.5	1.4	61,811,239	1.6	1.6
New Mexico	37,009,837	5.3	4.5	39,674,339	4.7	4.0
New York	140,322,100	21.4	2.4	133,150,550	24.1	3.4
North Carolina	125,239,063	4.0	1.5	118,407,403	6.0	1.6
North Dakota	32,734,579	9.0	5.2	34,196,467	13.1	8.8
Ohio	153,412,251	0.7	0.4	136,090,225	0.9	0.5
Oklahoma	76,328,908	8.3	3.3	75,066,809	8.6	3.9
Oregon	58,718,438	63.4	5.8	56,690,856	65.8	7.5
Pennsylvania	222,350,925	2.4	1.3	219,496,144	2.7	1.5
Rhode Island	7,387,266	2.2	2.1	7,696,824	1.9	1.9
South Carolina	100,978,005	2.9	1.8	100,125,486	4.1	1.7

See footnotes at end of table.

Table 1.27 Renewable market share of net generation by State, 2008 and 2009 (cont.)

(thousand kilowatthours)

State	2008			2009		
	Total Generation	Percent Renewable	Percent NonHydro Renewable	Total Generation	Percent Renewable	Percent NonHydro Renewable
South Dakota	7,082,672	44.3	2.1	8,196,531	59.3	5.2
Tennessee	90,663,312	7.3	1.1	79,716,889	14.0	1.2
Texas	404,787,781	4.6	4.4	397,167,910	5.6	5.3
Utah	46,578,763	2.1	0.6	43,542,946	3.0	1.1
Vermont	6,820,216	28.1	6.2	7,282,348	26.3	5.9
Virginia	72,678,531	5.1	3.7	70,082,066	5.6	3.4
Washington	110,828,451	74.5	4.5	104,470,133	74.6	4.8
West Virginia	91,123,097	1.8	0.4	70,782,514	3.4	1.0
Wisconsin	63,479,555	5.3	2.8	59,959,060	6.2	3.9
Wyoming	46,500,448	3.9	2.1	46,029,212	6.9	4.8
U.S. Total	4,119,387,760	9.2	3.1	3,950,330,926	10.6	3.7

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report."

Table 1.28 Renewable portfolio standards and State mandates by State, 2009

State	RPS or Mandate
Alabama	-
Alaska	-
Arizona	X
Arkansas	-
California	X
Colorado	X
Connecticut	X
Delaware	X
District of Columbia	X
Florida ¹	X
Georgia	-
Hawaii	X
Idaho	-
Illinois	X
Indiana	-
Iowa	X
Kansas	X
Kentucky	-
Louisiana	-
Maine	X
Maryland	X
Massachusetts	X
Michigan	X
Minnesota	X
Mississippi	-
Missouri	X
Montana	X
Nebraska	-
Nevada	X
New Hampshire	X
New Jersey	X
New Mexico	X
New York	X
North Carolina	X
North Dakota	X
Ohio	X
Oklahoma	X
Oregon	X
Pennsylvania	X
Rhode Island	X
South Carolina	-
South Dakota	X
Tennessee	-
Texas	X
Utah	X
Vermont	X
Virginia	X
Washington	X
West Virginia	X
Wisconsin	X
Wyoming	-

¹In Florida the RPS is not state wide.

- = No RPS or state mandate for that state.

Note: In some states, including Oklahoma, North Dakota, South Dakota, Utah, Vermont, and Virginia, the renewable portfolio standard (RPS) is voluntary.

Source: North Carolina Solar Center, Database of State Incentives for Renewable Energy (DSIRE) website: <http://www.dsireusa.org> (January 4, 2011).

Table 1.A1 Other non-renewable energy consumption by energy-use sector and energy source, 2005 – 2009

(quadrillion Btu)

Sector and Source	2005	2006	2007	2008	2009
Total	0.259	0.259	0.276	0.248	0.262
Commercial	0.020	0.021	0.017	0.021	0.022
MSW Non-Biogenic ¹	0.020	0.020	0.017	0.021	0.022
Other Non-Biogenic ²	*	*	0.001	*	*
Industrial	0.116	0.114	0.135	0.096	0.116
MSW Non-Biogenic ¹	0.005	0.005	0.004	0.002	0.003
Other Non-Biogenic ²	0.110	0.109	0.130	0.094	0.113
Electric Power ³	0.123	0.125	0.124	0.131	0.124
MSW Non-Biogenic ¹	0.107	0.109	0.108	0.110	0.108
Other Non-Biogenic ²	0.016	0.015	0.016	0.020	0.016

¹Includes glass, steel, aluminum, other nonferrous metals, plastic, rubber, other materials, and miscellaneous inorganic wastes.

²Tires and other (nonspecified).

³The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

MSW = Municipal Solid Waste.

* = Less than 500 billion Btu.

Note: Details of EIA's analysis that revised MSW consumption are found in the U.S. Energy Information Administration (EIA) report, *Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy* (Washington, DC, May 2007). After 200

Source: Analysis conducted by the U.S. Energy Information Administration (EIA), Office of Electricity, Coal, Nuclear, and Renewables Analysis, and specific sources: Form EIA-923, "Power Plant Operations Report," and predecessor forms: Form EIA-906, "Power

Table 1.A2 Other non-renewable net electricity generation by energy-use sector and energy source, 2005 – 2009

(thousand kilowatthours)

Sector and Source	2005	2006	2007	2008	2009
Total	12,821,059	12,974,399	12,231,131	11,803,665	11,928,334
Commercial	755,987	758,464	764,083	719,532	841,850
MSW Non-Biogenic ¹	748,861	751,077	756,260	715,716	820,737
Other Non-Biogenic ²	7,126	7,388	7,823	3,815	21,113
Industrial	5,136,905	5,103,173	4,690,087	4,124,817	4,457,306
MSW Non-Biogenic ¹	27,059	27,138	31,258	-	-
Other Non-Biogenic ²	5,109,845	5,076,035	4,658,829	4,124,817	4,457,306
Electric Power ³	6,928,167	7,112,762	6,776,960	6,959,316	6,629,179
MSW Non-Biogenic ¹	5,769,465	5,882,743	5,736,991	5,646,076	5,510,271
Other Non-Biogenic ²	1,158,702	1,230,019	1,039,970	1,313,240	1,118,908

¹Includes glass, steel, aluminum, other nonferrous metals, plastic, rubber, other materials, and miscellaneous inorganic wastes.

²Tires and other (nonspecified).

³The electric power sector comprises electricity-only and combined-heat-power (CHP) plants within North American Classification System (NAICS) 22 category whose primary business is to sell electricity, or electricity and heat, to the public.

MSW = Municipal Solid Waste.

- = No data reported.

Notes: Totals may not equal sum of components due to independent rounding.

Details of EIA's analysis that revised MSW consumption are found in the U.S. Energy Information Administration (EIA) report, *Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy* (Washington, DC, May 2007).

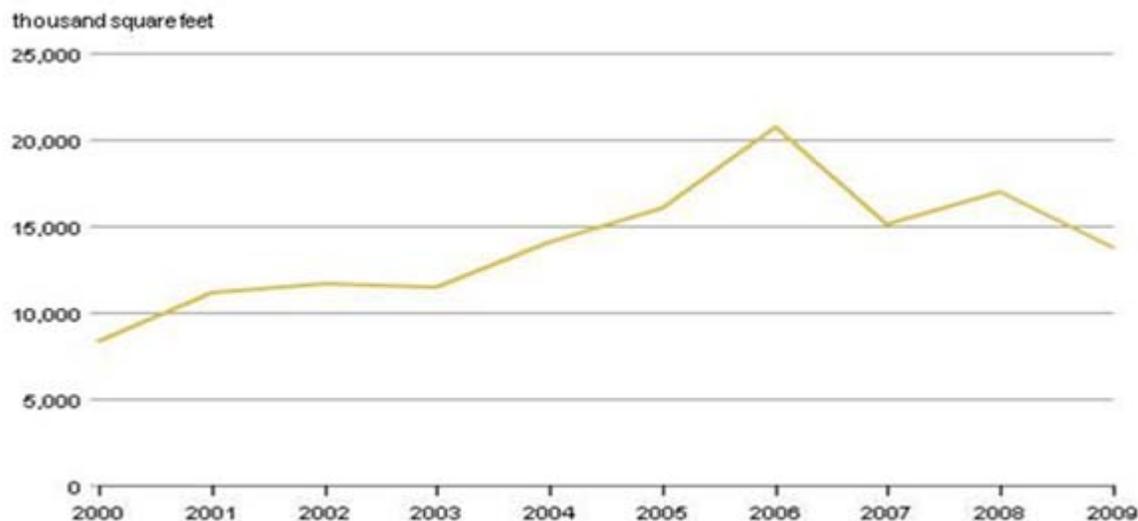
Source: U.S. Energy Information Administration, Form EIA-923, "Power Plant Operations Report," and predecessor forms: Form EIA-906, "Power Plant Report," and Form EIA-920, "Combined Heat and Power Plant Report."

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2. Solar thermal collector manufacturing activities 2009

Total shipments²⁶ of solar thermal collectors decreased dramatically falling from 17.0 million square feet in 2008 to 13.8 million square feet in 2009, a decline of almost a percent. Total shipments in 2009 were down 33 percent from the 2006 record level of 20.7 million square feet (Figure 2.1 and Table 2.1).

Figure 2.1 Total solar thermal collector shipments, 2000-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-63A. "Annual Solar Thermal Collector Manufacturers Survey."

Background

Solar thermal collectors are classified as low-, medium-, and high-temperature collectors:

- Low-temperature collectors provide low-grade heat (less than 110 degrees Fahrenheit), through either metallic or nonmetallic absorbers, and are used in such applications as swimming pool heating and low-grade water and space heating.
- Medium-temperature collectors provide medium-grade heat (greater than 110 degrees Fahrenheit, usually 140 degrees to 180 degrees Fahrenheit), either through glazed flat-plate collectors using air or liquid as the heat transfer instrument, or concentrator collectors that concentrate the heat of incident insolation to greater than "one sun,"²⁷ and are mainly used for domestic hot water heating. Evacuated-tube collectors are also included in this category.
- High-temperature collectors are parabolic dish or trough collectors designed to operate at a temperature of 180 degrees Fahrenheit or higher, and are primarily used by utilities and independent power producers to generate electricity for the grid.

²⁶ Total shipments as reported by respondents include all domestic and export shipments and may include imported collectors that subsequently were shipped to domestic or foreign customers.

²⁷ One sun: Natural solar insolation falling on an object without concentration or diffusion of the solar rays.

The solar thermal collector performance rating is an analytically-derived set of numbers representing the characteristic all-day energy output of the solar thermal collector under standard rating conditions, measured in Btu per square foot per day (Btu/ft²/day). In 2009, the average solar thermal performance rating for low-temperature collectors (metallic and nonmetallic) was 1,239 Btu/ft²/day, medium-temperature (air) was 971 Btu/ft²/day, medium-temperature (integral collector storage/thermosiphon) was 913 Btu/ft²/day, medium-temperature (flat-plate) was 981 Btu/ft²/day, medium-temperature (evacuated-tube) was 973 Btu/ft²/day, medium-temperature (concentrator) was 2,196 Btu/ft²/day, and high-temperature (parabolic dish/trough) was 1,262 Btu/ft²/day (Table 2.14).

Industry status

In 2009, there were 88 manufacturers and/or importers active in manufacturing, importing, and/or exporting solar thermal collectors, an 18.9-percent increase from the 74 companies operating in 2008. These companies shipped 13.8 million square feet of solar thermal collectors in 2009, compared to 17.0 million square feet in 2008 (Figure 2.1 and Table 2.1).

Of the 88 companies reporting solar thermal collector shipments in 2009, many manufacturers also reported being involved in one or more of the following solar thermal-related activities (Table 2.19):

- 59 designed collectors or systems.
- 27 developed prototype collectors.
- 23 developed prototype systems.
- 61 were involved in wholesale distribution.
- 31 were involved in retail distribution.
- 27 installed collectors.

In addition, several manufacturers are planning to introduce new solar thermal-related products in the 2010 (Table 2.16):

- 4 plan to introduce new low-temperature collectors.
- 16 plan to introduce new medium-temperature collectors.
- 11 plan to introduce new high-temperature collectors.

In 2009, employment in solar-thermal-related activities totaled 1,321 person-years,²⁸ a nearly 22 percent increase from the 2008 level (Table 2.18). The average employment per company was 15 person-years, compared with 14.6 person-years in 2008.

Fifty-six companies had 90 percent or more of their total company-wide sales revenue in solar thermal-related products, 7 companies had 50 to 89 percent, 12 companies had 10 to 49 percent, and 13 companies had less than 10 percent (Table 2.20).

²⁸ Person-year: One whole year, or fraction thereof, worked by an employee, including contracted manpower.

In 2009, the solar thermal industry remained highly concentrated, with the 5 largest companies accounting for 79 percent of total shipments. This concentration, however, was the lowest recorded in the past 10 years (Table 2.17). The decrease is likely due to the new start-up companies that have entered the market over the last three years.

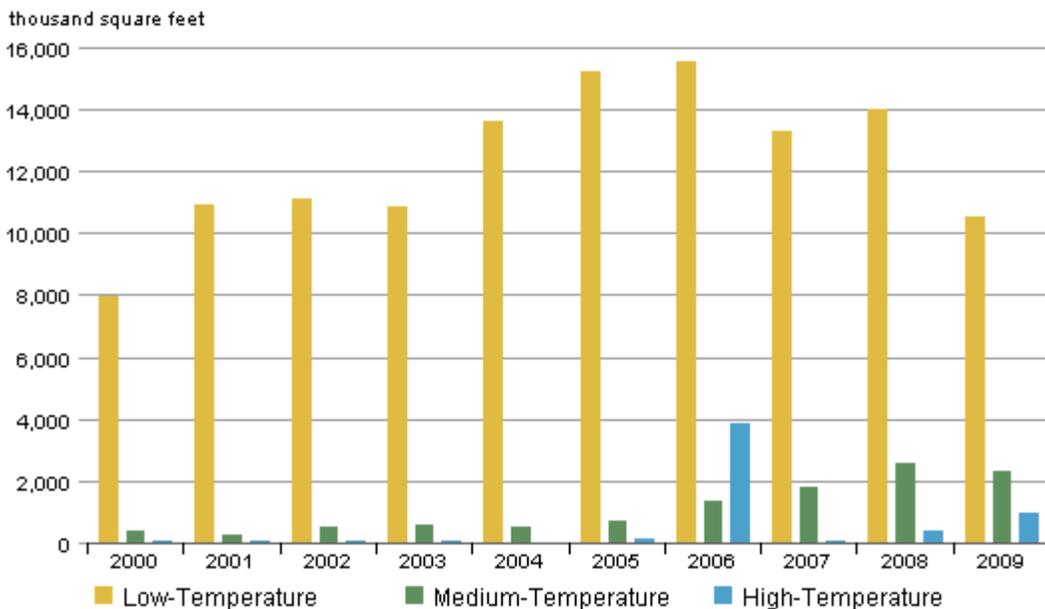
Solar thermal collector shipments

In 2009, low-temperature collector shipments totaled 10.5 million square feet, about 3.5 million square feet less than the shipments in 2008 (Figure 2.2 and Table 2.3). Nearly 94 percent of low-temperature collectors are used in the residential sector, primarily for pool heating (Table 2.13). However, shipments to the pool heating market fell by more than 25 percent in 2009 compared with shipments in 2008, due partly to declines in U.S. home sales and prices, and the economic downturn.

Shipments of medium-temperature collectors totaled 2.3 million square feet in 2009, nearly 10 percent less than the shipments of approximately 2.6 million square feet in 2008 (Figure 2.2 and Table 2.3). The decrease in shipments is believed to be mainly due to the economic recession. Approximately 87 percent of medium-temperature collectors are used for hot water heating (Table 2.13).

High-temperature collector shipments, primarily for utility-scale concentrating solar power (CSP), totaled 978 thousand square feet and represented more than 8 percent of total shipments in 2009.

Figure 2.2 Solar thermal collector shipments by type, 2000-2009



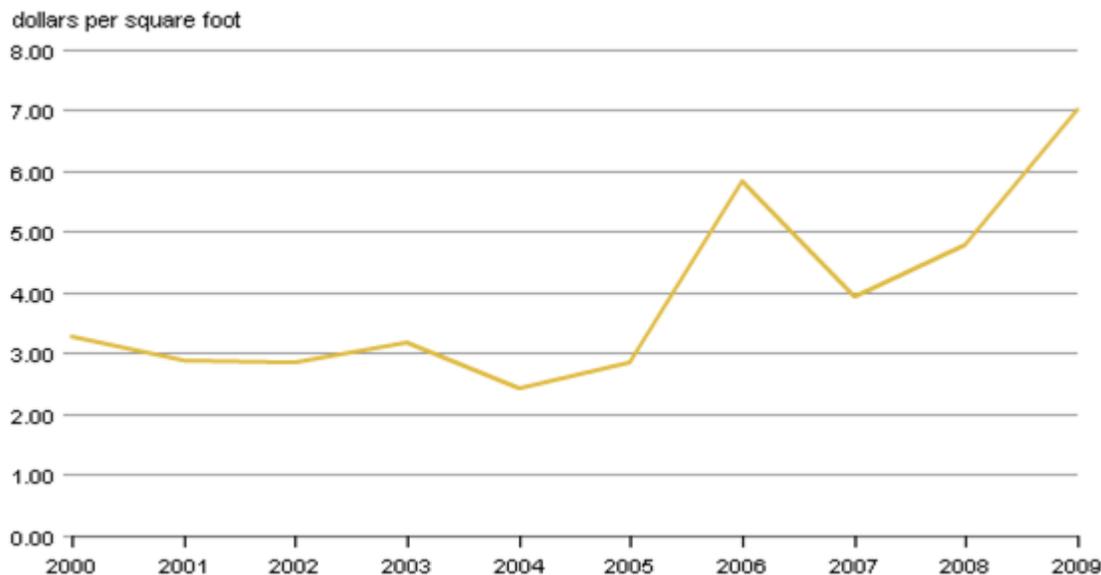
Source: U.S. Energy Information Administration (EIA), Form EIA-63A. "Annual Solar Thermal Collector Manufacturers Survey."

Total revenue and average price

The total revenue²⁹ of solar thermal collector shipments was \$96.7 million in 2009, an increase of nearly 19 percent from \$81.3 million in 2008 (Table 2.12). Revenue of low-temperature collector shipments was \$20.4 million, a 23-percent decrease compared with the revenue of \$26.5 million in 2008. Revenue of medium-temperature collector shipments was \$51.5 million, about a 3-percent increase compared with the revenue of \$50.1 million in 2008. Revenue of high-temperature collector shipments was \$24.8 million, an increase of about 435 percent compared with the revenue of \$4.6 million in 2008.

The average price for low-temperature collectors was \$1.94 per square foot in 2009, a nearly 3-percent increase from \$1.89 per square foot in 2008. The average price for medium-temperature collectors increased 14 percent from \$19.57 per square foot in 2008 to \$22.32 per square foot in 2009. The average price for high-temperature collectors increased nearly 112 percent from \$11.96 per square foot in 2008 to \$25.32 per square foot in 2009. Overall the average price for total shipments increased more than 46 percent, from \$4.80 per square foot in 2008 to \$7.01 per square foot in 2009 (Figure 2.3 and Table 2.12). The fluctuation in average price was heavily influenced by custom-made collectors, which includes most high-temperature and some medium-temperature collectors. These collectors are designed for limited, specialized applications, and their average prices are much higher than the conventional collectors.

Figure 2.3 Solar thermal collector average price, 2000-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-63A. "Annual Solar Thermal Collector Manufacturers Survey."

Domestic shipments

Domestic shipments of solar thermal collectors decreased almost 17 percent from a year ago to 12.2 million square feet during 2009. Compared to the 2006 record level, the 2009 level was more than 37 percent lower (Table 2.2).

²⁹ Total revenue as reported by respondents includes revenue from domestic and export shipments and may include imported collectors that subsequently were shipped to domestic or foreign customers.

The residential sector is the largest domestic market in the United States for solar thermal collectors. Solar thermal collectors shipped to the residential sector in 2009 totaled 10.2 million square feet, approximately 84 percent of total domestic shipments (Table 2.13). This market sector primarily involves the use of low-temperature solar collectors for pool heating and medium-temperature solar collectors for water heating. The second largest domestic market for solar thermal collectors in 2009 was the commercial sector, which accounted for nearly 8 percent of total domestic shipments.

The largest end use for solar thermal collectors shipped in 2009 was for swimming pool heating. Pool heating accounted for 73 percent of the total domestic shipments. The second largest end use in 2009 was for domestic hot water heating, which accounted for more than 16 percent of the total domestic shipments (Table 2.13).

More than 33 percent of the total domestic shipments in 2009 went to the wholesale market, nearly 47 percent to retail distribution, almost 3 percent to exporters, less than 8 percent to installers, and more than 9 percent directly to end users (Table 2.11).

Complete systems

Of the 88 active companies in 2009, 62 companies accounted for shipments of 75,066 complete solar thermal systems. These systems accounted for nearly 6 million square feet, or more than 43 percent, of the total solar thermal collectors shipped in 2009. The revenue from these solar thermal system shipments was reported as approximately \$159 million (Table 2.15).

Origin of shipments

Imports of solar thermal collectors totaled almost 3.5 million square feet in 2009 (Table 2.7). More than 57 percent of all imports were low-temperature collectors (nearly 2 million square feet). These imports originated in thirteen foreign countries, and about 61 percent (2.1 million square feet) of the solar thermal collectors were imported from Israel (Table 2.8).

In 2009, 73 percent (10 million square feet) of all solar thermal collectors were manufactured in five states (in order of descending volume): California, New Jersey, Florida, Arizona, and Virginia, with 61 percent (8.4 million square feet) of the total shipped from California and New Jersey (Table 2.4).

Destination of shipments

Export shipments totaled roughly 1.6 million square feet in 2009. About 1.5 million square feet, or more than 98 percent of total exports, were low-temperature solar thermal collectors (Table 2.9). The export market accounted for about 11 percent of total shipments and was dominated by sales to Canada (nearly 32 percent), Mexico (about 25 percent), and France (13 percent) (Table 2.10).

In 2009, almost 12.2 million square feet of domestic solar thermal shipments went to all 50 States, the District of Columbia, the Virgin Islands, Guam, and Puerto Rico (Table 2.6). Nearly two-thirds were shipped to the top five destinations (states): Florida, California, Arizona, Hawaii, and Oregon. California and Florida received 53 percent of total shipments (Table 2.4 and Table 2.6).

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Table 2.1 Annual shipments of solar thermal collectors by source, 2000 - 2009

Year	Number of Companies	Collector Shipments (thousand square feet)		
		Imports	Domestically Manufactured	Total
2000	26	2,201	6,153	8,354
2001	26	3,502	7,688	11,189
2002	27	3,068	8,595	11,663
2003	26	2,986	8,457	11,444
2004	24	3,723	10,392	14,114
2005	25	4,546	11,495	16,041
2006	44	4,244	16,500	20,744
2007	60	3,891	11,262	15,153
2008	74	5,517	11,446	16,963
2009	88	3,456	10,342	13,798

Notes: Totals may not equal sum of components due to independent rounding.

Domestically manufactured shipments include those made in U.S. Territories.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.2 Annual shipments of solar thermal collectors by disposition, 2000 - 2009

(thousand square feet)

Year	Number of Companies	Collector Shipments (thousand square feet)		
		Exports	Domestic Shipments	Total
2000	26	496	7,857	8,354
2001	26	840	10,349	11,189
2002	27	659	11,004	11,663
2003	26	518	10,926	11,444
2004	24	813	13,301	14,114
2005	25	1,361	14,680	16,041
2006	44	1,211	19,532	20,744
2007	60	1,376	13,777	15,153
2008	74	2,247	14,716	16,963
2009	88	1,577	12,221	13,798

Notes: Totals may not equal sum of components due to independent rounding.

Domestic shipments include those shipped to U.S. Territories.

Total shipments as reported by respondents include all domestic and export shipments and may include imported collectors that subsequently were shipped to domestic or foreign customers.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.3 Annual shipments of solar thermal collectors by type, 2000 – 2009

(thousand square feet)

Year	Low-Temperature		Medium-Temperature		High-Temperature
	Total Shipments	Average per Manufacturer	Total Shipments	Average per Manufacturer	Total Shipments ¹
2000	7,948	723	400	25	5
2001	10,919	1,092	268	16	2
2002	11,126	856	535	31	2
2003	10,877	906	560	33	7
2004	13,608	1,512	506	30	-
2005	15,224	1,522	702	41	115
2006	15,546	1,413	1,346	38	3,852
2007	13,323	1,025	1,797	35	33
2008	14,015	1,274	2,560	41	388
2009	10,511	809	2,307	32	980

¹For high-temperature average annual shipments per manufacturer are not disclosed.

- = No data reported.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.4 Shipments of solar thermal collectors ranked by origin and destination, 2009

Origin/Destination	2009 Shipments	
	Thousand Square Feet	Percent of U.S.Total
Origin		
Top Five States	10,031	73
California	4,402	32
New Jersey	4,019	29
Florida	1,299	9
Arizona	164	1
Virginia	148	1
Other Domestic	311	2
Imported	3,456	25
U.S. Total	13,798	100
Destination		
Top Five States	8,961	65
Florida	3,771	27
California	3,537	26
Arizona	745	5
Haw aii	520	4
Oregon	387	3
Other Domestic	3,260	24
Exported	1,577	11
U.S. Total	13,798	100

Notes: Totals may not equal sum of components due to independent rounding.

U.S. total includes territories.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.5 Shipments of solar thermal collectors ranked by origin and destination, 2008

Origin/Destination	2008 Shipments	
	thousand square feet	Percent of U.S.Total
Origin		
Top Five States	10,933	64
California	4,933	29
New Jersey	4,211	25
Florida	1,271	7
Nevada	289	2
Puerto Rico	230	1
Other Domestic	512	3
Imported	5,517	33
U.S. Total	16,963	100
Destination		
Top Five States	11,093	65
Florida	5,175	31
California	3,746	22
Arizona	939	6
Haw aii	780	5
Oregon	452	3
Other Domestic	3,623	21
Exported	2,247	13
U.S. Total	16,963	100

Notes: Totals may not equal sum of components due to independent rounding.

U.S. total includes territories.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.6 Shipments of solar thermal collectors by destination, 2008 and 2009

(square feet)

Destination	2008	2009
Alabama	8,905	2,938
Alaska	6,529	2,878
Arizona	939,228	745,462
Arkansas	2,512	18,655
California	3,746,327	3,537,009
Colorado	88,680	75,985
Connecticut	230,978	197,196
Delaware	26,482	42,207
District of Columbia	80	1,675
Florida	5,174,765	3,771,020
Georgia	64,518	105,060
Guam	512	362
Hawaii	780,394	520,103
Idaho	10,460	5,854
Illinois	397,234	317,495
Indiana	16,099	98,391
Iowa	7,656	46,121
Kansas	8,553	4,562
Kentucky	28,588	43,849
Louisiana	12,189	9,145
Maine	60,451	35,638
Maryland	27,773	67,250
Massachusetts	108,554	112,073
Michigan	48,915	126,913
Minnesota	137,897	38,655
Mississippi	4,759	1,121
Missouri	6,053	3,758
Montana	8,452	10,541
Nebraska	6,772	2,627
Nevada	233,456	180,192
New Hampshire	29,232	16,694
New Jersey	230,584	185,862
New Mexico	54,751	61,991
New York	411,268	301,014
North Carolina	136,015	118,354
North Dakota	1,242	2,380
Ohio	85,475	191,420
Oklahoma	7,869	5,173
Oregon	452,032	387,217
Pennsylvania	232,063	220,479
Puerto Rico	276,346	101,210
Rhode Island	23,106	11,700
South Carolina	18,913	9,693
South Dakota	1,282	2,426
Tennessee	7,278	3,864
Texas	90,077	176,752
Utah	17,039	37,221
Vermont	66,685	36,984
Virgin Islands of the U.S.	8,745	4,540
Virginia	213,860	108,345
Washington	26,304	29,755
West Virginia	11,786	1,269
Wisconsin	119,242	80,640
Wyoming	716	994
Shipments to United States/Territories	14,715,681	12,220,712
Exported	2,247,116	1,577,061
Total Shipments	16,962,797	13,797,773

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.7 Import shipments of solar thermal collectors by type, 2000 – 2009

(thousand square feet)

Year	Type			Total
	Low-Temperature	Medium-Temperature	High-Temperature	
2000	2,188	10	2	2,201
2001	3,500	2	-	3,502
2002	3,066	2	-	3,068
2003	2,984	2	-	2,986
2004	3,702	21	-	3,723
2005	4,513	33	-	4,546
2006	3,979	265	-	4,244
2007	3,501	390	-	3,891
2008	4,831	687	-	5,517
2009	1,987	715	754	3,456

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."**Table 2.8 Import shipments of solar thermal collectors by country, 2008 and 2009**

(square feet)

Region/Country	2008	2009	Percent of U.S. Imports 2009
Asia			
China	318,123	591,459	17.11
Israel	4,904,128	2,110,847	61.08
Total	5,222,251	2,702,306	78.20
Australia and Oceania			
Australia	44,814	25,620	0.74
Total	44,814	25,620	0.74
Europe			
Austria	5,132	12,500	0.36
France	32,180	42,849	1.24
Germany	91,670	553,946	16.03
Hungary	-	25,300	0.73
Ireland	-	1,593	0.05
Italy	-	2,700	0.08
Portugal	729	12,000	0.35
Turkey	36,882	25,361	0.73
United Kingdom	33,286	35,599	1.03
Total	199,879	711,848	20.60
North America			
Canada	50,347	16,072	0.47
Total	50,347	16,072	0.47
U.S. Total	5,517,291	3,455,846	100.00

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.9 Export shipments of solar thermal collectors by type, 2000 – 2009

(thousand square feet)

Year	Type			Total
	Low-Temperature	Medium-Temperature	High-Temperature	
2000	486	10	s	496
2001	827	13	-	840
2002	654	3	2	659
2003	510	5	2	518
2004	809	4	-	813
2005	1,349	10	2	1,361
2006	1,169	42	-	1,211
2007	1,338	33	5	1,376
2008	2,115	128	4	2,247
2009	1,552	23	2	1,577

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.10 Export shipments of solar thermal collectors by country, 2008 and 2009

(square feet)

Region/Country	2008	2009	Percent of U.S. Exports 2009
Africa			
Egypt	-	1,771	0.11
Morocco	4,755	3,916	0.25
Nigeria	333	-	-
Total	5,088	5,687	0.36
Asia			
Indonesia	-	4,041	0.26
Israel	5,756	-	-
Japan	-	240	0.02
Jordan	-	13,200	0.84
Korea, South	-	336	0.02
Saudi Arabia	51,951	-	-
Taiwan	-	48	*
United Arab Emirates	4,412	-	-
Vietnam	2,640	1,980	0.13
Total	64,759	19,845	1.26
Australia and Oceania			
Australia	81,980	106,459	6.75
New Zealand	11,915	14,106	0.89
Total	93,895	120,565	7.64
Central America			
Antigua and Barbuda	224	2,890	0.18
Aruba	32	-	-
Bahamas	648	1,713	0.11
Belize	170	-	-
Bermuda	787	72	*
British Virgin Islands	8,228	117	*
Cayman Islands	3,496	2,654	0.17
Costa Rica	17,394	12,340	0.78
Dominican Republic	-	44	*
El Salvador	-	1,200	0.08
Guatemala	9,625	6,550	0.42
Honduras	3,233	-	-
Jamaica	5,742	3,684	0.23
Mexico	459,181	387,653	24.58
Netherlands Antilles	1,477	736	0.05
Nicaragua	-	192	0.01
Panama	128	-	-
Trinidad and Tobago	10,819	74	*
Total	521,184	419,919	26.63

See footnotes at end of table.

Table 2.10 Export shipments of solar thermal collectors by country, 2008 and 2009 (cont.)

(square feet)

Region/Country	2008	2009	Percent of U.S. Exports 2009
Europe			
Austria	-	17,080	1.08
Belgium	11,270	-	-
Cyprus	240	264	0.02
Czech Republic	23,379	15,664	0.99
France	150,509	206,348	13.08
Germany, Federal Republic of	71,254	99,352	6.30
Hungary	-	72	*
Ireland	-	48	*
Italy	-	14,846	0.94
Malta	1,344	-	-
Portugal	240	-	-
Romania	8,157	11,924	0.76
Russia	900	676	0.04
Spain	73,283	81,506	5.17
Sweden	22,230	-	-
Switzerland	6,065	7,964	0.50
Ukraine	40	-	-
United Kingdom	485	1,443	0.09
Total	369,396	457,187	28.99
North America			
Canada	804,969	499,278	31.66
Total	804,969	499,278	31.66
South America			
Argentina	5,616	12,871	0.82
Bolivia	19,032	17,458	1.11
Brazil	331,518	-	-
Chile	11,249	12,779	0.81
Colombia	3,596	874	0.06
Ecuador	1,478	10,598	0.67
Peru	15,336	-	-
Total	387,825	54,580	3.46
U.S. Total	2,247,116	1,577,061	100.00

* = Less than 0.01 percent.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.11 Distribution of domestic solar thermal collector shipments by customer type, 2008 and 2009

(thousand square feet)

Customer Type	Shipments	
	2008	2009
Wholesale Distributors	8,680	4,063
Retail Distributors	3,997	5,739
Exporters	368	346
Installers	948	939
End Users	723	1,134
U.S. Total	14,716	12,221

Notes: Totals may not equal sum of components due to independent rounding.

U.S. total includes territories.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."**Table 2.12 Solar thermal collector shipments by type, quantity, revenue, and average price, 2008 and 2009**

Type	2008			2009		
	Quantity (thousand square feet)	Revenue (thousand dollars)	Average Price (dollars per square foot)	Quantity (thousand square feet)	Revenue (thousand dollars)	Average Price (dollars per square foot)
Low-Temperature						
Liquid and Air	14,015	26,518	1.89	10,511	20,411	1.94
Medium-Temperature	2,560	50,109	19.57	2,307	51,483	22.32
Air	28	1,256	45.46	22	883	40.31
Liquid						
ICS/Thermosiphon	321	6,631	20.66	147	4,830	32.80
Flat Plate	1,842	32,043	17.40	1,783	34,642	19.43
Evacuated Tube	351	9,009	25.69	328	8,481	25.88
Concentrator	19	1,170	62.20	27	2,646	99.10
High-Temperature						
Parabolic Dish/Trough	388	4,640	11.96	980	24,814	25.32
U.S. Total	16,963	81,348	4.80	13,798	96,708	7.01

Notes: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.13 Domestic shipments of solar thermal collectors by market sector, end use, and type, 2008 and 2009

(thousand square feet)

Market Sector/End Use	Type							2009 Total	2008 Total
	Low-Temperature		Medium-Temperature				High-Temperature		
	Liquid/Air Metallic and Nonmetallic	Air	Liquid			Parabolic Dish/Trough			
			ICS/Thermos iphon	Flat-Plate (Pumped)	Evacuated Tube		Concentrator		
Market Sector									
Residential	8,423	17	134	1,466	199	-	-	10,239	13,000
Commercial	526	4	7	278	123	26	10	974	1,294
Industrial	11	-	-	27	1	-	594	634	128
Electric Power	-	-	-	-	-	-	374	374	294
Transportation	-	-	-	-	-	-	-	-	-
U.S. Total	8,959	21	141	1,771	324	26	978	12,221	14,716
End Use									
Pool Heating	8,882	-	-	47	5	-	-	8,934	11,973
Hot Water	7	5	141	1,553	286	-	-	1,992	1,978
Space Heating	61	14	-	70	5	-	-	150	186
Space Cooling	-	s	-	-	-	-	10	10	18
Combined Space and Water Heating	9	2	-	100	27	-	-	137	148
Process Heating	-	-	-	2	s	11	594	608	50
Electricity Generation	-	-	-	-	-	15	374	389	361
U.S. Total	8,959	21	141	1,771	324	26	978	12,221	14,716

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.14 Average thermal performance rating of solar thermal collectors by type shipped in 2009

(Btu per square foot per day)

Year	Type						
	Low-Temperature	Medium-Temperature				High Temperature	
	Liquid/air	Liquid			Concentrator	Parabolic Dish/Trough	
	Metallic and Nonmetallic	Air	ICS/Thermo siphon	Flat-Plate (Pumped)			Evacuated Tube
2009	1,139	971	913	981	973	2,196	1,262

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.15 Shipments of complete solar thermal collector systems, 2008 and 2009

Shipment Information	2008	2009
Complete Collector Systems		
Shipped	63,961	75,066
Thousand Square Feet	4,058	5,995
Percent of Total Shipments	24	43
Number of Companies	46	62
Revenue of Systems (Thousand Dollars)	47,523	159,085

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.16 Number of companies expecting to introduce new solar thermal collector products in 2010

New Product Type	Number of Companies
Low-Temperature Collectors	4
Medium-Temperature Collectors	16
High-Temperature Collectors	11
Noncollector Components	12

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.17 Percent of solar thermal collector shipments by the 10 largest companies, 2000 – 2009

Year	Company Rank	Shipments (Thousand Square Feet)	Percent of Total Shipments
2000	1-5	7,521	90
	6-10	567	7
2001	1-5	10,732	96
	6-10	325	3
2002	1-5	10,755	92
	6-10	670	6
2003	1-5	10,485	92
	6-10	700	6
2004	1-5	13,291	94
	6-10	664	5
2005	1-5	14,801	92
	6-10	934	6
2006	1-5	18,535	89
	6-10	1,484	7
2007	1-5	13,015	86
	6-10	1,202	8
2008	1-5	14,023	83
	6-10	1,453	9
2009	1-5	10,868	79
	6-10	1,538	11

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.18 Employment in the solar thermal collector industry, 2000 – 2009

Year	Person-Years
2000	284
2001	256
2002	356
2003	287
2004	317
2005	353
2006	1,069
2007	686
2008	1,083
2009	1,321

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.19 Companies involved in solar thermal collector-related activities by type, 2008 and 2009

Type of Activity	2008	2009
Collector or System Design	45	59
Prototype Collector Development	27	27
Prototype System Development	23	23
Wholesale Distribution	58	61
Retail Distribution	29	31
Installation	21	27
Noncollector System Component Manufacture	26	32

Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 2.20 Solar-related sales as a percentage of total company sales revenue, 2008 and 2009

Percent of Total Sales Revenue	Number of Companies	
	2008	2009
90-100	49	56
50-89	9	7
10-49	7	12
Less than 10	9	13
U.S. Total	74	88

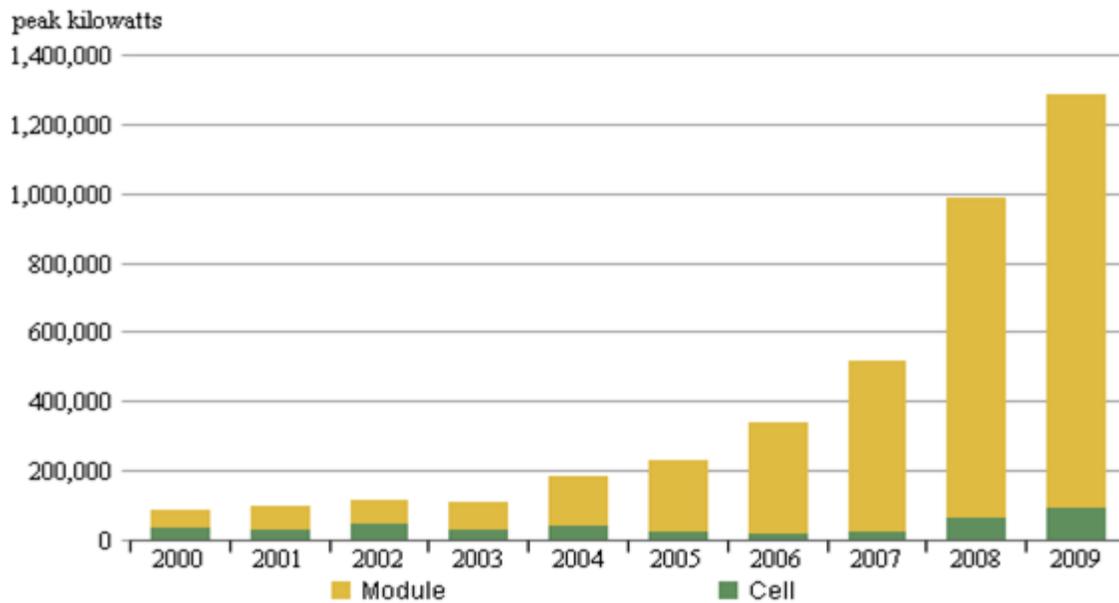
Source: U.S. Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

3. Solar photovoltaic cell/module manufacturing activities 2009

Overview

The U.S. photovoltaic (PV) industry hit a record high in 2009, shipping nearly 1.3 peak gigawatts of cells and modules (Figure 3.1 and Table 3.1). This represents a nearly 30-percent increase from 2008. Government stimulus funding and significant manufacturing cost reductions were believed to be major factors driving 2009 shipments. Although demand for solar cells/modules increased greatly, overall profit margins decreased significantly, compared with 2008.

Figure 3.1 Photovoltaic cell and module shipments, 2000-2009



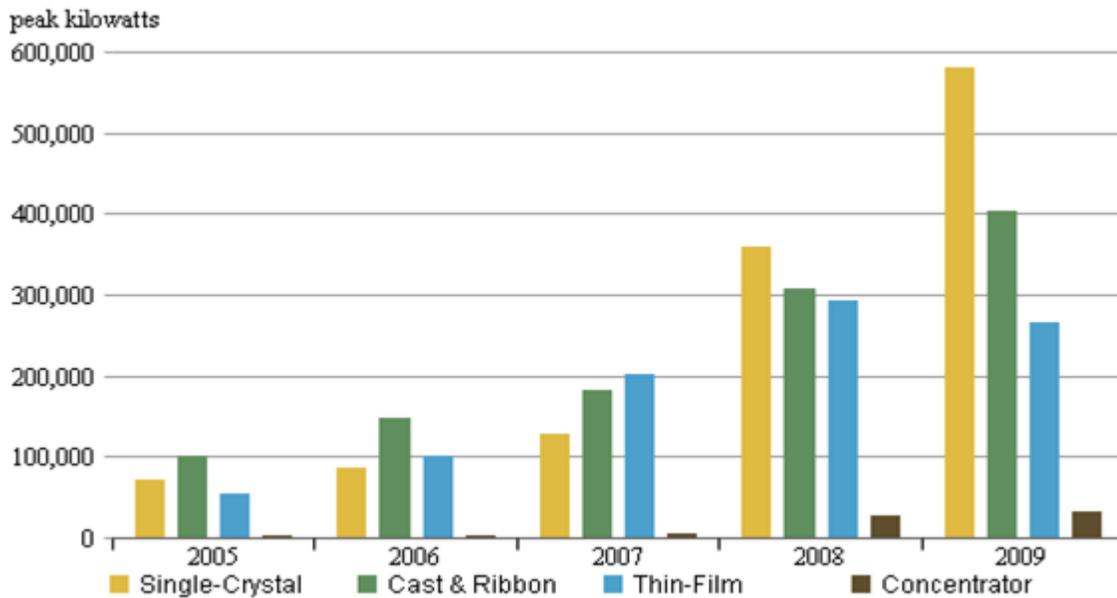
Source: U.S. Energy Information Administration (EIA), Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturing Survey."

Background

PV cells and modules can be made from different semiconductor materials, varying in cost and performance, and are divided into three main categories by product type (Figure 3.2):

- Crystalline silicon, which has two subtypes: (a) photovoltaic cell/module made from a wedge of a single-crystal; (b) polycrystalline silicon, based on crystal-producing processes such as cast and ribbon.
- Thin-film, photovoltaic cell/module made from layers of semiconductor material, such as amorphous silicon (a-Si), cadmium telluride (CdTe), or copper indium gallium selenide (CIGS).
- Concentrator, a type of photovoltaic cell/module including a reflective or refractive device (such as lenses) that gather and concentrate sunlight onto the photovoltaic cell.

Figure 3.2 Photovoltaic cell and module shipments by type, 2005-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

The performance of a photovoltaic cell/module can be described in terms of its energy conversion efficiency, i.e., the percentage of incident solar energy (input) that the cell converts to electricity (output) under standard rating conditions. In 2009, the average energy conversion efficiencies were as follows (Table 3.8):

- Crystalline silicon (single-crystal) PV cell/module was 20 percent.
- Crystalline silicon (cast) PV cell/module was 14 percent.
- Crystalline silicon (ribbon) PV cell/module was 13 percent.
- Thin-film (amorphous silicon) PV cell/module was 8 percent.
- Thin-film other (special photovoltaic material such as CdTe and CIGS) PV cell/module was 12 percent.
- Concentrator PV cell/module was 38 percent.

Industry status

With overall shipments of 1,282,560 peak kilowatts of cells and modules in 2009, the PV industry saw increases in shipments from existing companies as well as new companies entering the PV market. The number of active PV manufacturers and/or importers that ship PV cells and modules increased 53 percent, from 66 companies in 2008 to 101 companies in 2009 (Table 3.1).

Many of the companies reporting PV shipments in 2009 also reported being involved in one or more of the following photovoltaic-related activities (Table 3.18)

- 43 companies were involved in module and/or cell manufacturing.
- 49 designed modules or systems.
- 34 developed prototype modules.
- 26 developed prototype systems.
- 54 were involved in wholesale distribution.
- 23 were involved in retail distribution.
- 42 installed PV systems.

In addition, several manufacturers are planning to introduce new photovoltaic-related technical products in the next calendar year (Table 3.17).

- 22 plan to introduce new single-crystal silicon modules.
- 11 plan to introduce new cast silicon modules.
- 2 plan to introduce new ribbon silicon modules.
- 20 plan to introduce new thin-film modules.
- 3 plan to introduce new concentrator photovoltaic modules.

Corresponding to the strong growth in PV shipments, employment in PV-related activities increased more than 28 percent, from 11,245 person-years³⁰ in 2008 to 14,443 person-years in 2009 (Table 3.16). Of the 101 companies, 70 had 90 percent or more of their total company-wide revenues in PV-related activities, 10 had 50 to 89 percent, 8 had 10 to 49 percent, and 13 had less than 10 percent (Table 3.19).

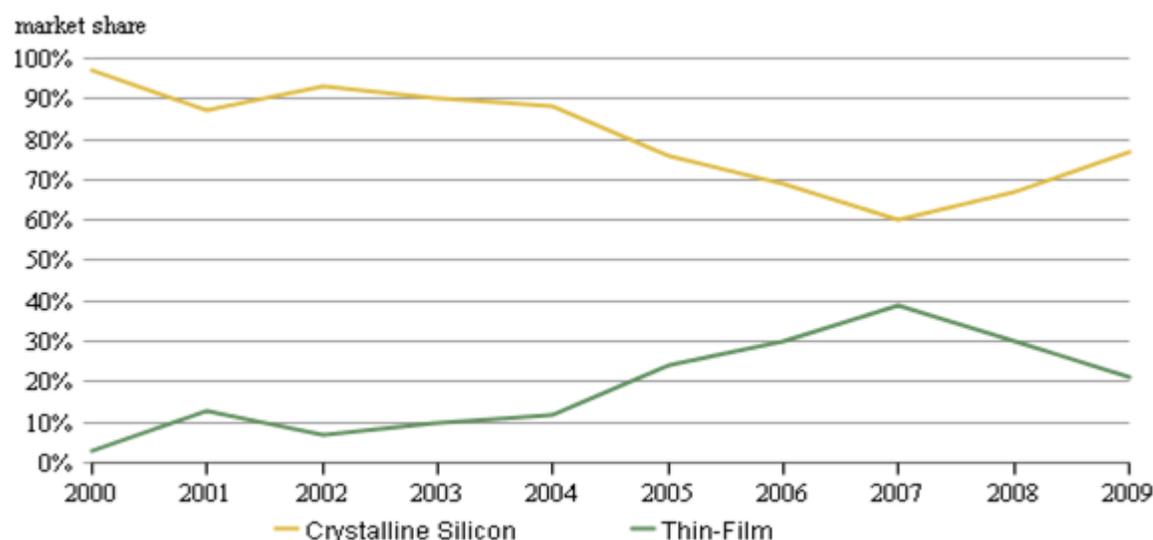
Photovoltaic cell and module shipments

Photovoltaic (PV) cell and module shipments increased for the sixth-consecutive year, reaching a record of 1,282,560 peak kilowatts in 2009. Cell shipments accounted for 93,681 peak kilowatts, while module shipments accounted for 1,188,879 peak kilowatts (Table 3.3).

Crystalline silicon cells and modules continued to dominate the PV industry in 2009, accounting for 77 percent of the total shipments (Figure 3.3 and Table 3.5). From 2000 to 2007, thin-film cells/modules (which do not rely on silicon and are less expensive to manufacture than the crystalline silicon cells/modules) took market share away from the established crystalline silicon cells/modules. Since 2007, crystalline silicon cells/modules have re-gained some of the lost market share from its chief rival, thin-film cells/modules.

³⁰ Person-year: One whole year, or fraction thereof, worked by an employee, including contracted manpower.

Figure 3.3 Crystalline silicon shipment and thin-film shipment market shares, 2000-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

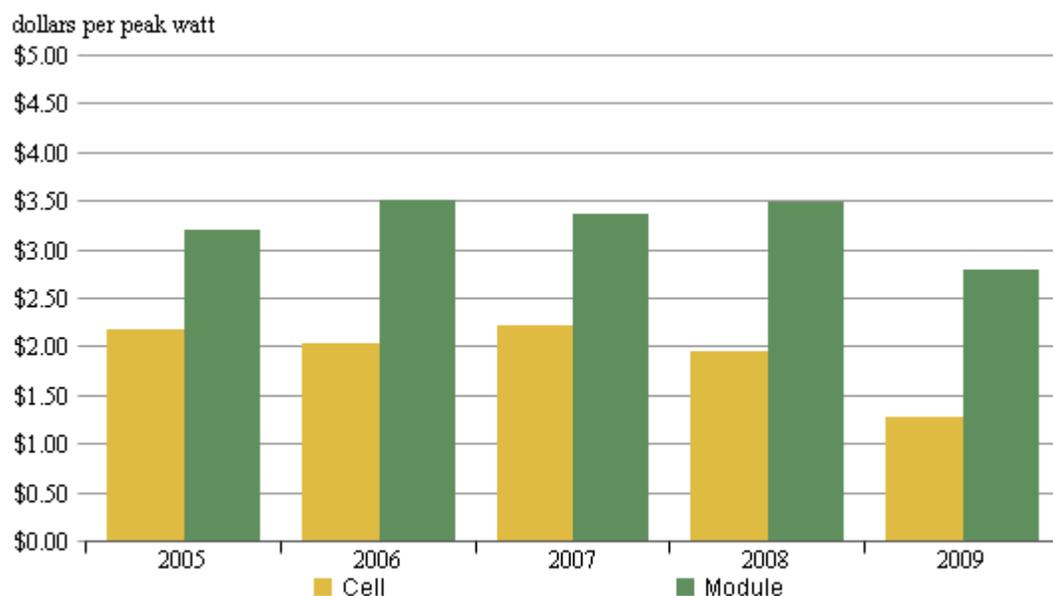
Shipments of single-crystal silicon totaled 580,629 peak kilowatts, an increase of nearly 62 percent compared with corresponding 2008 shipments. Cast and ribbon silicon shipments totaled 403,531 peak kilowatts in 2009, nearly a 32-percent increase from the corresponding 2008 shipments. Thin-film shipments decreased to 266,547 peak kilowatts in 2009, compared to 293,182 peak kilowatts in 2008. In 2009, thin-film shipments accounted for nearly 21 percent of the market, compared to slightly more than 39 percent in 2007. Shipments of concentrators accounted for less than 2 percent of the total in 2009 (Figure 3.3 and Table 3.5).

Total revenue and average price

Total revenue of photovoltaic cell and module shipments grew nearly 3 percent from \$3.34 billion in 2008 to \$3.43 billion in 2009 (Table 3.6). Revenue includes charges for cooperative advertising and warranties, but does not include excise taxes and the cost of freight or transportation.

The average price for modules (dollars per peak watt) decreased 20 percent, from \$3.49 in 2008 to \$2.79 in 2009. For cells, the average price decreased more than 34 percent, from \$1.94 in 2008 to \$1.27 in 2009 (Figure 3.4 and Table 3.6).

Figure 3.4 Photovoltaic cell and module average prices, 2005-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Domestic shipments

During 2009, shipments of solar cells and modules to domestic customers increased to 601,133 peak kilowatts, nearly 15 percent higher than the 524,252 peak kilowatts in 2008 (Table 3.2). The shipments went to all 50 States, the District of Columbia, Guam, Puerto Rico, and the Virgin Islands (Table 3.10). Nearly 75 percent of domestic PV cell and module shipments (449,438 peak kilowatts) went to five States (in order of decreasing volume): California, New Jersey, Florida, Arizona, and New York, with more than 55 percent (332,204 peak kilowatts) of domestic shipments going to California and New Jersey.

Domestic shipments to the commercial sector in 2009 accounted for 282,273 peak kilowatts, or nearly 47 percent of the domestic market. Of the domestic shipments to the commercial sector, nearly 86 percent were crystalline silicon, about 11 percent were thin-film PV, and more than 3 percent were concentrator PV (Table 3.7).

The residential sector was the second-largest domestic market in 2009, accounting for 221,245 peak kilowatts, or nearly 37 percent of the domestic market share. About 88 percent of its shipments were crystalline silicon shipments and about 12 percent were thin-film PV shipments.

Shipments to the electric power sector amounted to 53,636 peak kilowatts, or nearly 9 percent of the domestic market share. Crystalline silicon accounted for nearly 57 percent of the electric power shipments, thin-film PV accounted for nearly 43 percent, and concentrator PV accounted for 0.5 percent.

The industrial sector, with more than 7 percent of domestic shipments, was the smallest domestic sales market, totaling 43,445 peak kilowatts. Nearly 83 percent were crystalline silicon, and more than 17 percent were thin-film PV.

Electricity generation, which consists of both grid-connected (those connected to the electric power grid) and remote or dispersed applications (those not connected), continues to be the predominant end use for PV cells and modules. In 2009, PV cell and module shipments to the electricity generation market totaled 593,308 peak kilowatts, or nearly 99 percent of domestic shipments. Domestic shipments to original equipment manufacturers (OEM) and communication end uses were the second- and third-largest end uses, respectively, totaling nearly 0.9 percent. Domestic shipments to consumer goods, transportation, water pumping, and health end users held small market shares, totaling nearly 0.4 percent of domestic shipments (Table 3.7).

During 2009, PV shipments to installers, the largest customer type, totaled 214,799 peak kilowatts, nearly 36 percent of the domestic market share. Shipments to the second-largest customer type, wholesale distributors, amounted to 140,530 peak kilowatts, or more than 23 percent of the domestic market share (Table 3.4).

Export shipments

Exports of PV cells and modules totaled 681,427 peak kilowatts in 2009, a more than 47-percent increase from the 2008 exports of 462,252 peak kilowatts (Table 3.13). Exports exceeded domestic shipments in 2009, accounting for about 53 percent of total shipments. In contrast, 2008 exports were approximately 47 percent of total shipments (Table 3.10). The predominant type of export shipment was crystalline silicon cells and modules, accounting for nearly 71 percent (480,423 peak kilowatts) of total exports. The export market was dominated by sales to France, Germany, and Italy (Table 3.14).

Complete systems

A complete PV system is defined as a power supply unit that satisfies all the power requirements of an application. Such a system is made up of different components, including one or more PV modules, a power conditioning unit to process the electricity into the form needed by the application, wires, and other electrical connectors. Batteries for back-up power supply are an option. Some large-scale PV systems use concentrators to focus incident insolation onto small PV cells and tracking systems to track the sun. These large-scale systems convert sunlight directly into electricity and typically produce the greatest amounts of power during the afternoon, when electricity demand is high.

During 2009, the number of shipments of complete PV systems decreased to 9,233 systems from the 20,025 systems in 2008. The total value of complete systems decreased 8 percent to \$1.15 billion in 2009. The total peak kilowatts of complete systems shipped increased from 202,632 in 2008 to 228,017 in 2009 (Table 3.15).

Origin of shipments

Imports of PV cells and modules shipments increased nearly 27 percent from 2008, to 743,414 peak kilowatts in 2009 (Table 3.11). Imports in 2009 accounted for over half of total shipments. The predominant type of import shipment was crystalline silicon cells and modules, accounting for more than 95 percent (708,246 peak kilowatts) of total imports. China, Mexico, and Philippines accounted for 78 percent of total imports (Table 3.12).

In 2009, about 42 percent of PV cells and modules were manufactured in the United States; manufacturers in California, Maryland, Massachusetts, Michigan, and Ohio produced nearly 87 percent of domestically produced cells and modules (Table 3.9).

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Table 3.1 Annual shipments of photovoltaic cells and modules by source, 2000 – 2009

Photovoltaic Cell and Module Shipments (peak kilowatts)				
Year	Number of Companies	Imports	Domestically Manufactured	Total
2000	21	8,821	79,400	88,221
2001	19	10,204	87,462	97,666
2002	19	7,297	104,793	112,090
2003	20	9,731	99,626	109,357
2004	19	47,703	133,413	181,116
2005	29	90,981	135,935	226,916
2006	41	173,977	163,291	337,268
2007	46	238,018	279,666	517,684
2008	66	586,558	399,947	986,504
2009	101	743,414	539,146	1,282,560

Notes: Totals may not equal sum of components due to independent rounding.

Domestically manufactured shipments include those made in U.S. Territories

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.2 Annual shipments of photovoltaic cells and modules by disposition, 2000 – 2009

Photovoltaic Cell and Module Shipments (peak kilowatts)				
Year	Number of Companies	Exports	Domestic Shipments	Total
2000	21	68,382	19,838	88,221
2001	19	61,356	36,310	97,666
2002	19	66,778	45,313	112,090
2003	20	60,693	48,664	109,357
2004	19	102,770	78,346	181,116
2005	29	92,451	134,465	226,916
2006	41	130,757	206,511	337,268
2007	46	237,209	280,475	517,684
2008	66	462,252	524,252	986,504
2009	101	681,427	601,133	1,282,560

Notes: Totals may not equal sum of components due to independent rounding.

Total shipments as reported by respondents include all domestic and export shipments and may include imported cells and modules that subsequently were shipped to domestic or foreign customers.

Domestic shipments include those shipped to U.S. Territories

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.3 Annual photovoltaic shipments by cells and modules, 2000 – 2009

(peak kilowatts)

Year	Cells	Modules	Total
2000	33,213	55,007	88,221
2001	30,633	67,033	97,666
2002	47,677	64,413	112,090
2003	29,295	80,062	109,357
2004	37,842	143,274	181,116
2005	21,920	204,996	226,916
2006	17,060	320,208	337,268
2007	23,535	494,148	517,684
2008	65,811	920,693	986,504
2009	93,681	1,188,879	1,282,560

Note: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."**Table 3.4 Distribution of domestic photovoltaic cells and modules by customer type, 2007 – 2009**

(peak kilowatts)

Customer Type	Shipments		
	2007	2008	2009
Wholesale Distributors	109,015	125,527	140,530
Retail Distributors	19,748	44,203	87,093
Exporters	1,513	888	950
Installers	110,009	231,235	214,799
End Users	38,686	109,879	132,293
Module Manufacturers	1,504	12,521	25,469
U.S. Total	280,475	524,252	601,133

Note: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.5 Photovoltaic cell and module shipments by type, 2007 – 2009

Type	Shipments (Peak Kilowatts)			Percent of Total		
	2007	2008	2009	2007	2008	2009
Crystalline Silicon						
Single-Crystal	128,542	359,259	580,629	25	36	45
Cast and Ribbon	181,788	306,537	403,531	35	31	31
Subtotal	310,330	665,795	984,161	60	67	77
Thin-Film	202,519	293,182	266,547	39	30	21
Concentrator	4,835	27,527	31,852	1	3	2
U.S. Total	517,684	986,504	1,282,560	100	100	100

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.6 Photovoltaic cell and module shipment revenue by type, 2008 and 2009

Type	2008			2009		
	Revenue (Thousand Dollars)	Average Price (Dollars per Peak Watt)		Revenue (Thousand Dollars)	Average Price (Dollars per Peak Watt)	
		Modules	Cells		Modules	Cells
Crystalline Silicon						
Single-Crystal	1,398,140	3.97	2.94	1,735,298	3.06	1.71
Cast and Ribbon	1,091,526	3.60	2.44	1,036,045	2.63	1.73
Subtotal	2,489,666	3.80	2.80	2,771,343	2.89	1.72
Thin-Film	826,657	2.82	1.03	642,601	2.43	1.18
Concentrator	26,380	5.74	0.68	17,650	5.33	s
U.S. Total	3,342,702	3.49	1.94	3,431,594	2.79	1.27

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.7 Domestic shipments of photovoltaic cells and modules by market sector, end use, and type, 2008 and 2009

(peak kilowatts)

Sector and End Use	Crystalline Silicon ¹	Thin-Film Silicon	Concentrator Silicon	2009 Total	2008 Total
Market Sector					
Residential	195,391	25,854	-	221,245	173,989
Commercial	241,520	31,440	9,313	282,273	253,852
Industrial	35,886	7,560	-	43,445	51,493
Electric Power	30,407	22,951	278	53,636	35,819
Transportation	534	-	-	534	9,100
U.S. Total	503,738	87,804	9,591	601,133	524,252
End Use					
Electricity Generation					
Grid-Connected	489,554	86,043	9,591	585,189	500,854
Remote	7,550	569	-	8,119	15,527
Communication	1,678	139	-	1,817	2,622
Consumer Goods	120	170	-	290	312
Transportation	951	10	-	961	916
Water Pumping	903	20	-	923	1,145
Cells/Modules to OEM	2,610	845	-	3,455	2,659
Health	373	8	-	381	217
U.S. Total	503,738	87,804	9,591	601,133	524,252

¹Includes single-crystal and cast and ribbon types.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.8 Average energy conversion efficiency of photovoltaic cells and modules shipped, 2007 – 2009

(percent of energy converted)

Year	Crystalline Silicon			Thin-Film Silicon		Concentrator Silicon
	Single-Crystal	Cast	Ribbon	Amorphous Silicon	Other	
2007	17	14	12	8	12	35
2008	19	14	13	8	12	34
2009	20	14	13	8	12	38

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.9 Shipments of photovoltaic cells and modules by origin, 2008 and 2009

(peak kilowatts)

Origin	Percent of U.S. Shipments 2008		Percent of U.S. Shipments 2009	
	2008	2009	2008	2009
Arizona	13,583	1.38	13,091	1.02
California	44,059	4.47	132,499	10.33
Colorado	-	-	100	*
Delaware	15,000	1.52	-	-
Georgia	423	0.04	21,000	1.64
Idaho	1,143	0.12	874	0.07
Maryland	29,768	3.02	26,793	2.09
Massachusetts	38,811	3.93	115,277	8.99
Michigan	109,122	11.06	73,900	5.76
New Jersey	2,886	0.29	1,387	0.11
New Mexico	7,427	0.75	17,561	1.37
New York	144	0.01	1,114	0.09
Ohio	133,681	13.55	120,329	9.38
Pennsylvania	3,900	0.40	15,139	1.18
Texas	-	-	83	*
Shipments from United States/Territories	399,947	40.54	539,146	42.04
Imports	586,558	59.46	743,414	57.96
Total Shipments	986,504	100.00	1,282,560	100.00

* = Less than 0.01 percent.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.10 Shipments of photovoltaic cells and modules by destination, 2008 and 2009

(peak kilowatts)

Destination	2008	Percent of U.S. Shipments 2008	2009	Percent of U.S. Shipments 2009
Alabama	92	*	77	*
Alaska	37	*	32	*
Arizona	17,908	1.82	38,536	3.00
Arkansas	100	0.01	193	0.02
California	327,788	33.23	266,629	20.79
Colorado	22,624	2.29	25,406	1.98
Connecticut	8,085	0.82	15,027	1.17
Delaware	1,008	0.10	1,001	0.08
District of Columbia	795	0.08	123	*
Florida	24,713	2.51	45,228	3.53
Georgia	473	0.05	1,009	0.08
Guam	-	-	110	*
Hawaii	7,879	0.80	6,625	0.52
Idaho	118	0.01	86	*
Illinois	1,443	0.15	6,500	0.51
Indiana	693	0.07	1,347	0.11
Iowa	74	*	111	*
Kansas	68	*	85	*
Kentucky	64	*	16	*
Louisiana	431	0.04	1,708	0.13
Maine	172	0.02	663	0.05
Maryland	9,451	0.96	7,859	0.61
Massachusetts	5,029	0.51	7,406	0.58
Michigan	365	0.04	935	0.07
Minnesota	234	0.02	599	0.05
Mississippi	15	*	28	*
Missouri	403	0.04	238	0.02
Montana	470	0.05	453	0.04
Nebraska	55	*	49	*
Nevada	14,330	1.45	5,783	0.45
New Hampshire	842	0.09	1,751	0.14
New Jersey	31,973	3.24	65,575	5.11
New Mexico	3,387	0.34	8,115	0.63
New York	11,813	1.20	33,470	2.61
North Carolina	2,674	0.27	11,226	0.88
North Dakota	13	*	18	*
Ohio	969	0.10	12,246	0.95
Oklahoma	364	0.04	185	0.01
Oregon	6,782	0.69	2,651	0.21
Pennsylvania	1,563	0.16	10,259	0.80
Puerto Rico	170	0.02	881	0.07
Rhode Island	87	*	645	0.05
South Carolina	106	0.01	262	0.02

See footnotes at end of table.

Table 3.10 Shipments of photovoltaic cells and modules by destination, 2008 and 2009 (cont.)

(peak kilowatts)

Destination	2008	Percent of U.S. Shipments 2008	2009	Percent of U.S. Shipments 2009
South Dakota	31	*	10	*
Tennessee	155	0.02	734	0.06
Texas	8,778	0.89	8,999	0.70
Utah	314	0.03	215	0.02
Vermont	5,257	0.53	3,969	0.31
Virgin Islands of the U.S	22	*	25	*
Virginia	379	0.04	1,208	0.09
Washington	1,988	0.20	1,482	0.12
West Virginia	72	*	1,529	0.12
Wisconsin	1,490	0.15	1,732	0.14
Wyoming	107	0.01	89	*
Shipments to United State	524,252	53.14	601,133	46.87
Exported	462,252	46.86	681,427	53.13
Total Shipments	986,504	100.00	1,282,560	100.00

* = Less than 0.01 percent.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.11 Import shipments of photovoltaic cells and modules by type, 2000 – 2009

(peak kilowatts)

Item/Year	Crystalline Silicon	Thin-Film Silicon	Concentrator Silicon	Total
Cells				
2000	3,779	3	24	3,805
2001	3,169	6	-	3,175
2002	915	4	-	919
2003	439	3	-	442
2004	33,607	-	-	33,607
2005	46,538	-	-	46,538
2006	74,290	-	-	74,290
2007	64,757	-	95	64,852
2008	136,740	5	-	136,745
2009	118,167	65	-	118,231
Modules				
2000	4,383	633	-	5,016
2001	6,681	348	-	7,029
2002	6,119	259	-	6,378
2003	9,027	262	-	9,289
2004	14,096	-	-	14,096
2005	33,081	11,337	25	44,443
2006	84,308	14,170	1,209	99,687
2007	149,699	23,466	-	173,165
2008	418,252	30,661	900	449,813
2009	590,079	35,103	-	625,182
Totals				
2000	8,161	636	24	8,821
2001	9,850	354	-	10,204
2002	7,034	263	-	7,297
2003	9,466	265	-	9,731
2004	47,703	-	-	47,703
2005	79,619	11,337	25	90,981
2006	158,598	14,170	1,209	173,977
2007	214,457	23,466	95	238,018
2008	554,992	30,666	900	586,558
2009	708,246	35,168	-	743,414

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.12 Origin of U.S. photovoltaic cell and module import shipments by country, 2008 and 2009

(peak kilowatts)

Region/Country	2008	Percent of U.S. Imports 2008	2009	Percent of U.S. Imports 2009
Asia				
China	133,038	22.68	234,717	31.57
Hong Kong	6,200	1.06	3,100	0.42
India	1,096	0.19	1,847	0.25
Japan	145,745	24.85	84,134	11.32
Philippines	150,092	25.59	213,200	28.68
Taiwan	44,889	7.65	61,792	8.31
Total	481,060	82.01	598,790	80.55
Central America				
Mexico	43,440	7.41	132,564	17.83
Total	43,440	7.41	132,564	17.83
Europe				
Germany	58,517	9.98	11,731	1.58
Norway	-	-	86	0.01
Spain	3,540	0.60	243	0.03
Total	62,057	10.58	12,060	1.62
U.S. Total	586,558	100.00	743,414	100.00

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.13 Export shipments of photovoltaic cells and modules by type, 2000 - 2009

(peak kilowatts)

Item/Year	Crystalline Silicon	Thin-Film Silicon	Concentrator Silicon	Total
Cells				
2000	32,019	-	86	32,105
2001	26,899	-	174	27,073
2002	33,952	-	267	34,219
2003	30,337	-	127	30,464
2004	36,492	-	-	36,492
2005	20,434	-	-	20,434
2006	12,960	838	400	14,198
2007	16,592	1,500	3,753	21,845
2008	36,419	605	15,967	52,991
2009	42,299	2,291	21,743	66,333
Modules				
2000	35,440	837	-	36,277
2001	29,660	4,622	-	34,282
2002	29,987	2,572	-	32,559
2003	25,190	5,039	-	30,229
2004	52,938	13,341	-	66,278
2005	39,992	32,000	25	72,017
2006	47,681	68,880	-	116,561
2007	66,791	148,477	95	215,364
2008	204,471	203,391	1,400	409,261
2009	438,124	176,452	518	615,094
Totals				
2000	67,460	837	86	68,382
2001	56,559	4,622	174	61,356
2002	63,939	2,572	267	66,778
2003	55,527	5,039	127	60,693
2004	89,430	13,341	-	102,770
2005	60,426	32,000	25	92,451
2006	60,640	69,718	400	130,757
2007	83,383	149,977	3,848	237,209
2008	240,890	203,996	17,367	462,252
2009	480,423	178,743	22,261	681,427

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.**Source:** U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.14 Destination of U.S. photovoltaic cell and module export shipments by country, 2008 and 2009

(peak kilowatts)

Region/Country	2008	Percent of U.S. Exports 2008	2009	Percent of U.S. Exports 2009
Africa				
Egypt	-	-	1	*
Ethiopia	-	-	2	*
Kenya	416	0.09	400	0.06
Nigeria	400	0.09	450	0.07
South Africa	1,162	0.25	902	0.13
Total	1,978	0.43	1,754	0.26
Asia				
Afghanistan	76	0.02	-	-
Bahrain	1	*	s	*
Cambodia	624	0.13	-	-
China	4,418	0.96	18,297	2.69
Hong Kong	4,120	0.89	3,609	0.53
India	1,137	0.25	14,806	2.17
Indonesia	176	0.04	-	-
Israel	149	0.03	3,800	0.56
Japan	440	0.10	5,472	0.80
Korea, South	10,763	2.33	12,581	1.85
Malaysia	19	*	25	*
Oman	24	*	-	-
Singapore	12,297	2.66	3	*
Sri Lanka	-	-	1	*
Taiwan	700	0.15	1,244	0.18
Thailand	14	*	-	-
United Arab Emirates	234	0.05	195	0.03
Total	35,192	7.61	60,034	8.81
Australia and Oceania				
Australia	8,108	1.75	8,368	1.23
New Zealand	48	0.01	2	*
Vanuatu	-	-	s	*
Total	8,156	1.76	8,370	1.23
Central America				
Bahamas	100	0.02	-	-
Belize	7	*	-	-
British Virgin Islands	-	-	31	*
Cayman Islands	3	*	-	-
Costa Rica	16	*	6	*
Dominica	5	*	-	-
Dominican Republic	159	0.03	1,062	0.16
El Salvador	2	*	17	*
Guatemala	16	*	9	*
Haiti	225	0.05	111	0.02
Honduras	61	0.01	47	*
Jamaica	50	0.01	50	*
Nicaragua	139	0.03	166	0.02
Panama	134	0.03	104	0.02
Trinidad and Tobago	4	*	-	-
Total	1,484	0.32	2,239	0.33

See footnotes at end of table.

Table 3.14 Destination of U.S. photovoltaic cell and module export shipments by country, 2008 and 2009 (cont.)

(peak kilowatts)

Region/Country	2008	Percent of U.S. Exports 2008	2009	Percent of U.S. Exports 2009
Europe				
Albania	481	0.10	4,700	0.69
Austria	4,155	0.90	3,000	0.44
Belgium	2,148	0.46	27,247	4.00
Bulgaria	541	0.12	4,700	0.69
Czech Republic	592	0.13	6,902	1.01
Denmark	101	0.02	7	*
Finland	1	*	4	*
France	31,196	6.75	47,271	6.94
Germany	198,230	42.88	309,147	45.37
Greece	487	0.11	1,600	0.23
Hungary	512	0.11	4,701	0.69
Ireland	17	*	29	*
Italy	49,830	10.78	108,187	15.88
Kazakhstan	1	*	-	-
Netherlands	20	*	2,994	0.44
Norway	-	-	2	*
Poland	482	0.10	4,700	0.69
Portugal	10	*	1,007	0.15
Romania	482	0.10	4,700	0.69
Russia	2	*	-	-
Spain	105,555	22.84	23,460	3.44
Sweden	1,131	0.24	1,868	0.27
Switzerland	383	0.08	8,182	1.20
Turkey	3	*	41	*
United Kingdom	50	0.01	18	*
Total	396,410	85.76	564,466	82.84
North America				
Mexico	564	0.12	638	0.09
Canada	17,819	3.85	43,458	6.38
Total	17,819	3.85	43,458	6.38
South America				
Argentina	5	*	-	-
Bolivia	135	0.03	139	0.02
Brazil	652	0.14	503	0.07
Chile	145	0.03	190	0.03
Colombia	97	0.02	53	*
Ecuador	21	*	16	*
Guyana	-	-	7	*
Peru	152	0.03	148	0.02
Uruguay	8	*	2	*
Venezuela	-	-	50	*
Total	1,214	0.26	1,107	0.16
U.S. Total	462,252	100.00	681,427	100.00

* = Less than 0.01 percent.

s = Value is less than 0.5 of the table metric, but value is included in any associated total.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.15 Shipments of complete photovoltaic module systems, 2007 - 2009

Shipment Information	2007	2008	2009
Complete Photovoltaic Module Systems Shipped	10,600	20,025	9,233
Peak Kilowatts	80,560	202,632	228,017
Percentage of Total Module Shipments	16	22	19
Revenue of Systems (Thousand Dollars)	491,740	1,246,126	1,145,366

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.16 Employment in the photovoltaic manufacturing industry, 2000 – 2009

Year	Number of Companies	Number of Person-Years
2000	21	1,913
2001	19	2,666
2002	19	2,696
2003	20	2,590
2004	19	2,916
2005	29	3,198
2006	41	4,028
2007	46	6,170
2008	66	11,245
2009	101	14,443

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.17 Number of companies expecting to introduce new photovoltaic products in 2010

New Product Type	Number of Companies
Crystalline Silicon	
Single-Crystal Silicon Modules	22
Cast Silicon Modules	11
Ribbon Silicon Modules	2
Thin-Film	
Amorphous Silicon Modules	11
Other (Thin Film)	9
Concentrators	3
Nonmodule System Components	8

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.18 Number of companies involved in photovoltaic-related activities, 2008 and 2009

Type of Activity	Number of Companies	
	2008	2009
Module or Cell Manufacturing	29	43
Module or Systems Design	39	49
Prototype Module Development	28	34
Prototype Systems Development	20	26
Wholesale Distribution	37	54
Retail Distribution	16	23
Installation	28	42
Noncollector System Component Manufacture	9	15

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 3.19 Photovoltaic-related sales as a percentage of total company sales revenue, 2008 and 2009

Percent of Total Sales Revenue	Number of Companies	
	2008	2009
90-100	50	70
50-89	7	10
10-49	4	8
Less than 10	5	13
U.S. Total	66	101

Source: U.S. Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

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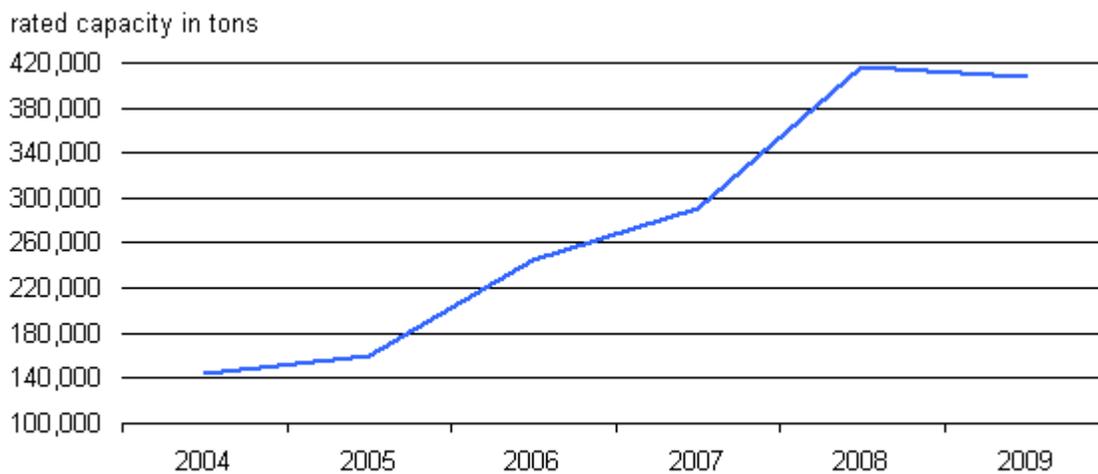
4. Geothermal heat pump manufacturing activities 2009

Overview

Shipments of geothermal heat pumps decreased nearly 5 percent in 2009 to 115,442 units from a year ago (Table 4.1), while capacity shipped decreased by only 2 percent to 407,093 tons³¹ (Figure 4.1 and Table 4.2). This marked the first decrease in shipments experienced by the geothermal heat pump (GHP) industry since 2003.

On February 17, 2009, the American Recovery and Reinvestment Act of 2009 (ARRA) was signed into law. This legislation provides significant new Federal funding, loan guarantees, and tax credits to stimulate investments in energy efficiency and renewable energy.

Figure 4.1 Geothermal heat pump shipments, 2004-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Industry status

In 2009, there were 27 known domestic manufacturers of geothermal heat pumps (Table 4.16), including brand name manufacturers³² that shipped geothermal heat pumps manufactured by others under contract.

Almost all manufacturers have their geothermal heat pumps tested and certified by the Air Conditioning, Heating, and Refrigeration Institute (AHRI) for their cooling capacities and operating efficiencies. In general, geothermal heat pumps are rated based on one of the four standards by the AHRI. The four classifications for geothermal heat pumps are as follows:

³¹ Ton: A measure of the amount of Btu's (British thermal units) needed to melt one ton of ice in a 24-hour period. One ton equals 12,000 Btu's/hour available to heat and/or cool space.

³² Brand name manufacturer is defined as a name used to identify a product in the consumer marketplace, which attributes the product to the owner of the name as the manufacturer.

- ARI-320, Water-Source Heat Pumps (WSHP). These systems are installed in commercial buildings, where a central chiller or boiler supplies chilled or heated water, respectively, to heat pumps installed in series. The heat pumps reject building heat to chilled water during the cooling season and, during the heating season, take heat from boiler water
- ARI-325, Ground Water-Source Heat Pumps (GWHP). The GWHP is an open-loop system directly utilizes water from a well or water body, pumps it through a pipe for use as a heat exchanger, and returns it back to the environment
- ARI-330, Ground Source Closed-Loop Heat Pumps (GSHP). A water or water/glycol (antifreeze) solution flows continuously through a closed loop of pipe buried underground. Ground heat is absorbed into or rejected from the solution flowing in the closed loop. At the heat pump, heat is drawn from or dumped to the closed loop solution via heat transfer through a heat exchanger, which passes heat to, or removes heat from, the refrigerant in the heat pump
- ARI-870, Direct Geoexchange Heat Pumps (DXHP). A geothermal heat pump system that uses refrigerant in a buried pipe loop as a heat exchanger. The refrigerant in the loop never leaves the system. A direct expansion system is a ground source system with a closed-loop which uses refrigerant throughout the system rather than a water/glycol solution to exchange heat

Out of 115,442 geothermal heat pump units shipped in 2009, a total of 22,009 were WSHP units (ARI-320 rated), 87,717 were GWHP or GSHP units (ARI-325 or ARI-330 rated), and 759 were DXHP units (ARI-870 rated). ARI-rated shipments decreased to 110,485 units in 2009, while the number of other non-ARI rated units shipped decreased to 4,957 in 2009 (Table 4.1).

Of the 27 manufacturers reporting GHP shipments in 2009, many manufacturers also reported being involved in one or more of the following geothermal heat pump-related activities (Table 4.15):

- 17 designed geothermal heat pumps or systems
- 13 developed prototype geothermal heat pumps only
- 7 developed prototype systems, which include geothermal heat pumps and other components
- 18 were involved in wholesale distribution
- 3 were involved in retail distribution
- 3 installed GHP products
- 4 manufactured system components

In addition, several manufacturers are planning to introduce new geothermal heat pump-related products in the next calendar year (Table 4.13):

- 10 plan to introduce new ARI-320 rated water-source heat pumps
- 13 plan to introduce new ARI-325 rated ground water-source heat pumps
- 11 plan to introduce new ARI-330 rated ground source closed-loop heat pumps
- 2 plan to introduce new ARI-870 rated direct geoexchange heat pumps
- 4 plan to introduce new Non-ARI rated heat pumps in 2010 (Table 4.13)

In 2009, direct employment in the geothermal heat pump manufacturer industry accounted for 1,832 person-years³³ (Table 4.14). Of the 27 manufacturers, 12 had 90 percent or more of their total company-wide revenues from geothermal heat pump-related activities, 3 had 50 to 89 percent, 4 had 10 to 49 percent, and 8 manufacturers had less than 10 percent (Table 4.16).

Geothermal heat pump shipments

The total rated capacity of geothermal heat pumps shipped in 2009 was 407,093 tons, approximately 2 percent less than the 2008 shipments of 416,105 tons (Table 4.2). The average unit size shipped in 2009 was 3.53 tons, compared to an average unit size of 3.43 tons in 2008 (Table 4.1 and Table 4.2).

In 2009, water-source heat pump (ARI-320 rated) shipments decreased to 56,181 tons (Figure 4.2 and Table 4.2). This category has fluctuated in the past few years, largely due to one manufacturer classifying its equipment differently each year.

Shipments of ground water-source heat pumps and ground source closed-loop heat pumps (ARI-325/330 rated) continued to dominate the GHP industry in 2009, accounting for more than 73 percent of the total shipments (Figure 4.2 and Table 4.2). The shipments of ARI-325 and ARI-330 were 298,209 tons of capacity, a nearly 2.8 percent decrease from the corresponding 2008 shipments.

Shipments of direct geoexchange heat pumps (ARI-870 Rated) totaled 3,103 tons in 2009 (Figure 4.2 and Table 4.2).

Despite the decline in total shipments, capacity of non-ARI rated heat pump shipments in 2009 increased more than 5.6 percent (49,600 tons) from 2008 shipments (Figure 4.2 and Table 4.2).

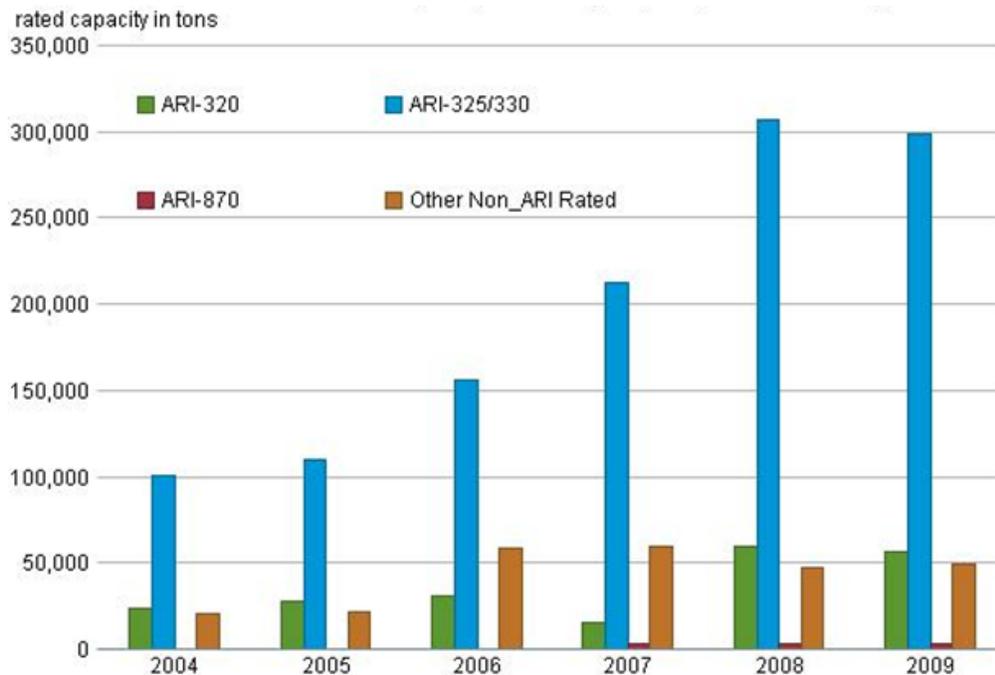
Total revenue and average price

The total revenue for shipments of geothermal thermal heat pumps was approximately \$319.5 million in 2009, almost the same as 2008 (Table 4.5). Revenue includes charges for cooperative advertising and warranties, but does not include excise taxes and the cost of freight or transportation.

³³ Person-year: One whole year, or fraction thereof, worked by an employee, including contracted manpower.

The average price (dollars per ton) for water-source heat pumps (ARI-320 rated) was \$590.38 in 2009, ground water-source heat pumps and ground source closed-loop heat pumps (ARI-325/330 rated) was \$835.21, direct geoechange heat pumps (ARI-870 rated) was \$957.10, and non-ARI rated heat pumps was \$691.54 (Table 4.5).

Figure 4.2 Geothermal heat pump shipments by capacity and model type, 2004-2009



Source: U.S. Energy Information Administration, (EIA) Form EIA-902, Annual Geothermal Heat Pump Manufacturers Survey.*

Domestic shipments

During 2009, domestic shipments declined slightly, with rated capacity totaling 338,689 tons, a 2 percent decrease from 346,622 tons in 2008 (Table 4.6).

During 2009, GHP shipments to domestic wholesale distributors, the largest customer category, totaled 173,065 tons of capacity or 51 percent of the domestic market share. Shipments to the second-largest customer category, installers, amounted to 154,321 tons, or nearly 46 percent of the domestic market-share (Table 4.10).

In 2009, domestic shipments to the residential sector accounted for 172,559 tons of capacity or almost 51 percent of the domestic market. Of the domestic shipments to the residential sector, 4.8 percent were ARI-320 rated, 88 percent were ARI-325/330 rated, 1.5 percent were ARI-870 rated, and 5.6 percent were non-ARI rated (Table 4.11). The commercial sector was the second largest domestic market in the United States in 2009, accounting for 156,533 tons of capacity or 46 percent of the domestic market share. Almost 27 percent of the purchases for this sector were ARI-320 rated GHP, 61 percent ARI-325/330 rated GHP, just over 0.01 percent ARI-870 rated GHP, and 12.5 percent non-ARI rated GHP. The industrial sector, with slightly less than 3 percent of domestic shipments, was the smallest domestic sector.

Complete systems

In general, geothermal heating/cooling systems provide space heating and cooling, as well as water heating. A complete geothermal heating/cooling system is defined as a unit with all the necessary functional components,

except for installation materials. The system includes three principal components (listed below) and a device called a “desuperheater” which can be added to produce hot water when the system is providing heat or air conditioning.

The major components are:

- Geothermal earth connection subsystem: Using the earth as the heat source and heat sink, this subsystem consists of a series of pipes which are commonly called a “loop.” They carry a fluid used to connect the geothermal system's heat pump to the earth near the building to be conditioned
- Geothermal heat pump subsystem: An electric heat pump that exchanges heat between the fluid and the air that conditions the building
- Geothermal heat distribution subsystem: An air-delivery system that delivers the conditioned air to the building

Of the manufacturers reporting 2009 shipments, the majority of these manufacturers sell only geothermal heat pump subsystems (geothermal heat pump units), and three manufacturers reported selling complete systems. The complete systems accounted for 19,598 tons, or 5 percent of total (including exports) GHP shipped in 2009 (Table 4.6 and Table 4.12).

Origin of shipments

Of the 407,093 tons of total GHP capacity shipped in 2009, 250 tons were imported from China. The remaining 406,843 tons of GHP capacity shipped were manufactured in the United States. The top five manufacturing states were: Florida, Indiana, Oklahoma, South Dakota, and Texas, with almost 57 percent (231,471 tons) of the total capacity shipped from Indiana and Oklahoma (Table 4.8).

Destination of shipments

GHP export shipments totaled 68,404 tons of capacity in 2009. The export market accounted for nearly 17 percent of total capacity shipments and was dominated by sales to Canada, with more than 83 percent (56,845 tons) of total exports (Table 4.7).

In 2009, domestic GHP shipments totaling 338,689 tons of capacity went to all 50 States, and the District of Columbia (Table 4.6). About 52 percent of domestic GHP shipments (176,162 tons of capacity) went to ten States: Florida, Illinois, Indiana, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, and Texas, with more than 13 percent (44,705 tons of capacity) of the total sent to Ohio and Pennsylvania.

Geothermal direct use of energy and heat pumps

EIA does not collect data on non-electric applications of geothermal energy such as crop drying and groundwater heat pumps. Analysis conducted by the Oregon Institute of Technology, Geo-Heat Center, indicated that non-electric uses of geothermal energy amounted to nearly 53.7 trillion Btu in 2009, increased more than 16 percent from a year ago (Table 4.17)³⁴. Almost 84 percent of this energy was provided by geothermal heat pumps.

³⁴ Data provided by Dr. John W. Lund, Oregon Institute of Technology, Geo-Heat Center.

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Table 4.1 Geothermal heat pump shipments by model type, 2000 – 2009

(number of units)

Year	Model Type				Total
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	
2000	7,808	26,219	-	1,554	35,581
2001	NA	NA	NA	NA	NA
2002	6,445	26,802	-	3,892	37,139
2003	10,306	25,211	-	922	36,439
2004	9,130	31,855	-	2,821	43,806
2005	9,411	34,861	-	3,558	47,830
2006	10,968	47,440	-	5,274	63,682
2007	8,112	66,863	809	10,612	86,396
2008	23,204	91,402	783	5,854	121,243
2009	22,009	87,717	759	4,957	115,442

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geothermal Heat Pumps.

NA = Not available. No survey was conducted for 2001.

- = No data reported.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.2 Rated capacity of geothermal heat pump shipments by model type, 2000 - 2009

(tons)

Year	Model Type				Total
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	
2000	26,469	130,132	-	7,590	164,191
2001	NA	NA	NA	NA	NA
2002	16,756	96,541	-	12,000	125,297
2003	29,238	89,731	-	5,469	124,438
2004	23,764	100,317	-	20,220	144,301
2005	28,064	110,291	-	22,047	160,402
2006	31,198	155,736	-	58,669	245,603
2007	15,667	212,739	3,412	59,482	291,300
2008	59,360	306,650	3,114	46,981	416,105
2009	56,181	298,209	3,103	49,600	407,093

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geothermal Heat Pumps.

NA = Not available. No survey was conducted for 2001.

- = No data reported.

Note: One ton of capacity is equal to 12,000 Btus per hour.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.3 Average cooling efficiency for geothermal heat pump shipments, 2008 and 2009

(average energy efficiency ratio)

Year	Model Type			
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated
2008	13.1	19.5	17.5	13.5
2009	14.6	20.4	18.2	14.3

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geoexchange Heat Pumps.

Notes: One ton of capacity is equal to 12,000 Btus per hour.

Efficiency is expressed as btus of output per watt-hours of input. The greater the EER the more efficient the unit.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.4 Average heating efficiency for geothermal heat pump shipments, 2008 and 2009

(average coefficient of performance)

Year	Model Type			
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated
2008	4.4	4.0	4.2	3.6
2009	3.9	4.1	4.3	3.8

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geoexchange Heat Pumps.

Notes: One ton of capacity is equal to 12,000 Btus per hour.

Efficiency is expressed as btus of output per watt-hours of input. The greater the COP the more efficient the unit.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.5 Geothermal heat pump shipments by model type, quantity, revenue, and average price, 2008 and 2009

Model Type	2008			2009		
	Quantity (Rated Capacity in Tons)	Revenue (Thousand Dollars)	Average Price (Dollars per Ton)	Quantity (Rated Capacity in Tons)	Revenue (Thousand Dollars)	Average Price (Dollars per Ton)
ARI-320	59,360	44,125	743.34	56,181	33,168	590.38
ARI-325/330	306,650	241,556	787.73	298,209	249,067	835.21
ARI-870	3,114	3,306	1,061.63	3,103	2,970	957.10
Other Non-ARI Rated	46,981	30,533	649.90	49,600	34,300	691.54
U.S. Total	416,105	319,520	767.88	407,093	319,506	784.85

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geoexchange Heat Pumps.

Notes: Totals may not equal sum of components due to independent rounding.

One ton of capacity is equal to 12,000 Btus per hour.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.6 Geothermal heat pump shipments by destination, 2008 and 2009

(rated capacity in tons)

Destination	2008	2009
Alabama	1,963	1,782
Alaska	107	190
Arizona	6,608	4,036
Arkansas	4,057	3,558
California	9,522	6,998
Colorado	4,233	3,134
Connecticut	3,577	2,684
Delaware	1,835	2,605
District of Columbia	1,792	1,345
Florida	12,439	18,558
Georgia	8,013	5,305
Hawaii	174	52
Idaho	1,180	1,433
Illinois	26,599	18,795
Indiana	18,119	17,764
Iowa	12,801	12,907
Kansas	2,720	4,447
Kentucky	10,931	12,366
Louisiana	603	1,299
Maine	719	556
Maryland	12,048	11,062
Massachusetts	7,719	3,054
Michigan	13,075	13,191
Minnesota	17,124	16,823
Mississippi	1,711	1,583
Missouri	8,585	13,724
Montana	1,755	1,766
Nebraska	12,618	9,154
Nevada	4,286	1,815
New Hampshire	3,324	2,812
New Jersey	2,785	5,131
New Mexico	1,806	1,027
New York	19,589	18,142
North Carolina	2,645	3,629
North Dakota	3,483	5,789
Ohio	20,332	23,348
Oklahoma	9,036	7,451
Oregon	2,343	1,875
Pennsylvania	22,494	21,357
Puerto Rico	21	-
Rhode Island	339	470
South Carolina	2,455	3,405
South Dakota	4,215	2,729
Tennessee	10,144	7,625
Texas	10,207	14,460
Utah	2,689	3,065
Vermont	543	535
Virginia	8,610	8,338
Washington	3,936	5,446
West Virginia	771	976
Wisconsin	7,522	8,370
Wyoming	420	723
Shipments to United States/Territories	346,622	338,689
Exported	69,483	68,404
Total Shipments	416,105	407,093

- = No data reported.

Note: "Export" in Table 4.6 and "Exporter" in Table 4.10 are different. "Export" refers to shipments outside of the country, while "Exporter" is the type of customer.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.7 Distribution of U.S. geothermal heat pump exports by country of destination, 2008 and 2009

(rated capacity in tons)

Region/Country	2008	2009	Percent of U.S. Exports 2009
Africa			
South Africa	-	74	0.11
Total	-	74	0.11
Asia			
China	6	549	0.80
India	5	162	0.24
Japan	-	13	0.02
Jordan	19	10	0.01
Korea, South	3,905	2,890	4.22
Palestinian Authority	183	-	-
Thailand	366	-	-
Total	4,484	3,624	5.30
Australia and Oceania			
Australia	345	811	1.19
New Zealand	101	6	*
Total	446	817	1.19
Central America			
Barbados	91	69	0.10
Bermuda	-	36	0.05
Cayman Islands	5	-	-
Costa Rica	-	21	0.03
Netherlands Antilles	-	33	0.05
Total	112	159	0.23
Europe			
Czech Republic	-	4	*
Hungary	12	30	0.04
Ireland	50	-	-
Italy	30	-	-
Kazakhstan	-	762	1.11
Latvia	5	3	*
Lithuania	45	-	-
Netherlands	8	2	*
Poland	303	2,705	3.95
Portugal	7	35	0.05
Romania	432	407	0.59
Russia	47	17	0.02
Slovakia	273	10	0.01
Spain	39	301	0.44
Turkey	2,816	557	0.81
United Kingdom	4,162	2,047	2.99
Total	8,229	6,880	10.06
North America			
Mexico	16	-	-
Canada	56,212	56,845	83.10
Total	56,212	56,845	83.10
South America			
Argentina	-	5	*
Total	-	5	*
U.S. Total	69,483	68,404	100.00

* = Less than 0.01 percent.

- = No data reported.

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration (EIA), Form EIA-902,

"Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.8 Geothermal heat pump shipments by origin, 2008 and 2009

(rated capacity in tons)

Origin	2008	2009
Arkansas	3,618	3,823
Florida	61,388	76,293
Indiana	115,428	103,916
Michigan	31,561	17,155
Minnesota	13,010	10,618
New York	13,961	11,100
Ohio	3,459	4,950
Oklahoma	117,460	127,555
Oregon	-	29
Pennsylvania	4,849	5,393
South Dakota	18,709	20,227
Tennessee	129	333
Texas	32,447	18,291
Wisconsin	-	7,160
Shipments from United States/Territories	416,019	406,843
Imported	86	250
Total Shipments	416,105	407,093

- = No data reported.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.9 Distribution of U.S. geothermal heat pump imports by country of origin, 2008 and 2009

(rated capacity in tons)

Region/Country	2008	2009	Percent of U.S. Imports 2009
Asia			
China	86	250	100.00
Total	86	250	100.00
U.S. Total	86	250	100.00

Note: Totals may not equal sum of components due to independent rounding.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.10 Geothermal heat pump domestic shipments by customer type, 2008 and 2009

(rated capacity in tons)

Customer	2008	2009
Exporter	-	-
Wholesale Distributor	184,869	173,065
Retail Distributor	1,256	10,463
Installer	160,084	154,321
End-User	413	840
U.S. Total	346,622	338,689

- = No data reported.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.11 Geothermal heat pump domestic shipments by sector and model type, 2009

(rated capacity in tons)

Destination	Model Type				Total
	ARI-320	ARI-325/330	ARI-870	Other Non-ARI Rated	
Residential	8,348	152,107	2,524	9,580	172,559
Commercial ¹	42,051	94,917	18	19,547	156,533
Industrial	3,274	1,448	-	4,875	9,597
Electric Power	-	-	-	-	-
Transportation	-	-	-	-	-
U.S. Total	53,673	248,472	2,542	34,002	338,689

¹Including government.

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geexchange Heat Pumps.

- = No data reported.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.12 Shipments of complete geothermal heating/cooling systems, 2008 and 2009

Shipments Information	2008	2009
Complete Systems		
Shipped	3,891	5,924
Rated Capacity (Tons)	19,043	19,598
Percent of Total Shipments	5	5
Number of Companies	5	3
Revenue of Systems (Thousand Dollars)	17,647	30,908

Note: Complete geothermal heating/cooling system is defined as geothermal heat pump unit with all the necessary functional components, except for installation materials. These include geothermal heat pump, air handler, heat exchanger, and system kits.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.13 Number of companies expecting to introduce new geothermal heat pump products in 2010

New Product Type	Number of Companies
ARI-320 Water-Source Heat Pumps	10
ARI-325 Ground Water-Source Heat Pumps	13
ARI-330 Ground Source Closed-Loop Heat Pumps	11
ARI-870 Direct Geoexchange Heat Pumps	2
Other Non-ARI Rated	4
Non-Geothermal Heat Pump System Components	-

ARI-320 = Water-Source Heat Pumps.

ARI-325 = Ground Water-Source Heat Pumps.

ARI-330 = Ground Source Closed-Loop Heat Pumps.

ARI-870 = Direct Geoexchange Heat Pumps.

- = No data reported.

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.14 Employment in the geothermal heat pump industry, 2007 - 2009

Year	Person Years
2007	1,219
2008	1,537
2009	1,832

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.15 Companies involved in geothermal heat pump activities by type, 2008 and 2009

Type of Activity	2008	2009
Geothermal Heat Pump or System Design	17	17
Prototype Geothermal Heat Pump Development	12	13
Prototype Systems Geothermal Development	5	7
Wholesale Distribution	15	18
Retail Distribution	3	3
Installation	4	3
Manufacture of System Components	3	4

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.16 Geothermal heat pump-related sales as a percentage of total company sales revenue, 2008 and 2009

Percent of Total Sales Revenue	Number of Companies	
	2008	2009
90-100	11	12
50-89	1	3
10-49	4	4
Less than 10	7	8
U.S. Total	23	27

Source: U.S. Energy Information Administration (EIA), Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 4.17 Geothermal energy consumption by direct use of energy and from heat pumps, 1990 - 2009

(quadrillion Btu)

Year	Direct Use	Heat Pumps	Total
1990	0.0048	0.0054	0.0102
1991	0.0050	0.0060	0.0110
1992	0.0051	0.0067	0.0118
1993	0.0053	0.0072	0.0125
1994	0.0056	0.0076	0.0132
1995	0.0058	0.0083	0.0141
1996	0.0059	0.0093	0.0152
1997	0.0061	0.0101	0.0162
1998	0.0063	0.0115	0.0178
1999	0.0079	0.0114	0.0193
2000	0.0084	0.0122	0.0206
2001	0.0090	0.0135	0.0225
2002	0.0090	0.0147	0.0237
2003	0.0086	0.0188	0.0274
2004	0.0086	0.0212	0.0298
2005	0.0088	0.0240	0.0328
2006	0.0091	0.0276	0.0367
2007	0.0094	0.0317	0.0411
2008	0.0097	0.0365	0.0462
2009	0.0087	0.0450	0.0537

Note: Direct use includes applications such as: district heating, aquaculture pond and raceway heating, greenhouse heating and agricultural drying.

Source: John Lund, Oregon Institute of Technology, Geo-Heat Center (Klamath Falls, Oregon, March 2010).

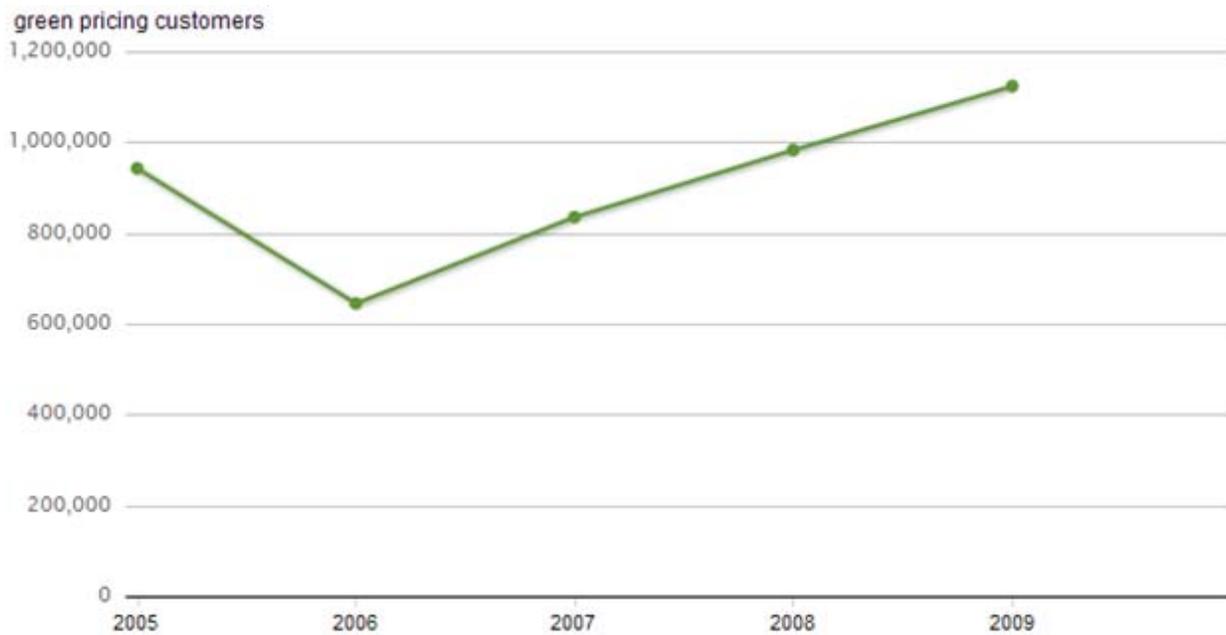
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5. Green pricing and net metering programs 2009

Green pricing programs

In 2009, a total of 680 electric industry participants reported having customers in green pricing programs, 6 percent more than in 2008. The number of customers in green pricing programs increased for the third consecutive year in 2009, reaching a high of 1,123,778 out of a nationwide customer base of 143,497,060³⁵ (Table 5.1). Texas had the most customers with 316,585 in 2009, followed by Oregon with 127,290 and California with 85,535. Although participation varied widely, every state had some green pricing customers, except Alaska, Hawaii, and New Hampshire. The net increase in customers for the year was 140,783, led by large increases in Texas and New York. There were also some states (such as Maryland and Florida) with sharp decreases. Ninety-four percent of green pricing customers nationwide were residential.

Figure 5.1 U.S. green pricing customers, 2005-2009



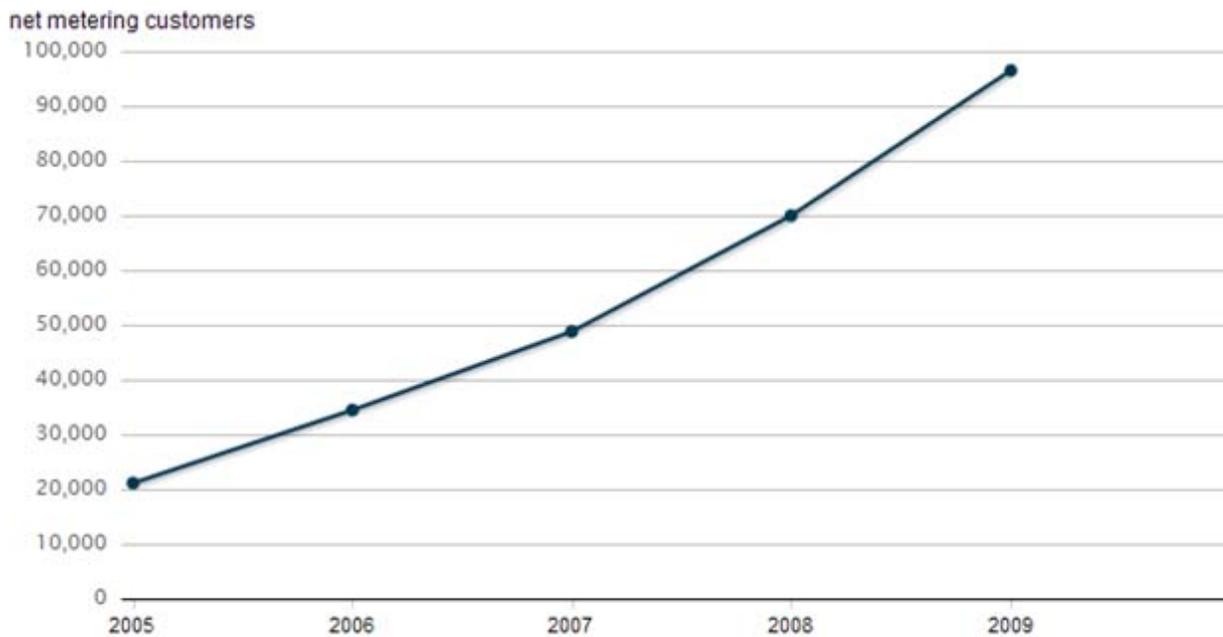
Source: U.S. Energy Information Administration (EIA), Form EIA-861, "Annual Electric Power Industry Report."

³⁵ See also EIA, Electric Power Annual 2009 (Washington, DC April 2011), table 7.1.

Net metering programs

A total of 540 electric industry participants reported having net metering customers in 2009, with customers in every state except Alaska and Tennessee (Table 5.2). Net metering customers totaled 96,506 in 2009, 38 percent more than in 2008 (Figure 5.2). California had, by far, the largest number of net metering customers with 53,187, or 55 percent of the U.S. total. California also accounted for slightly more than a quarter of the increase in 2009. Ninety-one percent of net metering customers nationwide were residential.

Figure 5.2 U.S. net metering customers, 2005-2009



Source: U.S. Energy Information Administration (EIA), Form EIA-861, "Annual Electric Power Industry Report."

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Table 5.1 Estimated U.S. green pricing customers by State and customer class, 2008 and 2009

State	Electric Industry Participants 2009 ¹	Participating Customers			
		Residential	2009		2008
			Residential	Non-Residential	Total
Alabama	24	1,831	30	1,861	1,816
Alaska	-	-	-	-	460
Arizona	6	7,396	224	7,620	4,345
Arkansas	3	24	1	25	25
California	12	81,961	3,574	85,535	83,610
Colorado	28	52,545	2,194	54,739	58,236
Connecticut	5	19,398	567	19,965	146
Delaware	10	4,227	1,296	5,523	12,453
District of Columbia	1	589	1,694	2,283	5,515
Florida	4	3,199	48	3,247	38,484
Georgia	23	8,314	195	8,509	9,356
Hawaii	-	-	-	-	-
Idaho	6	4,690	145	4,835	5,127
Illinois	4	4,752	29	4,781	4,265
Indiana	18	6,424	130	6,554	6,208
Iowa	39	8,220	757	8,977	9,265
Kansas	4	94	4	98	1
Kentucky	25	3,399	37	3,436	3,058
Louisiana	2	485	34	519	395
Maine	2	2,512	244	2,756	2,221
Maryland	3	9,819	6,329	16,148	59,027
Massachusetts	8	13,356	361	13,717	10,212
Michigan	12	30,873	252	31,125	28,128
Minnesota	100	45,241	978	46,219	44,433
Mississippi	13	244	11	255	258
Missouri	19	5,332	84	5,416	4,338
Montana	9	507	29	536	564
Nebraska	3	7,273	22	7,295	7,646
Nevada	2	27	1	28	31
New Hampshire	-	-	-	-	1
New Jersey	3	1,971	30	2,001	2,268
New Mexico	13	18,638	2,050	20,688	3,429
New York	9	64,127	3,753	67,880	28,535
North Carolina	24	12,722	237	12,959	14,223
North Dakota	6	1,643	13	1,656	3,109
Ohio	15	4,203	143	4,346	3,755
Oklahoma	12	14,744	1,114	15,858	10,421
Oregon	24	123,480	3,810	127,290	113,098
Pennsylvania	6	34,577	758	35,335	37,554
Rhode Island	1	4,640	125	4,765	5,206
South Carolina	21	5,878	432	6,310	10,380
South Dakota	6	543	14	557	612
Tennessee	65	19,805	969	20,774	12,699
Texas	22	288,779	27,806	316,585	205,725
Utah	8	27,136	614	27,750	25,898
Vermont	2	4,690	246	4,936	4,792
Virginia	3	6,111	72	6,183	1,062
Washington	25	49,476	1,455	50,931	47,907
West Virginia	2	128	3	131	74
Wisconsin	63	47,669	2,346	50,015	48,118
Wyoming	7	4,493	333	4,826	4,506
U.S. Total	680	1,058,185	65,593	1,123,778	982,995

¹Includes entities with green pricing programs in more than one state.

- = No data reported.

Notes: Totals may not equal the sum of the components due to independent rounding.

Non-residential may include some customers for whom no customer class is specified.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report."

Table 5.2 Estimated U.S. net metering customers by State and customer class, 2008 and 2009

	2009			2008	
	Residential	Non-Residential	Total	Total	
Alabama	1	2	-	2	2
Alaska	-	-	-	-	26
Arizona	9	3,678	161	3,839	1,951
Arkansas	9	57	6	63	31
California	28	49,892	3,295	53,187	45,719
Colorado	28	7,132	672	7,804	3,787
Connecticut	2	1,210	138	1,348	795
Delaware	3	511	79	590	329
District of Columbia	2	97	7	104	31
Florida	30	1,374	196	1,570	509
Georgia	8	65	12	77	43
Hawaii	4	2,632	404	3,036	862
Idaho	5	175	31	206	127
Illinois	12	305	42	347	254
Indiana	13	81	36	117	63
Iowa	18	76	16	92	49
Kansas	6	28	1	29	11
Kentucky	11	40	12	52	23
Louisiana	10	425	11	436	78
Maine	2	51	16	67	14
Maryland	9	749	80	829	255
Massachusetts	10	1,642	412	2,054	1,601
Michigan	13	214	19	233	67
Minnesota	40	661	87	748	588
Mississippi	1	-	1	1	1
Missouri	20	226	124	350	42
Montana	8	451	118	569	469
Nebraska	5	14	7	21	5
Nevada	5	491	58	549	409
New Hampshire	5	342	67	409	224
New Jersey	8	3,959	746	4,705	3,486
New Mexico	15	903	27	930	446
New York	5	3,323	232	3,555	2,320
North Carolina	11	56	25	81	52
North Dakota	3	4	-	4	7
Ohio	16	300	100	400	215
Oklahoma	4	35	3	38	20
Oregon	25	1,446	227	1,673	1,106
Pennsylvania	10	552	98	650	340
Rhode Island	2	120	52	172	125
South Carolina	8	45	9	54	14
South Dakota	4	28	2	30	19
Tennessee	-	-	-	-	-
Texas	25	1,432	112	1,544	991
Utah	9	510	63	573	351
Vermont	7	405	66	471	464
Virginia	15	288	25	313	194
Washington	27	1,403	159	1,562	938
West Virginia	5	41	5	46	25
Wisconsin	44	568	200	768	416
Wyoming	11	166	25	191	115
U.S. Total	540	88,222	8,284	96,506	70,009

¹Includes entities with net metering programs in more than one state.

- = No data reported.

Notes: Totals may not equal the sum of the components due to independent rounding.

Non-residential may include some customers for whom no customer class is specified.

Source: Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report."