DOE/EIA-0603(2002)

Renewable Energy Annual 2002

With Preliminary Data For 2002

November 2003

Energy Information Administration
Office of Coal, Nuclear, Electric and Alternate Fuels
U.S. Department of Energy
Washington, DC 20585

This report is available on the Web at:
http://www.eia.doe.gov/cneaf/solar.renewables/page/rea2002/rea2002.html

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Preface

The *Renewable Energy Annual 2002* is the eighth annual report that the Energy Information Administration (EIA) has published on U.S. renewable energy. It covers energy consumption and electricity generation, as well as solar thermal, photovoltaic, and geothermal heat pump manufacturing activities. This report provides preliminary information for 2002.

The renewable energy resources in the report include: biomass (wood, wood waste, municipal solid waste, landfill gas, ethanol, and other biomass); geothermal; wind; solar (solar thermal and photovoltaic); and conventional hydropower. Hydroelectric pumped storage is excluded, because it is usually based on non-renewable energy sources. Since EIA collects data only on terrestrial (land-based) solar energy systems, satellite and some military applications are not included in this report.

The first chapter provides an overview of renewable energy use and capability from 1998 through 2002. It discusses renewable energy consumption, electric capacity and generation, and energy consumption for non-electric use. Chapter 2 presents current (through 2002) information on the U.S. solar energy industry. EIA collected this information on the Form EIA-63A, "Annual Survey of Solar Collector Manufacturers," and the Form EIA-63B, "Annual Survey of Photovoltaic Module/Cell Manufacturers." Chapter 3 presents information on the U.S. geothermal heat pump industry. This information was collected on the Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey," and covers the calendar years 1996 through 2002.

Appendix A describes EIA surveys that include information on renewable energy resources. Appendix B provides detailed tables of historical data back to 1989 and detailed characteristics especially of biomass energy consumption. Appendix C provides State-level renewable electricity generation, market share, and electric capacity information for 2000 and 2001. Appendix D discusses factors affecting the quality of EIA's renewable data. Appendix E provides a description of all legislation introduced into the 108th session of the U.S. Congress (through September 22, 2003) that affects renewable energy. Appendix F explains revisions made to the EIA methodologies including changes to electricity trade made for the first time in this report. Appendix G provides Internet addresses for information by renewable energy resource. Appendix H lists State agencies that provide energy information. Appendix I is new and presents information on green pricing and net metering programs. Appendix J provides lists of survey respondents for the geothermal heat pump and solar equipment manufacturers' surveys. A glossary of renewable energy terms concludes the report.

The EIA was established formally by the Department of Energy Organization Act of 1977 (Public Law 95-91). The legislation requires EIA to carry out a comprehensive, timely, and accurate program of energy data collection and analysis. It also vests EIA with considerable independence in fulfilling its mission.

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Highlights

Summary

The year 2002 was a year of moderate overall growth in renewable energy-related industries and markets. Total consumption of renewable energy rebounded from the precipitous drop between 2000 and 2001 caused by record low water levels in the West for hydropower. However, geothermal and non-electric biomass energy consumption continued to decline. The photovoltaic (PV) manufacturing industry maintained a healthy growth rate, with domestic sales increases outpacing exports. Finally, the number of geothermal heat pumps manufactured rose in 2002, although total capacity (tonnage) declined.

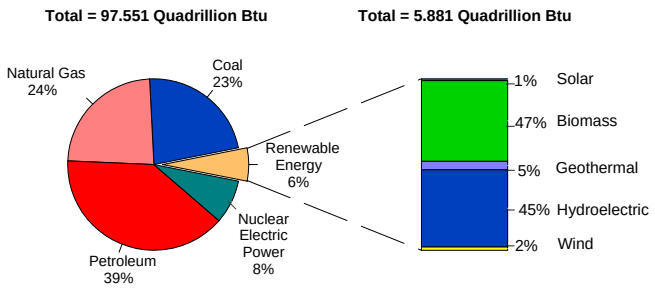
Renewable Energy Consumption

Consumption of renewable energy rose 11 percent between 2001 and 2002 to 5.9 quadrillion Btu (Table H1). A substantial rise in water availability for hydropower (2.7 quadrillion Btu) provided most of the increase. Biomass energy consumption increased very modestly to slightly over 2.7 quadrillion Btu in 2002, due to increased use of biomass for electricity and ethanol as an oxygenate in gasoline. For the third year in a row, biomass was the largest renewable fuel consumed.

Wind energy consumption, though very small at 0.106 quadrillion Btu, grew 56 percent in 2002, largely due to new capacity that came on line at the end of 2001 in response to the expiration of the wind Production Tax Credit. Geothermal and solar energy consumption declined from 2001 to 2002 to 0.304 and 0.064 quadrillion Btu, respectively.

Despite the 11 percent increase, renewable energy's share of total U.S. energy consumption was just 6 percent in 2002 (Figure H1), compared with nearly 7 percent in 1998. Growth in renewable energy continues to be challenged by little or no development of new hydroelectric sites, a slow but lengthy decline in the use of biomass for non-electric purposes, and the high capital costs of most renewable energy production facilities, compared with fossil-fueled alternatives.

Figure H1. The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2002



Source: Table 1 of this report.

Solar Manufacturing Activity

Photovoltaic (PV) cell and module shipments by manufacturers rose 15 percent in 2002 to 112.1 peak megawatts in 2002. Shipments have grown every year since 1993. Domestic shipments grew faster than exports in 2002, in contrast to growth during the 1998-2000 period, which was fueled primarily by exports. Shipments of cells rose rapidly while module shipments declined in 2002. Sales to module manufacturers jumped 69 percent to 23.8 peak megawatts, the highest growth in shipments to any recipient group. Electricity generation (both grid-interactive and remote applications)

Table H1. U.S. Renewable Energy Consumption by Energy Source, 1998-2002
(Quadrillion Btu)

Energy Source	1998	1999	2000	2001	P2002
Renewable Energy	***6.549***	***6.587***	***6.145***	***5.310***	**5.881**
Conventional Hydroelectric	*3.297*	*3.268*	*2.811*	*2.201*	2.668
Geothermal Energy	*0.328*	*0.331*	0.317	*0.311*	0.304
Biomass	2.823	*2.873*	*2.893*	*2.663*	2.738
Solar Energy	0.070	0.069	0.066	*0.065*	0.064
Wind Energy	0.031	0.046	0.057	*0.068*	0.106

P=Preliminary.
Note: Revised data are in italics. The methodology for estimating electricity net imports is revised; see Appendix F. Totals may not equal sum of components due to independent rounding.
Source: Table 1 of this report.

continued as the predominant end use sector for PV cells and modules. Electric generation accounted for half of all shipments, with grid-interactive markets outpacing markets for remote uses.

Exports of PV cells and modules rose 9 percent to 66.8 peak megawatts in 2002. Exports have grown every year since 1985, except 2001. Germany maintained its position as the predominant importer of U.S. PV cells and modules, importing 50 percent of shipments. Japan continued the downward trend seen since 1999, dropping from 4.2 peak megawatts in 2001 to 3.2 peak megawatts in 2002. Japan imported nearly 15 peak megawatts from the U.S in 1999. In contrast, exports to Hong Kong rose 129 percent in 2002, becoming the second-largest U.S. export market with a 16 percent share.

The average unit price of PV cells decreased in 2002 by 14 percent to $2.12 per peak watt. Average module prices, however, increased 9 percent to $3.74 in 2002. The total value of cell and module shipments increased from $305 million in 2001 to $342 million in 2002.

Solar thermal collector manufacturing rose modestly in 2002, consistent with the general pattern seen since 1992 (except for a sharp rise between 2000 and 2001). Total shipments of solar thermal collectors rose 4 percent to 11.7 million square feet. Solar thermal collectors continue to be used mainly for swimming pools and hot water heating. Not surprisingly, most shipments were to the residential sector. Prices of solar thermal collectors were stable at $2.85 per square foot in 2002, compared with $2.90 in 2001.

Geothermal Heat Pump Activity

Shipments of geothermal heat pumps rose 4 percent between 2000 and 2002 to 37,139 units. (EIA did not survey geothermal heat pump manufacturers in 2001.) Heat pump tonnage, however, declined substantially from 164,191 in 2000 to 125,297 in 2002, due to a large drop in sales to industrial customers.

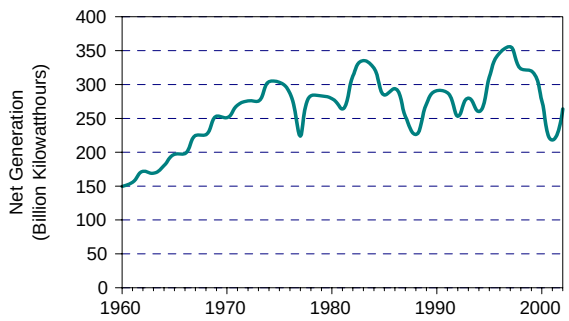
Green Pricing and Net Metering

Survey results on green pricing showed 211 electric industry participants reporting customers in green pricing programs during 2002, with just over 710,000 customers. Also, 98 electric industry participants reported being involved in net metering programs with 5,001 customers.

1. U.S. Renewable Energy Consumption

Renewable energy consumption rebounded nearly 11 percent in 2002 from a decade-low level of 5.3 quadrillion Btu in 2001 (Table 1). Despite this increase, 2002 consumption of 5.9 quadrillion Btu was lower than for any year prior to 2001 since EIA began surveying nonutilities in 1989. Water levels affecting hydroelectric output were principally responsible for both the huge drop in generation in 2001 and the increase in 2002 (Figure 1). Consumption for conventional hydroelectricity dropped from 2.8 quadrillion Btu in 2000 to 2.2 quadrillion Btu in 2001, then rose to 2.7 quadrillion Btu in 2002 (Figure 2).

Figure 1. Conventional Hydroelectric Net Generation, 1960-2002



Notes: Excludes imports. Before 1990 includes pumped storage.
Sources: **1960-1988:** Energy Information Administration, *Annual Energy Review 2000*, DOE/EIA-0384(2000) (Washington, DC, August 2001), Table 8.2**; 1989-2002:** Table 4 of this report.

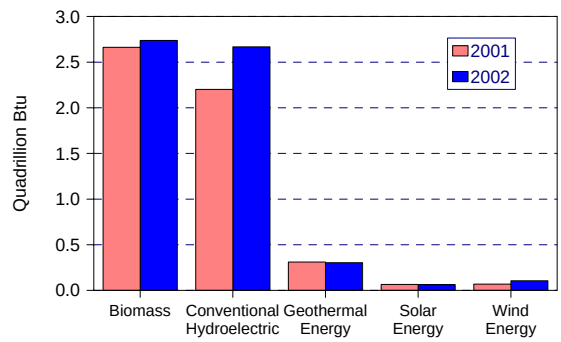
Not all of the impact was due to water levels, however. Biomass energy consumption experienced a similar but less pronounced pattern to that of hydroelectric power from 2000 through 2002. This reflected weak economic activity in 2001 and a partial recovery during 2002.

Geothermal energy consumption continued to decline, reflecting pressure problems at older large fields. Solar energy declined slightly, despite increased sales of solar panels in 2002. This is due to the fact that solar panels are estimated to have a 20-year life, and sales 20 years ago (when larger tax incentives were in place for solar thermal panel purchases) exceeded 2002 levels.

In contrast, wind energy showed strong continuing gains, rising from 0.06 quadrillion Btu in 2000 to 0.07 quadrillion Btu in 2001 and 0.11 quadrillion Btu in 2002. Even the impressive 2001-2002 increase may understate the gains in wind energy capacity, as EIA continues to track down new wind facilities that came on line during 2002.

Over the past 5 years, renewable energy's market share has declined, from 7 percent of total energy consumption in 1998 to 6 percent in 2002. The failure of renewable energy consumption to increase its market share over the past decade reflects the continued high cost of many new renewable

Figure 2. Renewable Energy Consumption by Energy Source, 2001 and 2002



Source: Table 1 of this report.

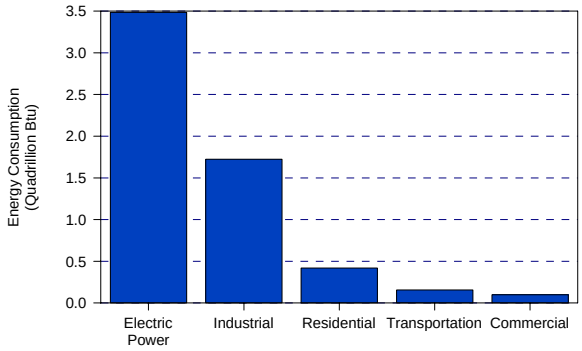
energy technologies, despite impressive cost reductions, compared to the costs of competing technologies, especially those using natural gas.[1]

The electric power sector continues to consume about 60 percent of all renewable energy (Table 2 and Figure 3). Three-fourths of energy consumed in this sector during 2002 was to produce hydroelectricity. Biomass accounted for 13 percent, geothermal 8 percent, and solar and wind the rest. Most biomass-generated electricity was from municipal solid waste (MSW) and landfill gas (LFG).

The industrial sector consumed about 30 percent of renewable energy in 2002. Nearly all (97 percent) was from biomass, principally wood and wood waste (87 percent).

[1]Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2002), Table 1.3.

Figure 3. Renewable Energy Consumption by Energy Use Sector, 2002



Source: Table 2 of this report.

Residential energy demand is heavily from biomass (84 percent), and varies according to the severity of the heating season. Commercial energy demand is almost solely from biomass and has remained at about 0.1 quadrillion Btu for the past 5 years.

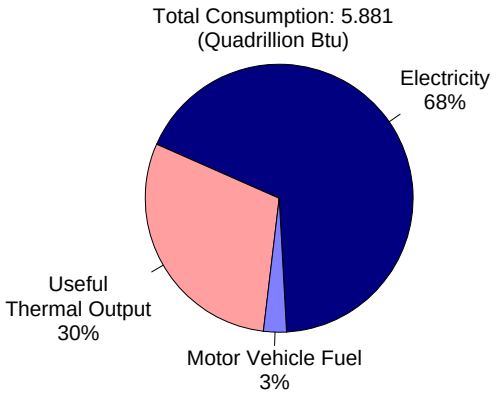
Ethanol consumption in the transportation sector, though small (0.16 quadrillion Btu in 2002), has grown steadily for several years. With several States banning the gasoline oxygenate MTBE (Methyl Tertiary Butyl Ether) and a Federal ban possible, ethanol consumption could surge in the next few years.

The electric power sector, consisting of electric utilities and independent power producers, consumed 87 percent of the total renewable energy used to produce electricity (Table 3). Most of the remaining renewable energy consumed to produce electricity was in the industrial sector, primarily biomass at combined heat and power (CHP) facilities in the paper, chemical, and food-processing industries.

Electricity generation from renewable energy closely mirrors renewable energy consumption for electricity generation. Ninety percent of all renewable electricity was generated by the electric power sector in 2002; almost all the rest was from biomass industrial plants (Table 4).

Renewable electric generating capacity increased barely 0.5 percent in 2002 to 96.2 GW (Table 5). Much of the capacity increase was due to up-ratings at existing hydroelectric facilities, with most of the rest from reported new wind facilities. Renewables' share of total electric generating capacity is essentially unchanged from 1998. Gains in wind and hydro have been offset by losses in wood/ wood waste and geothermal.

Figure 4. Renewable Energy Patterns of Use, 2002



Source: Tables 3 and 6 of this report.

Renewable energy consumption for non-electric use does not fluctuate much. It has declined slowly to 1.9 quadrillion Btu in 2002 from 2.1 quadrillion Btu in 1998 (Table 6). Nearly two-thirds of this consumption is from biomass in the industrial sector, principally paper plants. Over 20 percent is consumed as space heating in the residential sector, followed by ethanol in the transportation sector. Combined with the increase in hydroelectric power, the non-electric share of renewable energy consumption dropped from 35 percent in 2001 to 30 percent in 2002 (Figure 4).

For the third year in a row, biomass provided the most renewable energy consumption 2.7 quadrillion Btu (Table 1 and Table 7). Although three-fourths of this total was derived from wood, a fast-growing component of biomass energy consumption is landfill gas within the waste sub-sector**.** This reflects regulatory efforts to reduce emissions of methane, incentives for LFG facility construction and electricity production, and the recent higher cost of pipeline natural gas.[2] The industrial sector consumed between 72 and 75 percent of total wood energy over the 1998-2002 period.

Of the 1.6 quadrillion Btu of industrial biomass consumed in 2001, over 75 percent produced useful thermal output; only 25 percent was used to generate electricity (Table 8). Ninety-five percent of industrial biomass came from the manufacturing sub-sector, with paper and allied products using three-fourths (1.1 quadrillion Btu) of biomass consumed in manufacturing. A single waste product, black liquor, provided 48 percent of total industrial biomass energy consumption (Table B3).

[2]The principal component of pipeline natural gas is methane.

Over 60 percent of the 0.5 quadrillion Btu of waste biomass energy consumed in 2001 was by independent power producers (IPPs) in the electric power sector (Table 9). The industrial sector consumed almost one-third of waste energy. The vast majority of waste energy consumption by IPPs (0.3 quadrillion Btu) was at MSW facilities. Many of these facilities are "limited liability corporations" (LLCs) associated with specific industrial corporations. Industrial sector facilities consumed 0.15 quadrillion Btu, only half the waste energy consumed by IPPs, with about 40 percent coming from LFG facilities. However, consumption at these facilities is growing; energy from industrial LFG facilities increased from 0.057 quadrillion Btu in 2000 to 0.063 quadrillion Btu in 2001.[3]

Historical renewable energy consumption since 1989 (when EIA first collected information from nonutilities) is shown in Appendix B, Table B1. Over that period, renewable energy peaked in 1996 at 7.1 quadrillion Btu, and was lowest in 2001 at 5.3 quadrillion Btu.

[3]See Table 9 of this report and Energy Information Administration, *Renewable Energy Annual 2001*, DOE/EIA-0603(2001) (Washington, DC, November 2002), Table 9.

Table 1. U.S. Energy Consumption by Energy Source, 1998-2002
(Quadrillion Btu)

Energy Source	1998	1999	2000	2001	P2002
Total	***95.135***	***96.763***	***98.927***	***96.307***	**97.551**
Fossil Fuels	***81.592***	***82.650***	***85.001***	***83.131***	**83.711**
Coal	21.656	21.623	22.580	*21.897*	22.184
Coal Coke Net Imports	*0.067*	*0.058*	*0.065*	*0.032*	0.062
Natural Gas [a]	*22.936*	*23.010*	*23.952*	*22.869*	23.063
Petroleum [b]	36.934	37.960	38.404	*38.333*	38.401
Electricity Net Imports	***0.088***	***0.099***	***0.116***	***0.075***	**0.078**
Nuclear Electric Power	**7.068**	**7.610**	**7.862**	**8.028**	**8.145**
Hydroelectric Pumped Storage [c]	**-0.046**	**-0.062**	**-0.057**	**-0.090**	**-0.089**
Renewable Energy	***6.549***	***6.587***	***6.145***	***5.310***	**5.881**
Conventional Hydroelectric	*3.297*	*3.268*	*2.811*	*2.201*	2.668
Geothermal Energy	*0.328*	*0.331*	0.317	*0.311*	0.304
Biomass	2.823	*2.873*	*2.893*	*2.663*	2.738
Solar Energy	0.070	0.069	0.066	*0.065*	0.064
Wind Energy	0.031	0.046	0.057	*0.068*	0.106

[a] Includes supplemental gaseous fuels.
[b] Petroleum products supplied, including natural gas plant liquids and crude oil burned as fuel.
[c] Pumped storage facility production minus energy used for pumping.
P=Preliminary.

Note: Revised data are in italics. The methodology for estimating electricity net imports is revised; see Appendix F.Totals may not equal sum of components due to independent rounding.

Sources: **Non-renewable energy:** Energy Information Administration (EIA), *Monthly Energy Review April 2003*, DOE/EIA-0035 (2003/06) (Washington, DC, May 2003,) Tables 1.3 and 1.4. **Renewable Energy:** Table 2 of this report.

Table 2. Renewable Energy Consumption by Energy Use Sector and Energy Source, 1998-2002
(Quadrillion Btu)

Sector and Source	1998	1999	2000	2001	P2002
Total	*6.549*	*6.587*	*6.145*	*5.310*	5.881
Residential	**0.459**	**0.486**	**0.503**	*0.476*	**0.419**
Biomass	0.387	0.414	0.433	0.407	0.350
Geothermal	0.008	0.009	0.009	0.009	0.010
Solar [a]	0.065	0.064	0.061	*0.060*	0.058
Commercial	**0.111**	**0.114**	**0.109**	*0.089*	**0.098**
Biomass	0.102	0.106	0.100	*0.080*	0.088
Wood/Wood Waste	0.048	0.052	0.053	*0.041*	0.041
MSW/Landfill Gas	0.050	0.049	0.041	*0.035*	0.041
Other Biomass [b]	0.005	0.005	0.006	*0.004*	0.005
Geothermal	0.007	0.007	0.008	0.008	0.009
Conventional Hydroelectric	0.001	0.001	0.001	0.001	0.001
Industrial	**1.841**	*1.843*	*1.828*	*1.630*	**1.724**
Biomass	1.784	*1.791*	*1.781*	*1.593*	1.678
Wood/Wood Waste	1.603	*1.620*	1.636	*1.443*	1.506
MSW/Landfill Gas	0.092	0.094	*0.064*	*0.074*	0.084
Other Biomass [b]	0.088	0.077	0.081	*0.076*	0.088
Geothermal	0.003	0.004	0.004	0.005	0.005
Conventional Hydroelectric	0.055	0.049	0.042	*0.032*	0.041
Transportation					
Alcohol Fuels [c]	0.105	0.110	0.126	0.133	0.156
Electric Power [d]	**4.032**	**4.034**	**3.579**	*2.982*	**3.485**
Biomass	0.444	0.453	0.453	*0.450*	0.466
Wood/Wood Waste	0.137	0.138	0.134	*0.126*	0.135
MSW/Landfill Gas	0.288	0.292	0.295	*0.310*	0.312
Other Biomass [b]	0.020	0.023	0.023	*0.014*	0.019
Geothermal	0.311	0.312	0.296	*0.289*	0.281
Conventional Hydroelectric	3.241	3.218	2.768	*2.169*	2.627
Solar	0.005	0.005	0.005	*0.006*	0.006
Wind	0.031	0.046	0.057	*0.068*	0.106

[a] Includes small amounts of distributed solar thermal and photovoltaic energy used in the commercial, industrial and electric power sectors.
[b] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[c] Ethanol primarily derived from corn.
[d] Includes electric utilities and independent power producers.
P=Preliminary.

Note: Revised data are in italics. Electricity net imports derived from hydroelectric power and geothermal energy are no longer included in renewable energy consumption data due to the inadequacy of available data. They continue to be reported in total U.S. energy consumption as components of electricity net imports, with fuel sources unspecified. See Table 1 of this report. Totals may not equal sum of components due to independent rounding.

Sources: Analysis conducted by Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels and specific sources described as follows. **Residential:** Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and Energy Information Administration, Form EIA63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." **Commercial**: Energy Information Administration, Form EIA-860B, "Annual Electric Generator Report - Nonutility," Form EIA-906, "Power Plant Report," and Oregon Institute of Technology, Geo-Heat Center. **Industrial:** Energy Information Administration, Form EIA-846 (A, B, C) "Manufacturing Energy Consumption Survey," Form EIA-860B, " Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report;" Oregon Institute of Technology, Geo-Heat Center; and Government Advisory Associates, Resource Recovery Yearbook and Methane Recovery Yearbook. **Transportation:** Energy Information Administration, Form-EIA-819M, "Monthly Oxygenate Telephone Report," and Form EIA-814, "Monthly Imports Report." **Electric Power:** Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," Form EIA-860B, "Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report."

Table 3. Renewable Energy Consumption for Electricity Generation by Energy Use Sector and Energy Source, 1998-2002
(Quadrillion Btu)

Sector/Source	1998	1999	2000	2001	P 2002
Total	***4.450***	***4.452***	***3.995***	***3.397***	**3.979**
Biomass	0.807	0.822	0.826	*0.833*	0.918
Wood/Wood Waste	0.475	0.490	0.496	*0.486*	0.556
MSW/Landfill Gas	0.299	0.301	0.297	*0.323*	0.330
Other Biomass [a]	0.033	0.031	0.033	*0.023*	0.032
Geothermal	0.311	0.312	0.296	*0.289*	0.281
Conventional Hydroelectric	*3.297*	*3.268*	*2.811*	*2.201*	2.668
Solar	0.005	0.005	0.005	*0.006*	0.006
Wind	0.031	0.046	0.057	*0.068*	0.106
Commercial	**0.034**	**0.035**	**0.028**	***0.023***	**0.028**
Biomass	0.033	0.033	0.026	*0.023*	0.027
Wood/Wood Waste	0.001	*	*	*	*
MSW/Landfill Gas	0.029	0.029	0.021	*0.019*	0.023
Other Biomass [a]	0.003	0.004	0.005	*0.004*	0.004
Conventional Hydroelectric	0.001	0.001	0.001	0.001	0.001
Industrial	**0.417**	**0.422**	**0.421**	***0.412***	**0.479**
Biomass	0.362	0.373	0.379	*0.380*	0.438
Wood/Wood Waste	0.349	0.364	0.369	*0.370*	0.426
MSW/Landfill Gas	*	*	*	*0.003*	0.002
Other Biomass [a]	0.012	0.008	0.009	*0.007*	0.010
Conventional Hydroelectric	0.055	0.049	0.042	*0.032*	0.041
Electric Power [b]	**4.000**	**3.996**	**3.547**	***2.962***	**3.472**
Biomass	0.412	0.416	0.421	*0.430*	0.453
Wood/Wood Waste	0.125	0.125	0.126	*0.116*	0.130
MSW/Landfill Gas	0.270	0.271	0.275	*0.301*	0.305
Other Biomass [a]	0.017	0.019	0.020	*0.013*	0.018
Geothermal	0.311	0.312	0.296	*0.289*	0.281
Conventional Hydroelectric	3.241	3.218	2.768	*2.169*	2.627
Solar	0.005	0.005	0.005	*0.006*	0.006
Wind	0.031	0.046	0.057	*0.068*	0.106

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[b] Includes electric utilities and independent power producers.
* = Less than 500 billion Btu.
P=Preliminary.
Note: Revised data are in italics. Electricity net imports derived from hydroelectric power and geothermal energy are no longer included in renewable energy consumption data due to the inadequacy of available data. They continue to be reported in total U.S. energy consumption as components of electricity net imports, with fuel sources unspecified. See Table 1 of this report. Totals may not add due to independent rounding.
Sources: Analysis conducted by Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels and the following specific sources: Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," Form EIA-860B, " Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report."

Table 4. Electricity Net Generation from Renewable Energy by Energy Use Sector and Energy Source, 1998-2002
(Thousand Kilowatthours)

Sector/Source	1998	1999	2000	2001	P 2002
Total	***400,424,069***	***398,959,030***	***356,478,569***	***294,946,110***	**347,450,482**
Biomass	*58,786,321*	59,612,909	*60,726,180*	*56,964,468*	59,401,578
Wood/Wood Waste	*36,338,385*	37,040,734	37,594,866	*35,199,916*	36,543,764
MSW/Landfill Gas	19,930,526	20,072,515	20,304,943	*19,931,044*	20,180,962
Other Biomass [a]	2,517,410	2,499,660	*2,826,371*	*1,833,508*	2,676,851
Geothermal	*14,773,918*	*14,827,013*	14,093,158	*13,740,503*	13,357,034
Conventional Hydroelectric	*323,335,661*	*319,536,028*	*275,572,597*	*216,961,046*	263,641,906
Solar	502,473	495,082	493,375	*542,755*	543,853
Wind	3,025,696	4,487,998	5,593,261	*6,737,337*	10,506,112
Commercial	**2,493,233**	***2,527,117***	**2,111,620**	***1,548,109***	**1,862,248**
Biomass	2,372,766	2,412,455	2,011,871	*1,481,627*	1,777,785
Wood/Wood Waste	37,716	19,671	26,958	*17,626*	11,519
MSW/Landfill Gas	2,020,758	2,041,933	1,601,152	*1,181,827*	1,428,042
Other Biomass [a]	314,292	350,851	383,761	*282,174*	338,224
Conventional Hydroelectric	120,468	114,663	99,749	*66,482*	84,463
Industrial	**33,920,824**	**33,505,006**	**33,626,303**	***30,848,324***	**33,268,441**
Biomass	*28,572,251*	28,746,698	29,491,148	*27,703,056*	29,243,521
Wood/Wood Waste	27,692,538	28,060,358	28,651,835	*26,888,490*	28,212,636
MSW/Landfill Gas	15,637	20,516	30,858	*237,273*	212,489
Other Biomass [a]	864,075	665,824	808,456	*577,292*	818,395
Conventional Hydroelectric	5,348,573	*4,758,307*	4,135,155	*3,145,268*	4,024,920
Electric Power [b]	**364,010,012**	**362,926,907**	***320,740,647***	***262,549,676***	**312,319,793**
Biomass	27,841,304	*28,453,756*	*29,223,160*	*27,779,786*	28,380,272
Wood/Wood Waste	8,608,130	8,960,705	8,916,073	*8,293,800*	8,319,609
MSW/Landfill Gas	17,894,131	18,010,065	18,672,933	*18,511,944*	18,540,431
Other Biomass [a]	1,339,043	1,482,985	*1,634,155*	*974,042*	1,520,232
Geothermal	14,773,918	14,827,013	14,093,158	*13,740,503*	13,357,034
Conventional Hydroelectric	317,866,620	314,663,058	271,337,693	*213,749,295*	259,532,522
Solar	502,473	495,082	493,375	*542,755*	543,853
Wind	3,025,696	4,487,998	5,593,261	*6,737,337*	10,506,112

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[b] Includes electric utilities and independent power producers.
P=Preliminary.
Note: Revised data are in italics. Electricity net imports derived from hydroelectric power and geothermal energy are no longer included in renewable electricity generation data due to the inadequacy of available data. They continue to be reported in total U.S. energy consumption as components of electricity net imports, with fuel sources unspecified. See Table 1 of this report. Totals may not add due to independent rounding.
Sources: Energy Information Administration, Form EIA-759, "Montly Power Plant Report," Form EIA-860B, " Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report."

Table 5. U.S. Electric Net Summer Capacity, 1998-2002
(Megawatts)

Source	1998	1999	2000	2001	[P] 2002
Total	***775,868***	**785,927**	**812,667**	***848,254***	**902,726**
Renewable Total	***94,595***	***95,335***	**94,939**	***95,664***	**96,165**
Biomass	*10,495*	*10,454*	10,024	*9,709*	9,733
Wood/Wood Waste	6,802	6,795	6,141	*5,882*	5,886
MSW/Landfill Gas	3,253	3,214	3,381	*3,292*	3,308
Other Biomass (a)	*441*	*446*	502	*535*	539
Geothermal	2,893	2,846	2,793	*2,216*	2,216
Conventional Hydroelectric	79,151	79,393	79,359	*79,484*	79,842
Solar	335	389	386	*392*	392
Wind	1,720	2,252	2,377	*3,864*	3,982
Nonrenewable Total	***681,274***	***690,592***	**717,728**	***752,590***	**806,561**

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
P=Preliminary.
Note: Revised data are in italics. Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report," Form EIA-860A, " Annual Electric Generator Report - Utility," and Form EIA-860B, " Annual Electric Generator Report - Nonutility."

Table 6. Renewable Energy Consumption for Nonelectric Use by Energy Use Sector and Energy Source, 1998-2002
(Quadrillion Btu)

Sector/Source	1998	1999	2000	2001	P 2002
Total	**2.099**	***2.134***	***2.149***	***1.913***	**1.903**
Biomass	2.016	*2.051*	*2.067*	*1.831*	1.820
Wood	1.701	*1.734*	1.761	*1.531*	1.476
MSW/Landfill Gas	0.131	0.135	*0.104*	*0.095*	0.107
Other Biomass [a]	0.079	0.074	0.077	*0.071*	0.080
Alcohol Fuels [b]	0.105	0.110	0.126	0.133	0.156
Geothermal	0.018	0.019	0.021	0.022	0.024
Solar [c]	0.065	0.064	0.061	*0.060*	0.058
Residential	**0.459**	**0.486**	**0.503**	***0.476***	**0.419**
Biomass	0.387	0.414	0.433	0.407	0.350
Wood	0.387	0.414	0.433	0.407	0.350
Geothermal	0.008	0.009	0.009	0.009	0.010
Solar [c]	0.065	0.064	0.061	*0.060*	0.058
Commercial	**0.077**	**0.079**	**0.082**	***0.066***	**0.070**
Biomass	0.070	0.073	0.074	*0.058*	0.061
Wood	0.048	0.052	0.053	*0.041*	0.041
MSW/Landfill Gas	0.021	0.020	0.020	*0.016*	0.019
Other Biomass [a]	0.001	0.001	0.001	0.001	0.001
Geothermal	0.007	0.007	0.008	0.008	0.009
Industrial	**1.425**	***1.422***	***1.407***	***1.218***	**1.245**
Biomass	1.422	*1.418*	*1.402*	*1.213*	1.240
Wood	1.254	*1.255*	1.267	*1.073*	1.080
MSW/Landfill Gas	0.092	0.094	*0.063*	*0.071*	0.082
Other Biomass [a]	0.076	0.069	0.072	*0.069*	0.078
Geothermal	0.003	0.004	0.004	0.005	0.005
Transportation					
Alcohol Fuels [b]	**0.105**	**0.110**	**0.126**	**0.133**	**0.156**
Electric Power [d]	**0.032**	**0.038**	**0.032**	***0.020***	**0.014**
Biomass	0.032	0.038	0.032	*0.020*	0.014
Wood	0.012	0.013	0.008	*0.010*	0.005
MSW/Landfill Gas	0.018	0.021	0.020	*0.008*	0.007
Other Biomass [a]	0.003	0.004	0.004	*0.001*	0.001

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[b] Ethanol primarily derived from corn.
[c] Includes small amounts of distributed solar thermal and photovoltaic energy used in the commercial, industrial and electric power sectors.
[d] Includes electric utilities and independent power producers.
P=Preliminary.
Note: Revised data are in italics. Totals may not equal sum of components due to independent rounding.
Sources: Analysis conducted by Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels and specific sources described as follows. **Residential:** Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." **Commercial:** Energy Information Administration, Form EIA-860B, " Annual Electric Generator Report - Nonutility," Form EIA-906, "Power Plant Report," and Oregon Institute of Technology, Geo-Heat Center. **Industrial:** Energy Information Administration, Form EIA-846 (A, B, C) "Manufacturing Energy Consumption Survey," Form EIA-860B, " Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report;" Oregon Institute of Technology, Geo-Heat Center; and Government Advisory Associates, *Resource Recovery Yearbook* and *Methane Recovery Yearbook* (various issues). **Transportation:** Energy Information Administration, Form-EIA-819M, "Monthly Oxygenate Telephone Report," and Form EIA-814, "Monthly Imports Report." **Electric Power:** Energy Information Administration, Form EIA-759, "Monthly Power Plant Report," Form EIA-860B, " Annual Electric Generator Report - Nonutility," and Form EIA-906, "Power Plant Report."

Table 7. Biomass Energy Consumption by Energy Source and Energy Use Sector, 1998-2002
(Trillion Btu)

Source/Sector	1998	1999	2000	2001	P2002
Total	**2,823**	***2,873***	***2,893***	***2,663***	**2,738**
Wood Energy Total	**2,175**	***2,224***	**2,257**	***2,017***	**2,032**
Residential	387	414	433	407	350
Commercial	48	52	53	*41*	41
Industrial	1,603	*1,620*	1,636	*1,443*	1,506
Electric Power [a]	137	138	134	*126*	135
Waste Energy Total	**542**	**540**	***511***	***514***	**550**
MSW/Landfill Gas	430	435	*400*	*419*	437
Commercial	50	49	41	*35*	41
Industrial	92	94	*64*	*74*	84
Electric Power [a]	288	292	295	*310*	312
Other Biomass [b]	112	105	111	*95*	113
Commercial	5	5	6	*4*	5
Industrial	88	77	81	*76*	88
Electric Power [a]	20	23	23	*14*	19
Alcohol Fuels [c]					
Transportation	**105**	**110**	**126**	**133**	**156**

[a] Includes electric utilities and independent power producers.
[b] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[c] Ethanol primarily derived from corn.
P=Preliminary.
Note: Revised data are in italics. Totals may not equal sum of components due to independent rounding.
Source: Table 2 of this report.

Table 8. Industrial Biomass Energy Consumption and Electricity Net Generation by Primary Purpose of Business, 2001

Industry	Biomass Energy Consumption (Trillion Btus)			Net Generation (Thousand Kilowatthours)
	Total	For Electricity	For Useful Thermal Output	
Total	**1,592.920**	**379.614**	**1,213.305**	**27,703**
Agriculture, Forestry and Mining	10.445	2.602	7.843	204
Manufacturing	1,515.475	377.012	1,138.462	27,499
Food and Kindred Products	49.212	2.467	46.745	196
Lumber	269.783	29.505	240.278	1,648
Paper and Allied Products	1,144.422	343.358	801.064	25,524
Chemicals and Allied Products	21.583	0.758	20.826	32
Other [a]	30.474	0.925	29.549	99
Nonspecified [b]	67.000		67.000	

[a] Other includes Apparel; Petroleum Refining; Rubber and Misc. Plastic Products; Transportation Equipment; Stone, Clay, Glass, and Concrete Products; Furniture and Fixtures; and related industries.
[b] Primary purpose of business is not specified.
Note: Blank cell indicates the industry has no data to report. Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration, Form EIA-906, "Power Plant Report;" Government Advisory Associates, *Resource Recovery Yearbook and Methane Recovery Yearbook* (various issues); and analysis conducted by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

Table 9. Waste Energy Consumption by Type and Energy Use Sector, 2001
(Trillion Btu)

Type	Sector				
			Electric Power		
	Commercial	Industrial	Electric Utilities	Independent Power Producers	Total
Total	**39**	**150**	**13**	**311**	**514**
MSW and Landfill Gas	35	74	11	299	419
MSW	33	11	8	237	289
Landfill Gas	2	63	2	62	130
Other Biomass [a]	4	76	3	12	95

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
MSW = Municipal Solid Waste
Note: Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration, Form EIA-906, " Power Plant Report," and Government Advisory Associates, *Resource Recovery Yearbook and Methane Recovery Yearbook* (various issues); and analysis conducted by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

2. Solar Thermal and Photovoltaic Collector Manufacturing Activities

Introduction

Material in this chapter is based upon manufacturing shipment information reported on Form EIA-63A ("Annual Solar Thermal Collector Manufacturers Survey") and Form EIA-63B ("Annual Photovoltaic Module/Cell Manufacturers Survey"). Domestic shipments of photovoltaic cells and modules have increased to seven times the 1993 levels (Table 10), while solar thermal collector shipments have grown 68 percent during the same time frame (Table 11).

Solar Thermal Collector Manufacturing Activities

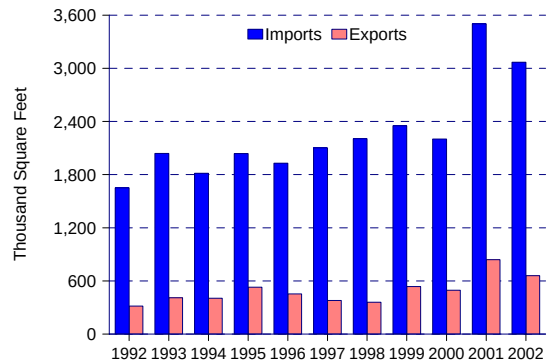
Total shipments of solar thermal collectors[4] were 11.7 million square feet in 2002. This represented an increase of 4 percent from the 2001 total of 11.2 million square feet. There were 27 companies shipping solar collectors in 2002, one more than in 2001. Import and export shipments both declined from 2001 record levels to 3.1 million square feet and 0.7 million square feet, respectively (Figure 5).

Low-temperature solar collectors represented 95 percent of total shipments, while medium-temperature collectors were responsible for approximately 5 percent (Table 12). Medium-temperature collector shipments in 2002 increased 129 percent from 2001, reversing the decline in shipments each year since 1995. High-temperature collectors used by utilities and non-utilities in experimental grid electricity programs represented less than 1 percent of total shipments (Table 12, Figure 6).

U.S. firms in six States (California, New York, Hawaii, New Jersey, Florida, and Texas) and Puerto Rico manufactured nearly all U.S. solar thermal collectors in 2002 (Table 13). Shipments included both components and integrated solar collector systems.

Domestic shipments were sent to 46 States, Puerto Rico, and the U.S. Virgin Islands (Table 14). Exports went mainly to Canada (41 percent), Mexico (23 percent), Sweden (8 percent), France (7 percent), Germany (4 percent), and Austria (3 percent) (Table 15). Fifty-five percent of total shipments were sent directly to wholesale distributors, 39 percent to retail distributors, 3 percent to installers, 2 percent to exporters, and 1 percent to other end users (Table 16). Compared with 2001, wholesalers, retail distributors and installers gained while exporters, end users and others declined.

Figure 5. Import and Export Shipments of Solar Thermal Collectors, 1992-2002



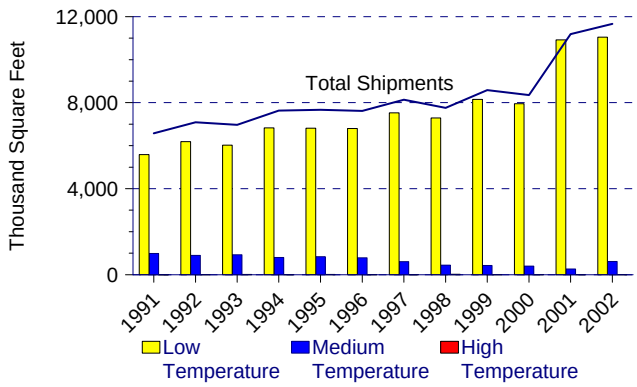
Notes: Total shipments as reported by respondents include all domestic and export shipments and may include imports that subsequently were shipped to domestic or foreign customers.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

The value of total shipments was $33.3 million in 2002, an increase of 3 percent from 2001 (Table 17). The average price for total shipments decreased 2 percent, from $2.90 per square foot in 2001 to $2.85 per square foot in 2002. The value of low-temperature collectors, 95 percent of total shipments, decreased from $23.5 million in 2001 to $21.8 million in 2002, a decrease of 7 percent (Figure 7, Table 17). The average price of low-temperature collectors decreased from $2.15 in 2001 to $1.97 in 2001. In contrast, while the value of medium-temperature collectors increased from $8.7 million to $11.4 million (a growth of 32 percent), the average price fell 43 percent to $18.63 per square foot. Shipments of flat plate collectors were responsible for the decline in average price of medium-temperature collectors, falling 47 percent.

The residential sector continues to be the prime market for solar collectors, totaling 11.0 million square feet, or 94 percent of total shipments (Table 18). The commercial sector was the second largest, with 0.6 million square feet (5 percent). The largest end use for solar collectors shipped in 2002 was for heating swimming pools, consuming 11.1

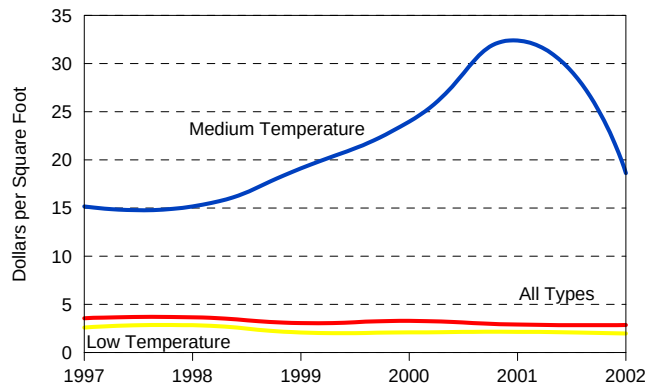
[4] Solar thermal collectors are divided into three categories: low, medium, and high-temperature collectors. The type is usually determined by the level of heat generated.

Figure 6. Solar Thermal Collector Shipments by Collector Type, 1991-2002



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

Figure 7. Average Price of Solar Thermal Collector Shipments by Collector Type, 1997-2002



Notes: The average price of high-temperature collectors, not shown in this figure, increased dramatically in 1999 from 1998. However, shipments of high-temperature collectors represented less than 0.25 percent of total shipments and thus had little impact on the overall trend.

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

million square feet (95 percent) of total shipments. The second-largest use was for domestic hot water heating (4 percent). This marked an increase from 2001 to 2002, when domestic hot water heating represented approximately 2 percent of total shipments. The value of shipments of complete systems increased to $10.4 million in 2002 from $8.9 million in 2001 (Table 19).

Of the 27 active companies shipping solar collectors, two are planning to introduce new low-temperature collectors, four are planning new medium-temperature collectors, and two expect to introduce high-temperature collectors (Table 20). In 2002, the industry remained highly concentrated – the 10 largest companies accounted for 98 percent of total shipments (Table 21). In fact, the percent of total shipments by the top 5 companies has been at least 90 percent since 1999. Employment increased 39 percent in 2002 from 2001 to the highest level since 1995 (Table 22). A total of 20 firms were involved in the design of collectors or systems, 13 were involved in prototype collector development, and 9 were active in prototype system development (Table 23). Nineteen companies had 90 percent or more of their total companywide sales in solar collectors, while four companies had 50 to 89 percent, and 3 companies had less than 10 percent (Table 24).

Photovoltaic Module and Cell Manufacturing Activities[5]

Photovoltaic (PV) cell and module shipments reached 112.1 peak megawatts in 2002, a 15 percent increase from the 2001 total of 97.7 peak megawatts (Table 25). Photovoltaic cells represented 43 percent of shipments in 2002 versus 31 percent in 2001. Photovoltaic modules represented 57 percent of shipments in 2002 versus 69 percent in 2001 (Table 25).

Exports increased to 66.8 peak megawatts in 2002 from 61.4 peak megawatts in 2001, an increase of 9 percent (Table 26 and Figure 8). However, exports' share of total shipments dropped to 60 percent in 2002, compared with 63 percent in 2001. In contrast, there was the same number (19) of companies manufacturing photovoltaic products in 2002 as in 2001.

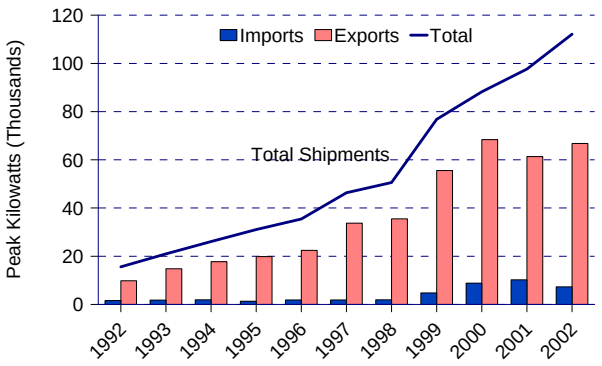
Trends in sales to different groups of recipients varied. Sales to wholesale distributors, the largest recipient category, rose 5 percent to 62.7 peak megawatts in 2002 from 59.8 peak megawatts, and represented 56 percent of total shipments in 2002 versus 61 percent in 2001 (Table27). Sales to the second-largest category, module manufacturers, jumped 69 percent to 23.8 peak megawatts in 2002 from 14 peak megawatts in 2001.

Crystalline silicon cells[6] and modules continued to dominate the PV industry in 2002, accounting for 93 percent of total shipments (Table 28). Within this category, single-crystal shipments in 2002 rose sharply to 74.7 peak megawatts, or 67 percent of total shipments. Cast and ribbon silicon shipments remained relatively unchanged during 2002 at 29.4 peak

[5] Data for cells and modules are for terrestrial use only (i.e., excludes space applications).

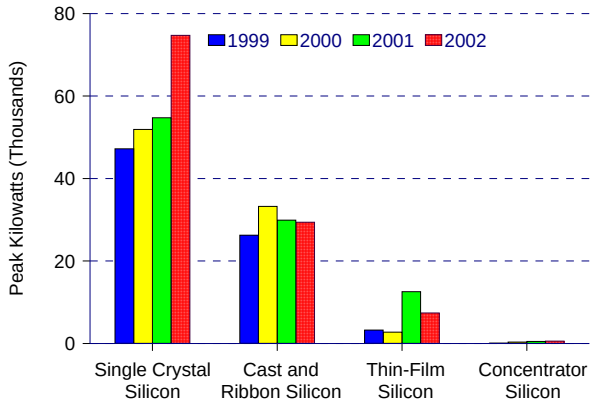
[6] Photovoltaic (PV) components are divided into three categories by product type: (1) crystalline silicon cells and modules which include single-crystal, cast silicon, and ribbon silicon; (2) thin-film cells and modules made from a number of layers of photosensitive materials such as amorphous silicon; and (3) concentrator cells and modules in which a lens is used to gather and converge sunlight onto the cell or module surface.

Figure 8. Import and Export Shipments of Photovoltaic Cells and Modules, 1992-2002



Notes: Total shipments as reported by respondents include all domestic and export shipments and may include imports that subsequently were shipped to domestic or foreign customers.
Source: Energy Information Administration, Form EIA-63B, Annual Photovoltaic Module/Cell Manufacturers Survey."

Figure 9. Photovoltaic Cell and Module Shipments by Type, 1999-2002



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

megawatts. However, its market share declined to 26 percent from 31 percent of total shipments in 2001. Thin-film shipments decreased substantially to 7.4 peak megawatts in 2002 and represented only 7 percent of total shipments (Figure 9).

The total value of photovoltaic cell and module shipments grew 12 percent to $342 million in 2002 from $305 million in 2001 (Table 29). The average price for modules (dollars per peak watt) increased 9 percent, from $3.42 in 2001 to $3.74 in 2002. For cells, the average price decreased 14 percent, from $2.46 in 2001 to $2.12 in 2002.

The industrial sector replaced the residential sector as the largest market for PV cells and modules in 2002. Shipments to this sector totaled 32.2 megawatts and grew at a rate of 15 percent from 2001 to 2002. The residential sector totaled 29.3 megawatts in 2002, declining 12 percent. However, its share of the market was still significant at 26 percent.

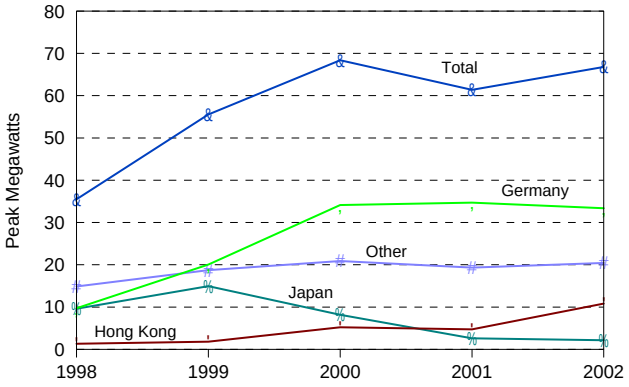
Internationally, the United States photovoltaics markets have benefited from new government–sponsored programs, such as favorable tax credits and loan subsidies including favorable loan repayment schedules in Germany and Japan in past years. However, since 2000 U.S. exports to Japan have dropped sharply, because Japan's domestic production is expanding rapidly.[7] In developing countries like Indonesia and Brazil, the World Bank has made low interest energy loans with long term pay-back schedules for the installation of residential applications for PVs. The United States also has implemented a "Million Solar Roofs Initiative" program as well as various loan programs. In addition, an increasing number of utilities have sponsored programs such as net metering, portfolio standards, and green pricing. In general, a growing group of industries and residential sector customers appears willing to pay for PV-based installations. The commercial sector, the third largest sector in peak kilowatts shipped, increased by 31 percent its use of PV cells and modules in 2002.

Electricity generation, which consists of both grid-interactive and remote applications, continues to be the predominant end use for PV cells and modules. In 2002, electric generation continued to account for 50 percent of total shipments with grid-interactive usage growing 25 percent. In 2002, communication and transportation end uses were the second- and third-largest end uses, respectively, totaling 30 percent. Shipments to the health sector increased 31 percent in 2002, while shipments for consumer goods declined 16 percent to 3.4 megawatts in 2002.

Export shipments rebounded 9 percent to 66.8 peak megawatts in 2002 from 61.4 peak megawatts in 2001 (Table 31 and Figure 10). Shipments to Europe represented 58 percent of total U.S. exports, with Germany alone being responsible for 50 percent. Asia and the Middle East totaled 23.5 percent of total exports. Hong Kong imported 16.2 percent of total U.S. exports, an increase of 129 percent (Table 32).[8] This increase coincides with a government

[7] For year 2000 data, see Table 30, "Destination of U.S. Photovoltaic Cell and Module Export Shipments by Country, 2000," on the EIA website: http:www.eia.doe.gov/cneaf/solar.renewable/page/solar/table30.html, (October 1, 2003).
[8] For year 2001 data, see Energy Information Administration, *Renewable Energy Annual 2001*, DOE/EIA-0603(2001) (Washington, DC, November 2002), p.24, Table 32.

Figure 10. U.S. Photovoltaic Export Shipments by Major Country of Destination, 1998-2002



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

sponsored study on the potential applications of renewable energy in Hong Kong. It includes a demonstration project to evaluate the performance of various building integrated photovoltaic (BIPV) panels.[9] The percent of shipments to Japan dropped to only 3.2 percent of the market in 2002, down from a previous peak of 26.9 percent in 1999.[10]

While complete PV systems[11] shipped increased by 64 percent in 2002, the total value of complete systems decreased 10 percent in 2002 to $45.4 million, as the complete systems shipped in 2002 were smaller and less expensive compared to 2001 (Table 33). Employment in the PV manufacturing industry remained stable, increasing only 1 percent from the nine-year high in 2001 (Table 34). Ten companies plan to introduce crystalline silicon products, and five companies plan to introduce thin-film products (Table 35) in 2003. Many companies that are engaged in the manufacture and/or importation of PV modules and cells reported their involvement in other PV-related activities including: 11 in cell manufacturing and 16 in module or system design; 12 in prototype module development and 11 in prototype systems development; 12 in wholesale distribution, 8 in retail distribution, and 8 in installation (Table 36).

[9] Environment, Transport and Works Bureau, The Government of the Hong Kong Special Administrative Region, *Study on the Potential Applications of Renewable Energy in Hong Kong*, see http://www.etwb.gov.hk/boards_and_committees/ace/2003ace/paper052003/index.aspx?langno=1&nodeid=324, (October 1, 2003).

[10] Energy Information Administration, *Renewable Energy Annual 2000*, DOE/EIA-0603(2000) Washington, DC, (March 2001), p. 25, Table 30.

[11] A complete PV system is defined as a power supply unit that satisfies all the power requirements of an application. Such a system is generally made up of one or more 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 that can be included.

Table 10. Annual Photovoltaic and Solar Thermal Domestic Shipments, 1993-2002

Year	Photovoltaic Cells and Modules [a] (Peak Kilowatts)	Solar Thermal Collectors [a] (Thousand Square Feet)
1993	6,137	6,557
1994	8,363	7,222
1995	11,188	7,136
1996	13,016	7,162
1997	12,561	7,759
1998	15,069	7,396
1999	21,225	8,046
2000	19,839	7,857
2001	36,310	10,349
2002	45,313	11,004
Total	**189,021**	**80,490**

[a] Total shipments minus export shipments.

Notes: Totals may not equal sum of components due to independent rounding. Total shipments include those made to U.S. Territories.

Sources: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 11. Annual Shipments of Solar Thermal Collectors, 1993-2002

Year	Number of Companies	Collector Shipments [a] (Thousand Square Feet)		
		Total [b]	Imports	Exports
1993	41	6,968	2,039	411
1994	41	7,627	1,815	405
1995	36	7,666	2,037	530
1996	28	7,616	1,930	454
1997	29	8,138	2,102	379
1998	28	7,756	2,206	360
1999	29	8,583	2,352	537
2000	26	8,354	2,201	496
2001	26	11,189	3,502	840
2002	27	11,663	3,068	659

[a] Includes imputation of shipment data to account for nonrespondents.

[b] Includes shipments of solar thermal collectors to the government, including some military, but excluding space applications.

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

Table 12. Annual Shipments of Solar Thermal Collectors by Type, 1993-2002
(Thousand Square Feet)

Year	Low-Temperature		Medium-Temperature		High-Temperature
	Total Shipments [a, b]	Average per Manufacturer	Total Shipments [a]	Average per Manufacturer	Total Shipments [a, c]
1993	6,025	464	931	28	12
1994	6,823	426	803	26	2
1995	6,813	487	840	32	13
1996	6,821	487	785	41	10
1997	7,524	579	606	29	7
1998	7,292	607	443	23	21
1999	8,152	627	427	21	4
2000	7,948	723	400	25	5
2001	10,919	1,092	268	16	2
2002	11,046	921	615	34	2

[a] Includes imputation of shipment data to account for nonrespondents.
[b] Includes shipments of solar thermal collectors to the government, including some military, but excluding space applications.
[c] For high-temperature collectors, average annual shipments per manufacturer are not disclosed.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 13a. Domestic Shipments of Solar Collectors Ranked by Top Five Origins and Destinations, 2002

Origin/Destination	2002 Shipments	
	Thousand Square Feet	Percent of U.S. Total
Origin		
California, New York, and Hawaii	4,481	38
New Jersey	3,482	30
Florida	502	4
Puerto Rico	111	1
Texas	13	*
Top Five Total	**8,588**	**74**
Other	**7**	*****
Imported	**3,068**	**26**
U.S. Total	**11,663**	**100.0**
Destination		
Florida	4,368	38
California	3,213	28
New Jersey	937	8
Arizona	530	5
Hawaii	274	2
Top Five Total	**9,322**	**80**
Other	**1,682**	**14**
Exported	**659**	**6**
U.S. Total	**11,663**	**100.0**

* Denotes values less than 0.5 percent.
Notes: Totals may not equal sum of components due to independent rounding. U.S. total includes territories.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 13b. Domestic Shipments of Solar Collectors Ranked by Top Five Origins and Destinations, 2001

Origin/Destination	2001 Shipments	
	Thousand Square Feet	Percent of U.S. Total
Origin		
New Jersey, New York, and Hawaii	3,646	33
California	3,413	31
Florida	503	4
Puerto Rico	90	1
Texas	29	*
Top Five Total	7,681	69
Other States	7	*
Imported	3,502	31
U.S. Total	11,189	100
Destination		
Florida, Connecticut	5,132	46
California	3,290	29
Arizona	450	4
Nevada	198	2
Oregon	154	1
Top Five Total	9,224	82
Other States	1,126	10
Exported	840	8
U.S. Total	11,189	100

* Denotes values less than 0.5 percent.

Notes: Totals may not equal sum of components due to independent rounding. U.S. total includes territories.

Source: Energy Information Administration, Form EIA-63A, “Annual Solar Thermal Collector Manufacturers Survey.”

Table 14. Shipments of Solar Thermal Collectors by Destination, 2002 (Square Feet)

Destination	Shipments
Alabama	502
Arizona	529,737
Arkansas	116
California	3,212,809
Colorado	19,179
Connecticut	213,875
Delaware	2,206
Florida	4,368,364
Georgia	50,664
Hawaii	274,143
Idaho	2,923
Illinois	255,949
Indiana	15,975
Iowa	437
Kansas	335
Kentucky	2,101
Louisiana	20,917
Maine	349
Maryland	8,174
Massachusetts	42,630
Michigan	46,206
Minnesota	18,766
Mississippi	1,114
Missouri	113
Nevada	108,208
New Hampshire	271
New Jersey	936,649
New Mexico	52,635
New York	99,426
North Carolina	17,792
Ohio	63,299
Oklahoma	2,188
Oregon	97,933
Pennsylvania	113,441
Puerto Rico	113,872
Rhode Island	852
South Carolina	4,390
South Dakota	9,577
Tennessee	1,985
Texas	86,574
Utah	4,671
Vermont	5,936
Virgin Islands	1,913
Virginia	140,969
Washington	16,142
West Virginia	1,354
Wisconsin	36,738
Wyoming	66
Shipments to United States/Territories	**11,004,464**
Exports	**658,865**
Total Shipments	**11,663,329**

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

Table 15. Distribution of U.S. Solar Thermal Collector Exports by Country, 2002

Country	Percent of U.S. Exports
Asia and the Middle East	
Japan	2.3
Saudi Arabia	.3
Total	**2.6**
Europe	
Austria	3.2
Belgium & Luxembourg	1.9
Czech Republic	2.3
Denmark	0.4
France	6.7
Germany	3.9
Sweden	8.2
United Kingdom	1.9
Total	**28.5**
North America	
Bahamas	*
Barbados	*
Canada	41.3
Costa Rica	2.3
Guatemala	1.3
Mexico	22.7
Total	**67.7**
South America	
Bolivia	0.3
Ecuador	0.1
Peru	0.4
Total	**0.8**
Total	**99.6**

Notes: Totals may not equal sum of components due to independent rounding.
* = Value less than 0.05 percent.
Source: EIA Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 16. Distribution of Solar Thermal Collector Shipments, 2001 and 2002

Recipient	Shipments (Thousand Square Feet) 2001	2002
Wholesale Distribution	6,086	6,411
Retail Distributors	4,076	4,509
Exporters	473	177
Installers	266	403
End Users and Other [a]	288	162
Total	**11,189**	**11,663**

[a] Other includes minimal shipments not explained on form EIA-63A.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration. Form EIA-63A. "Annual Solar Thermal Collector Manufacturers Survey."

Table 17. Solar Thermal Collector Shipments by Type, Quantity, Value, and Average Price, 2001 and 2002

Type	2001 Quantity (Thousand Square Feet)	2001 Value (Thousand Dollars)	2001 Average Price (Dollars per Square Foot)	2002 Quantity (Thousand Square Feet)	2002 Value (Thousand Dollars)	2002 Average Price (Dollars per Square Foot)
Low-Temperature						
Liquid and Air	10,919	23,498	2.15	11,046	21,783	1.97
Medium-Temperature						
Air	4	57	15.77	83	220	2.63
Liquid						
ICS/Thermosiphon	81	3,799	46.65	110	5,229	47.74
Flat Plate	181	4,707	25.98	419	5,771	13.77
Evacuated Tube	2	116	71.81	2	227	100.00
Concentrator	*	1	--	W	W	W
All Medium-Temperature	268	8,680	32.40	615	11,449	18.63
High-Temperature						
Parabolic Dish and Trough	2	261	107.76	2	54	22.50
Total	**11,189**	**32,438** [a]	**2.90**	**11,663**	**33,286**	**2.85**

[a] Total includes institutional research project.
ICS = Integral collector storage.
* = less than 0.5 thousand square feet
W = Data withheld to avoid disclosure of proprietary company data.
-- = Does not apply.
Notes: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 18. Shipments of Solar Collectors by Market Sector, End Use, and Type, 2001 and 2002
(Thousand Square Feet)

Type	Low-Temperature Liquid/Air Metallic and Nonmetallic	Medium-Temperature Air	Medium-Temperature Liquid ICS/Thermosiphon	Medium-Temperature Liquid Flat-Plate (Pumped)	Medium-Temperature Liquid Evacuated Tube	Medium-Temperature Liquid Concentrator	High-Temperature Parabolic Dish/Trough	2002 Total	2001 Total
Market Sector									
Residential	10,519	23	106	350	2	*	0	**11,000**	**10,125**
Commercial	524	1	3	65	*	0	2	**595**	**1,012**
Industrial	2	60	0	0	0	0	0	**62**	**17**
Utility	0	0	0	4	0	0	0	**4**	**1**
Other [a]	0	0	1	0	0	*	0	**1**	**35**
Total	**11,046**	**83**	**110**	**419**	**2**	*	**2**	**11,663**	**11,189**
End use									
Pool Heating	11,045	0	0	28	0	0	0	**11,073**	**10,797**
Hot Water	1	0	109	311	1	*	0	**423**	**274**
Space Heating	0	75	*	69	1	0	0	**146**	**70**
Space Cooling	0	0	0	0	*	0	0	*	**0**
Combined Space and Water Heating	0	4	0	11	0	*	2	**17**	**12**
Process Heating	0	4	0	0	0	0	0	**4**	**34**
Electricity Generation	0	0	0	0	0	0	0	**0**	**2**
Other [b]	0	0	0	0	0	0	0	**0**	**0**
Total	**11,046**	**83**	**110**	**419**	**2**	*	**2**	**11,663**	**11,189**

[a] Other market sector includes shipments of solar thermal collectors to sectors such as government, including the military but excluding space applications.
[b] Other end use includes shipments of solar thermal collectors for other uses such as cooking, water pumping, water purification, desalinization, distillation.
* = Less than 500 square feet.
ICS = Integral Collector Storage.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey."

Table 19. Shipments of Complete Solar Thermal Collector Systems, 2001 and 2002

Shipment Information	2001	2002
Complete Collector Systems		
Shipped	4,455	6,333
Thousand Square Feet	466	904
Percent of Total Shipments	4	8
Number of Companies	26	27
Value of Systems (Thousand Dollars)	8,863	10,363

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

Table 20. Number of Companies Expecting To Introduce New Solar Thermal Collector Products in 2003

New Product Type	Number of Companies
Low-Temperature Collectors	2
Medium-Temperature Collectors	4
High-Temperature Collectors	2
Noncollector Components	4

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

Table 21. Percent of Solar Collector Shipments by 10 Largest Companies, 1993-2002

Year	Company Rank	Shipments (Thousand Square Feet)	Percent of Total Shipments
1993	1-5	6,135	88
	6-10	551	8
1994	1-5	6,401	84
	6-10	861	11
1995	1-5	6,525	85
	6-10	806	11
1996	1-5	6,452	85
	6-10	910	12
1997	1-5	7,183	88
	6-10	731	9
1998	1-5	6,938	89
	6-10	613	8
1999	1-5	7,813	91
	6-10	563	7
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

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

Table 22. Employment in the Solar Thermal Collector Industry, 1993-2002

Year	Person Years
1993	392
1994	402
1995	386
1996	239
1997	184
1998	207
1999	289
2000	284
2001	256
2002	356

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

Table 23. Companies Involved in Solar Thermal Activities by Type, 2001 and 2002

Type of Activity	2001	2002
Collector or System Design	21	20
Prototype Collector Development	12	13
Prototype System Development	11	9
Wholesale Distribution	17	21
Retail Distribution	16	13
Installation	10	10
Noncollector System Component Manufacture	9	12

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

Table 24. Solar-Related Sales as a Percentage of Total Sales, 2001 and 2002

Percent of Total Sales	Number of Companies	
	2001	2002
90-100	20	19
50-89	4	4
10-49	0	1
Less than 10	2	3
Total	**26**	**27**

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

Table 25. Annual Shipments of Photovoltaic Cells and Modules, 2000-2002
(Peak Kilowatts)

Item	2000	2001	2002
Cells	33,213	30,633	47,677
Modules	55,007	67,033	64,413
Total	**88,221**	**97,666**	**112,090**

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

Table 26. Annual Shipments of Photovoltaic Cells and Modules, 1993-2002

Year	Number of Companies	Photovoltaic Cell and Module Shipments [a] (Peak Kilowatts)		
		Total	Imports	Exports
1993	19	20,951	1,767	14,814
1994	22	26,077	1,960	17,714
1995	24	31,059	1,337	19,871
1996	25	35,464	1,864	22,448
1997	21	46,354	1,853	33,793
1998	21	50,562	1,931	35,493
1999	19	76,787	4,784	55,562
2000	21	88,221	8,821	68,382
2001	19 [b]	97,666	10,204	61,356
2002	19	112,090	7,297	66,778

[a] Does not include shipments of cells and modules for space/satellite applications.
[b] British Petroleum (BP) purchased Solarex in 2000. In 2000, they submitted individual forms; in 2001, they submitted one merged form, decreasing the total number of companies that submitted forms.
Note: 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: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 27. Distribution of Photovoltaic Cells and Modules, 2000-2002

Recipient	Shipments (Peak Kilowatts)		
	2000	2001	2002
Wholesale Distributors	50,568	59,799	62,651
Retail Distributors	4,345	5,302	8,270
Exporters	2,648	4,441	449
Installers	6,055	10,810	11,538
End-Users	2,600	1,482	4,012
Module manufacturers	19,451	14,045	23,784
Other [a]	2,553	1,787	1,386
Total	**88,221**	**97,666**	**112,090**

[a] Other includes categories not identified by reporting companies.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, " Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 28. Photovoltaic Cell and Module Shipments by Type, 2000-2002

Type	Shipments (Peak Kilowatts)			Percent of Total		
	2000	2001	2002	2000	2001	2002
Crystalline Silicon						
Single Crystal	51,922	54,736	74,717	59	56	67
Cast and Ribbon	33,234	29,915	29,406	38	31	26
Subtotal	85,155	84,651	104,123	97	87	93
Thin-Film Silicon	2,736	12,541	7,396	3	13	7
Concentrator Silicon	329	474	571	*	*	*
Other [a]	0	0	0	0	0	0
Total	**88,221**	**97,666**	**112,090**	**100**	**100**	**100**

[a] Includes categories not identified by reporting companies.
* = Less than 0.5 percent.
Notes: Data do not include shipments of cells and modules for space/satellite applications. Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 29. Photovoltaic Cell and Module Shipment Values by Type, 2001 and 2002

Type	Value (Thousand Dollars)	2001 Average Price (Dollars per Peak Watt)		Value (Thousand Dollars)	2002 Average Price (Dollars per Peak Watt)	
		Modules	Cells		Modules	Cells
Crystalline Silicon						
Single-Crystal	160,677	3.48	2.48	201,488	3.64	2.14
Cast and Ribbon	100,126	3.39	1.92	115,625	3.98	1.38
Subtotal	260,804	3.43	2.46	317,113	3.81	2.13
Thin-Film Silicon	W	W	W	W	W	W
Concentrator Silicon	W	W	W	W	W	W
Other [a]	0	--	--	0	--	--
Total	**304,810**	**3.42**	**2.46**	**341,975**	**3.74**	**2.12**

[a] Includes categories not identified by reporting companies.
W = Data withheld to avoid disclosure of proprietary company data.
-- = Does not apply.
Notes: Data do not include shipments of cells and modules for space/satellite applications. Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 30. Shipments of Photovoltaic Cells and Modules by Market Sector, End Use, and Type, 2001 and 2002
(Peak Kilowatts)

Sector and End Use	Crystalline Silicon [a]	Thin-Film Silicon	Concentrator Silicon	Other	2002 Total	2001 Total
Market						
Industrial	30,471	1,747	0	0	32,218	28,063
Residential	26,513	2,802	0	0	29,315	33,262
Commercial	18,322	1,985	271	0	20,578	15,710
Transportation	12,849	83	0	0	12,932	8,486
Utility	7,176	164	300	0	7,640	5,846
Government [b]	8,381	184	0	0	8,565	5,728
Other [c]	410	431	0	0	841	571
Total	**104,123**	**7,396**	**571**	**0**	**112,090**	**97,666**
End Use						
Electricity Generation						
Grid Interactive	30,333	3,350	300	0	33,983	27,226
Remote	19,411	2,282	0	0	21,693	21,447
Communications	16,883	407	0	0	17,290	14,743
Consumer Goods	3,238	162	0	0	3,400	4,059
Transportation	15,855	173	0	0	16,028	12,636
Water Pumping	7,322	210	0	0	7,532	7,444
Cells/Modules To OEM [d]	7,034	564	271	0	7,869	6,268
Health	4,047	155	0	0	4,202	3,203
Other [e]	0	93	0	0	93	641
Total	**104,123**	**7,396**	**571**	**0**	**112,090**	**97,666**

[a] Includes single-crystal and cast and ribbon types.
[b] Includes Federal, State, local governments, excluding military.
[c] Other includes shipments that are manufactured for private contractors for research.
[d] Original equipment manufacturer.
[e] Other uses include shipments of photovoltaic and modules for other uses, such as cooking food, desalinization, distillation.
Note: Totals may not equal sum of components due to independent rounding.
Source: Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey."

Table 31. Export Shipments of Photovoltaic Cells and Modules by Type, 2001 and 2002
(Peak Kilowatts)

Item	Type							
	Crystalline		Thin-Film Silicon		Concentrator Silicon		Total	
	2001	2002	2001	2002	2001	2002	2001	2002
Cells	26,899	33,952	0	0	174	267	27,073	34,219
Modules	29,660	29,987	4,622	2572	0	0	34,282	32,559
Total	**56,559**	**63,939**	**4,622**	**2,572**	**174**	**267**	**61,356**	**66,778**

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

Table 32. Destination of U.S. Photovoltaic Cell and Module Export Shipments by Country, 2002

Country	Peak Kilowatts	Percent of U.S. Exports
Africa		
Egypt	123.9	0.2
Kenya	93.1	0.1
Morocco	93.1	0.1
Nigeria	93.1	0.1
Other Africa	244.4	0.4
South Africa, Rep of	2,278.3	3.4
Uganda	93.1	0.1
Total	**3,018.9**	**7.4**
Asia and the Middle East		
Bangladesh	185.5	0.3
Cambodia	93.1	0.1
China	526.8	0.8
Hong Kong	10,811.5	16.2
India	123.9	0.2
Indonesia	69.2	0.1
Israel	103.8	0.2
Japan	2,138.3	3.2
Korea, Republic of	247.0	0.4
Nepal	30.8	*
North Korea	123.3	0.2
Philippines	15.4	*
Singapore	462.4	0.7
South Korea	154.1	0.2
Taiwan	93.1	0.1
Thailand	401.3	0.6
Vietnam	93.1	0.1
Total	**15,672.5**	**23.5**
Australia		
Australia	1,291.5	1.9
New Zealand	1.7	*
Total	**1,293.2**	**1.9**
Europe		
France	93.1	0.1
Germany	33,389.0	50.0
Greece	94.1	0.1
Italy	131.4	0.2
Norway	93.1	0.1
Spain	4,655.1	7.0
Switzerland	186.1	0.3
United Kingdom	95.8	0.1
Total	**38,737.6**	**58.0**
North America		
British Virgin Islands	49.3	0.1
Canada	1,504.9	2.3
Costa Rica	185.0	0.3
Dominican Republic	57.4	0.1
French West Indies	93.1	0.1
Guatemala	12.4	*
Honduras	4.9	*
Mexico	2,104.2	3.2
Netherlands Antilles	1,542.1	2.3
Total	**5,553.3**	**8.3**

Table 32. Destination of U.S. Photovoltaic Cell and Module Export Shipments by Country, 2002 (Continued)

Country	Peak Kilowatts	Percent of U.S. Exports
South America		
Argentina	247.0	0.4
Bolivia	93.1	0.1
Brazil	995.7	1.5
Chile	92.5	0.1
Colombia	153.9	0.2
Ecuador	61.7	0.1
Other Latin America	125.3	0.2
Peru	277.5	0.4
Puerto Rico	1.3	*
Total	**2,047.9**	**3.1**
Other	454.3	0.7
Total U.S. Exports	**66,777.7**	**100.0**

Note: "Other" represents shipments to countries not disaggregated by companies on Form EIA-63B. Totals may not equal sum of components due to independent rounding.

* = Value less than 0.05 percent.

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

Table 33. Shipments of Complete Photovoltaic Module Systems, 2000-2002

Shipment Information	2000	2001	2002
Complete Photovoltaic Module Systems Shipped	10,737	6,759	11,108
Peak Kilowatts	4,099	10,075	8,351
Percent of Total Module Shipments	7	15	13
Value of Systems (Thousand Dollars)	44,263	50,467	45,423

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

Table 34. Employment in the Photovoltaic Manufacturing Industry, 1993-2002

Year	Number of Companies	Number of Person-Years
1993	19	1,431
1994	22	1,312
1995	24	1,578
1996	25	1,280
1997	21	1,736
1998	21	1,988
1999	19	2,013
2000	21	1,913
2001	19	2,666
2002	19	2,696

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

Table 35. Companies Expecting to Introduce New Photovoltaic Products in 2003

New Product Type	Number of Companies
Crystalline Silicon	
Single-Crystal Silicon Modules	5
Cast Silicon Modules	2
Ribbon Silicon Modules	3
Thin-Film	
Amorphous Silicon Modules	4
Other (Thin-Film)	1
Other (Flat Plate)	**0**
Concentrators	**0**
Nonmodule System Components	**0**

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

Table 36. Number of Companies Involved in Photovoltaic-Related Activities, 2001 and 2002

Type of Activity	Number of Companies	
	2001	2002
Cell Manufacturing	11	11
Module or System Design	14	16
Prototype Module Development	12	12
Prototype Systems Development	12	11
Wholesale Distribution	14	12
Retail Distribution	7	8
Installation	7	8
Noncollector System		
Component Manufacturing	4	3

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

3. Survey of Geothermal Heat Pump Shipments

This chapter provides information on geothermal heat pump shipments, based on the Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey." The survey shows that manufacturers shipped 37,139 geothermal heat pumps in 2002, a 4 percent increase over the 2000 total of 35,581. Of those shipped in 2002, 6,445 were ARI-320 rated,[12] and 26, 802 were ARI-325 or ARI-330. These shipments were less than 2000, while the number of non-ARI-rated units shipped in 2002 increased to 3,892, from 1,554 (Table 37).

The total rated capacity of heat pumps shipped in 2002 was 125,297 tons, compared to 164,191 tons in 2000 (Table 38).

The dramatic change in average capacity of units sold between 2000 and 2002 is largely due to a single manufacturer losing substantial sales in the commercial sector, where large units are sold.

The proportion of geothermal heat pumps shipped to each Census Region in 2002 was as follows: the South (37 percent), the Midwest (35 percent), Export (9 percent), the Northeast (10 percent), and the West (9 percent) (Table 39). Thirty-one percent of geothermal heat pumps were shipped to installers, and 54 percent to wholesale distributors. Two percent were shipped to retail distributors, while 3 percent went to exporters (Table 40).

Table 37. Geothermal Heat Pump Shipments by Model Type, 1996-2002
(Number of Units)

Model	1996	1997	1998	1999	2000	2001	2002
ARI-320	4,697	7,772	10,510	7,910	7,808	NA	6,445
ARI-325/330	25,697	28,335	26,042	31,631	26,219	NA	26,802
Other Non-ARI Rated	991	1,327	1,714	2,138	1,554	NA	3,892
Totals	**31,385**	**37,434**	**38,266**	**41,679**	**35,581**	**NA**	**37,139**

NA=Not Available. No survey was conducted for 2001.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

Table 38. Capacity of Geothermal Heat Pump Shipments by Model Type, 1996-2002
(Total Rated Capacity Tons)

Model	1996	1997	1998	1999	2000	2001	2002
ARI-320	15,060	24,708	35,776	27,970	26,469	NA	16,756
ARI-325/330	92,819	110,186	98,912	153,947	130,132	NA	96,541
Other Non-ARI Rated	5,091	6,662	6,758	9,735	7,590	NA	12,000
Totals	**112,970**	**141,556**	**141,446**	**191,651**	**164,191**	**NA**	**125,297**

Note: One ton of capacity is equal to 12,000 Btu.
NA=Not Available. No survey was conducted for 2001.
Source: Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey."

[12] For a detailed explanation of the Air-Conditioning & Refrigeration Institute (ARI) system of rating geothermal heat pumps see: http://www.eia.doe.gov/cneaf/solar.renewables/rea_issues/geo_hp_art.pdf, October 28, 2002 or Appendix A.

Table 39. Geothermal Heat Pump Shipments by Export, Census Region, and Model Type, 2002
(Number of Units)

Export and Census Region	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	Total
Export	506	1,680	1,085	3,271
Midwest	874	10,748	1,360	12,982
Northeast	912	2,730	261	3,903
South	3,892	8,928	840	13,660
West	261	2,716	346	3,323
Total	**6,445**	**26,802**	**3,892**	**37,139**

Notes: The **Midwest Census Region** consists of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. The **Northeast Census Region** consists of Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. The **South Census Region** consists of Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The **West Census Region** consists of Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming. “Export” in Table 39 and “Exporter” in Table 40 are different. “Export” refers to shipments outside of the country, while “Exporter” is the type of customer.

Source: Energy Information Administration, Form EIA-902, “Annual Geothermal Heat Pump Manufacturers Survey.“

Table 40. Geothermal Heat Pump Shipments by Customer Type and Model Type, 2002
(Number of Units)

Customer Type	ARI-320	ARI-325/330	Other Non-ARI Rated GHPs	Total
Exporter	134	1,029	2	1,165
Wholesale Distributor	5,033	15,554	301	20,888
Retail Distributor	0	352	200	552
Installer	5	8,817	2,177	10,999
End-User	0	185	22	207
Others	1,273	865	1,190	3,328
Total	**6,445**	**26,802**	**3,892**	**37,139**

Note: “Export” in Table 39 and “Exporter” in Table 40 are different. “Export” refers to shipments outside of the country, while “Exporter” is the type of customer.

Source: Energy Information Administration, Form EIA-902, “Annual Geothermal Heat Pump Manufacturers Survey.“

Appendix A

EIA Renewable Energy Data Sources

The Energy Information Administration (EIA) develops renewable energy information from a wide variety of sources, cutting across different parts of the organization. This appendix provides a list of all sources that EIA uses to obtain renewable energy information. While most data come from EIA data collection forms, some are derived from secondary sources. For EIA data collections, additional information is available on the EIA website: http://www.eia.doe.gov/oss/forms.html:

EIA-63A/B, "Annual Solar Thermal Collector Manufacturers Survey" and "Annual Photovoltaic Module/Cell Manufacturers Survey"

Energy Sources: Solar energy.
Energy Functions: Disposition.
Frequency of Collection: Annually.
Respondent Categories: Solar thermal collector manufacturers and/or importers; photovoltaic module/cell manufacturers and/or importers;
Reporting Requirement: Mandatory.
Description: Forms EIA-63A/B are designed to gather for publication data on shipments of solar thermal collectors and photovoltaic modules. Data are collected by end use and market sector. Collector types include low-temperature, medium-temperature air, medium-temperature liquid, thermosiphon, flat plate, concentrator, integral collector storage, and evacuated tube and concentrators. Respondents are manufacturers, importers, and exporters of solar thermal collectors and photovoltaic modules. These forms were formerly known as CE-63A/B.

EIA-457A/H, "Residential Energy Consumption Survey"

Energy Sources: Coal and coal products; electricity; natural gas; petroleum and petroleum products; wood. **Energy Functions:** Consumption costs and/or prices.
Frequency of Collection: Quadrennially.
Respondent Categories: Electric utilities; natural gas distributors (including importers/exporters); petroleum and petroleum product distributors; institutions (nonprofit); individuals/households.
Reporting Requirement: Voluntary and mandatory.
Description: Forms EIA-457A through G are used to collect comprehensive national and regional data on both the consumption of and expenditures for energy in the residential sector of the economy. Data are used for analyzing and forecasting residential energy consumption. Housing, appliance, and demographic characteristics data are collected via personal interviews with households, and consumption and expenditure billing data are collected from the energy suppliers. End-use intensities are produced for space heating, water heating, air conditioning, refrigerators, and appliances. Rental agents are contacted by telephone to check on fuels used in rented apartments. Surveys were conducted in 1978, 1979, 1980, 1981, 1982, 1984, 1987, 1990, 1993, and 1997. Form EIA-457H is used to collect detailed lighting usage information for a subsample.

EIA-819M, "Monthly Oxygenate Telephone Report"

Energy Sources: Petroleum and petroleum products.
Energy Functions: Production, Supply.
Frequency of Collection: Monthly.
Respondent Categories: Oxygenate producers; petroleum and petroleum product distributors; petroleum and petroleum product processors; petroleum and petroleum product storers.
Reporting Requirement: Mandatory.
Legal Citation: Public Law 93-275 (FEAA), 13(b), 5(a), 5(b), 52.
Description: Form EIA-819M is designed to obtain information on oxygenate production, imports, and end-of-month stocks. Data was previously collected using the EIA-819, Monthly Oxygenate Telephone Survey Data are reported by oxygenate type and PAD District. Respondents are a sample of: operators of facilities that produce oxygenates; operators of petroleum refineries; operators of bulk terminals, bulk stations, blending plants, and other non-refinery facilities that store or blend oxygenates; and importers of oxygenates.

EIA-846 (A,B,C), "Manufacturing Energy Consumption Survey"

Energy Sources: Coal and coal products; electricity; natural gas; petroleum and petroleum products; wood.
Energy Functions: Consumption; disposition; financial; and/or management; production; research and development; other energy functions.
Frequency of Collection: Quadrennially.
Respondent Categories: Manufacturing.
Reporting Requirement: Mandatory.
Description: Forms EIA-846A through D are used to collect information on energy consumption, energy usage patterns, and fuel-switching capabilities of the manufacturing sector of the U.S. economy. The information from this survey is used to

publish aggregate statistics on the consumption of energy for fuel and nonfuel purposes, fuel-switching capabilities, and certain energy-related issues such as energy prices, on-site electricity generation, and purchases of electricity from nonutilities. Since 1991, the survey has also collected information on end users of energy, participation in energy management programs, and penetration of new technology. Respondents are a sample of manufacturing establishments. Surveys were conducted for 1985, 1988, 1991, 1994, and 1998 although data for 1998 was not ready to be included in the preparation of this report.

EIA-860, "Annual Electric Generator Report"

Energy Sources: Electricity.
Energy Functions: Financial and/or management; production.
Frequency of Collection: Annually through 1997 and beginning again in 2000.
Respondent Categories: Electric utilities.
Reporting Requirement: Mandatory.
Description: Form EIA-860 is used to collect data on the status of electric generating plants and associated equipment in operation and those scheduled to be in operation in the United States within 10 years of filing of the report. These data are used to maintain and update EIA's electric power plant frame data base. Data are collected on power plant sites, and the design data of electric generators. Respondents include each electric utility that operates, or plans to operate, a power plant in the United States within 10 years of the report.

EIA-860A, "Annual Electric Generator Report – Utility"

Energy Sources: Electricity.
Energy Functions: Financial and/or management, Production.
Frequency of Collection: Annually from 1998 through 2000.
Respondent Categories: Electric utilities.
Reporting Requirement: Mandatory.
Description: Form EIA-860A is used to collect data on the status of electric generating plants and associated equipment in operation and those scheduled to be in operation in the United States within 5 years of filing of the report. These data are used to maintain and update EIA's electric power plant frame data base. Data are collected on power plant sites, and the design data of electric generators. Respondents include each electric utility that operates, or plans to operate, a power plant in the United States within 5 years of the report.

EIA-860B, "Annual Electric Generator Report – Nonutility"

Energy Sources: Electricity.
Energy Functions: Production.
Frequency of Collection: Annually from 1998 through 2000.
Respondent Categories: Nonutility power producers.
Reporting Requirement: Mandatory.
Description: EIA-860B collects data annually from nonutility power producers who own or plan on installing electric generation equipment with a total capacity of 1 megawatt or more at an existing or proposed site. Electricity generation, installed capacity, and energy consumption data are collected. These data are used to augment existing electric utility data and for electric power forecasts and analyses.

EIA-861, "Annual Electric Utility Report"

Energy Sources: Electricity.
Energy Functions: Disposition; financial and/or management; production.
Frequency of Collection: Annually.
Respondent Categories: Electric utilities.
Reporting Requirement: Mandatory.
Description: Form EIA-861 is a mandatory collection of data filed annually by each electric utility in the United States, its territories, and Puerto Rico. The survey collects data on generation, wholesale purchases, and sales and revenue by class of consumer and State. These data are used to maintain and update EIA's electric utility frame data base. This data base provides information to answer questions from the Executive Branch, Congress, other public agencies, and the general public. Respondents include each electric utility that is a corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities within the United States, its territories, or Puerto Rico for the generation, transmission, distribution, or sale of electric energy primarily for use by the public.

EIA-867, "Annual Nonutility Power Producer Report"

Energy Sources: Electricity.
Energy Functions: Production.
Frequency of Collection: Annually through 1997.
Respondent Categories: Nonutility power producers.
Reporting Requirement: Mandatory.
Description: Form EIA-867 is used to collect data annually from nonutility power producers who own or plan on installing electric generation equipment with a total capacity of 1 megawatt or more at an existing or proposed site. Electricity generation, installed capacity, and energy consumption data are collected. These data will be used to augment existing electric utility data and for electric power forecasts and analyses.

EIA-871A/F, "Commercial Buildings Energy Consumption Survey"

Energy Sources: Electricity; natural gas; natural gas products; petroleum and petroleum products; wood; other energy sources.
Energy Functions: Consumption; costs and/or prices.
Frequency of Collection: Quadrennially.
Respondent Categories: Commercial buildings; electric utilities; natural gas distributors (including impor-

ters/exporters); petroleum and petroleum product distributors; other (industry); Federal government institutions (nonprofit).
Reporting Requirement: Voluntary and mandatory.
Description: Forms EIA-871A through F are used to collect information for the Commercial Buildings Energy Consumption Survey (CBECS). The survey provides comprehensive national and regional information on the consumption of, and expenditures for, energy in the commercial sector of the economy. Data are used in EIA models and published in statistical and analytical reports. Physical characteristics information for commercial buildings is collected by personal interviews with building owners and managers using Form EIA-871A. Billing and consumption data for the buildings are collected by mail from individual energy suppliers by using Forms EIA-871C through F (depending upon the energy source). Supplemental information on construction improvements, maintenance, and repairs is collected for the Bureau of the Census by using Form EIA-871G. This survey was renamed the CBECS in 1989. Previously it was conducted under the name of Nonresidential Buildings Energy Consumption Survey.

EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey"

Energy Sources: Geothermal.
Energy Functions: Disposition.
Frequency of Collection: Annually.
Respondent Categories: Geothermal heat pump manufacturers and importers.
Reporting Requirement: Mandatory.
Description: The Form EIA-902 collects information on shipments of geothermal heat pumps. The survey tracks shipments of the following three main types of geothermal heat pumps, as classified by the Air-Conditioning & Refrigeration Institute (ARI), and the much smaller shipped volume of non-ARI rated systems. A brief description of the ARI-classified system is as follows:

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 transfer building heat to chilled water during the cooling season and, during the heating season, remove heat from boiler water.

ARI 325—Ground Water-Source Heat Pumps (GWHP)—The GWHP is an open-loop system in which ground water is drawn from an aquifer or other natural body of water into piping. At the heat pump, heat is drawn from or dumped to the water through a heat exchanger to the refrigerant in the heat pump. The heated or cooled water returns to its source.

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. Depending on the type of ground and land area, systems can either be installed horizontally or vertically.

Data are collected by model type, heat pump capacity, region of destination, customer type, and economic sector. Respondents are manufacturers and importers.

EIA-906, "Power Plant Report"

Energy Sources: Electricity.
Energy Functions: Supply.
Frequency of Collection: Monthly for a sample of electric generators and annually for generators not in the sample beginning in 2001.
Respondent Categories: Electric power plants.
Reporting Requirement: Mandatory.
Description: Form EIA-906 collects information from all regulated and unregulated electric power plants in the United States. Data collected include electric power generation, energy source consumption, end of reporting period fossil fuel stocks, and useful thermal output from cogenerators. Form EIA-906 monthly respondents are a representative sample of electric power plants by State and by energy source. Electric power plants that do not report data monthly submit data annually.

Appendix B

Renewable Energy Historical Statistics and Detailed Characteristics

Table B1. Historical Renewable Energy Consumption by Energy Use Sector and Energy Source, 1989-2002
(Quadrillion Btu)

Sector and Energy Source	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	P 2002
Total	***6.294***	***6.152***	***6.150***	***5.902***	***6.148***	***6.053***	***6.657***	***7.129***	***7.065***	***6.549***	***6.587***	***6.145***	***5.310***	**5.881**
Biomass	3.062	*2.681*	2.694	2.842	2.795	2.928	3.056	3.120	2.996	2.823	*2.873*	*2.893*	*2.663*	2.738
Wood	2.637	*2.191*	2.190	2.290	2.228	2.315	2.420	2.467	2.350	2.175	*2.224*	2.257	*2.017*	2.032
Waste [a]	0.354	*0.408*	0.440	0.473	0.479	0.515	0.531	0.577	0.551	0.542	0.540	*0.511*	*0.514*	0.550
Alcohol Fuels [b]	0.071	0.082	0.065	0.078	0.088	0.097	0.105	0.076	0.096	0.105	0.110	0.126	0.133	0.156
Geothermal	*0.317*	*0.336*	*0.346*	*0.349*	*0.364*	*0.338*	*0.294*	*0.316*	*0.325*	*0.328*	*0.331*	0.317	*0.311*	0.304
Hydroelectric	*2.837*	*3.046*	*3.016*	*2.617*	*2.892*	*2.683*	*3.205*	*3.590*	*3.640*	*3.297*	*3.268*	*2.811*	*2.201*	2.668
Solar [c]	0.055	0.060	0.063	0.064	0.066	0.069	0.070	0.071	0.070	0.070	0.069	0.066	*0.065*	0.064
Wind	*0.022*	0.029	0.031	0.030	0.031	0.036	0.033	0.033	0.034	0.031	0.046	0.057	*0.068*	0.106
Residential Sector	**0.976**	**0.642**	**0.677**	**0.711**	**0.616**	**0.607**	**0.667**	**0.667**	**0.506**	**0.459**	**0.486**	**0.503**	***0.476***	**0.419**
Biomass	0.918	0.581	0.613	0.645	0.548	0.537	0.596	0.595	0.433	0.387	0.414	0.433	0.407	0.350
Wood	0.918	0.581	0.613	0.645	0.548	0.537	0.596	0.595	0.433	0.387	0.414	0.433	0.407	0.350
Geothermal	0.005	0.006	0.006	0.006	0.007	0.006	0.007	0.007	0.008	0.008	0.009	0.009	*0.009*	0.010
Solar [c]	0.053	0.056	0.058	0.060	0.062	0.064	0.065	0.065	0.065	0.065	0.064	0.061	*0.060*	0.058
Commercial Sector	**0.061**	**0.071**	**0.072**	**0.081**	**0.084**	**0.086**	**0.092**	**0.110**	**0.113**	**0.111**	**0.114**	**0.109**	***0.089***	**0.098**
Biomass	0.058	0.067	0.068	0.076	0.079	0.081	0.086	0.103	0.107	0.102	0.106	0.100	*0.080*	0.088
Wood	0.036	0.039	0.041	0.044	0.046	0.046	0.046	0.050	0.049	0.048	0.052	0.053	*0.041*	0.041
Waste [a]	0.022	0.028	0.026	0.032	0.033	0.035	0.040	0.053	0.058	0.054	0.054	0.047	*0.039*	0.047
Geothermal	0.003	0.003	0.003	0.003	0.003	0.004	0.005	0.005	0.006	0.007	0.007	0.008	0.008	0.009
Hydroelectric	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Industrial Sector	***1.814***	***1.667***	***1.626***	**1.672**	**1.697**	**1.844**	**1.905**	**1.971**	**1.976**	**1.841**	***1.843***	***1.828***	***1.630***	**1.724**
Biomass	1.784	*1.634*	1.595	1.640	1.666	1.779	1.847	1.907	1.915	1.784	*1.791*	*1.781*	*1.593*	1.678
Wood	1.584	*1.442*	1.410	1.461	1.484	1.580	1.652	1.683	1.731	1.603	*1.620*	1.636	*1.443*	1.506
Waste [a]	0.200	*0.192*	0.185	0.179	0.181	0.199	0.195	0.224	0.184	0.180	0.171	*0.145*	*0.150*	0.172
Geothermal	0.002	0.002	0.002	0.002	0.002	0.003	0.003	0.003	0.003	0.003	0.004	0.004	0.005	0.005
Hydroelectric	*0.028*	*0.031*	*0.030*	0.031	0.030	0.062	0.055	0.061	0.058	0.055	0.049	0.042	*0.032*	0.041
Transportation Sector														
Alcohol Fuels [b]	**0.071**	**0.082**	**0.065**	**0.078**	**0.088**	**0.097**	**0.105**	**0.076**	**0.096**	**0.105**	**0.110**	**0.126**	**0.133**	**0.156**
Electric Power Sector	***3.372***	***3.689***	***3.710***	**3.360**	**3.662**	**3.420**	**3.889**	**4.305**	**4.375**	**4.032**	**4.034**	**3.579**	***2.982***	**3.485**
Electric Utilities	2.983	3.151	3.114	2.712	2.953	2.714	3.173	3.553	3.620	3.279	3.123	2.607	*2.031*	2.464
Biomass	0.020	0.022	0.021	0.022	0.021	0.021	0.017	0.020	0.020	0.021	0.020	0.021	0.019	0.025
Wood	0.010	0.008	0.008	0.008	0.009	0.008	0.007	0.008	0.008	0.007	0.007	0.007	0.006	0.008
Waste [a]	0.010	0.013	0.014	0.013	0.011	0.013	0.010	0.012	0.013	0.013	0.013	0.014	0.013	0.016
Geothermal	0.197	0.181	0.170	0.169	0.158	0.145	0.099	0.110	0.115	0.109	0.036	0.003	0.003	0.004
Hydroelectric	2.765	2.948	2.923	2.521	2.774	2.549	3.056	3.423	3.485	3.149	3.067	2.582	*2.007*	2.434
Solar	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Wind	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.001	0.002

See footnotes at end of table.

Table B1. Historical Renewable Energy Consumption by Energy Use Sector and Energy Source, 1989-2002
(Quadrillion Btu) (Continued)

Sector and Energy Source	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Independent Power Producers	*0.389*	0.538	*0.596*	0.648	0.709	0.705	0.716	0.752	0.754	0.753	0.910	0.972	*0.951*	1.021
Biomass	0.211	0.295	0.333	0.381	0.394	0.413	0.405	0.418	0.426	0.424	0.433	0.432	*0.432*	0.441
Wood	0.089	0.120	0.118	0.132	0.141	0.144	0.119	0.130	0.129	0.129	0.131	0.127	*0.121*	0.127
Waste [a]	0.122	0.175	0.215	0.249	0.253	0.269	0.286	0.288	0.296	0.294	0.302	0.305	*0.311*	0.315
Geothermal	*0.111*	0.145	*0.165*	0.168	0.193	0.180	0.181	0.191	0.194	0.202	0.276	0.293	*0.286*	0.277
Hydroelectric	*0.043*	0.066	*0.062*	0.065	0.087	0.072	0.093	0.104	0.096	0.092	0.151	0.185	*0.162*	0.193
Solar	0.003	0.004	0.005	0.004	0.005	0.005	0.005	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	0.057	*0.067*	0.104

[a] Municipal solid waste, landfill gases, agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
[b] Ethanol primarily derived from corn.
[c] Includes small amounts of distributed solar thermal and photovoltaic energy used in the commercial, industrial and electric power sectors.
P=Preliminary.

Note: Revised data are in italics. Electricity net imports derived from hydroelectric power and geothermal energy are no longer included in renewable energy consumption data due to the inadequacy of available data. They continue to be reported in total U.S. energy consumption as components of electricity net imports, with fuel sources unspecified. See Table 1 of this report. Electric utility consumption of solar energy was less than 500 billion Btu from 1989 to 2002 and of wind energy was less than 500 billion Btu from 1989 to 2000. Totals may not equal sum of components due to independent rounding.

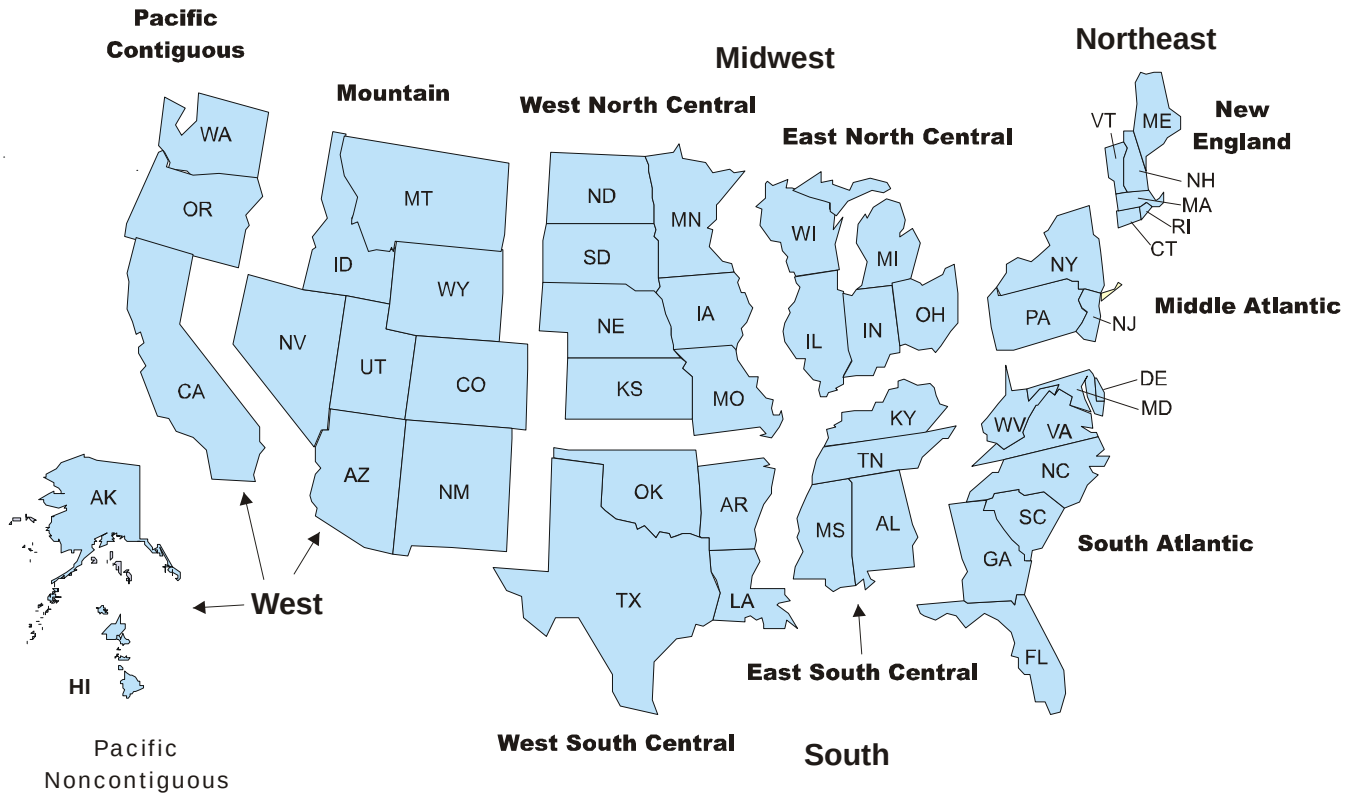
Sources: Analysis conducted by Energy Information Administration, Office of Coal, Nuclear, Electric, and Alternate Fuels and specific sources described as follows. **Residential:** Energy Information Administration, Form EIA-457A/G, "Residential Energy Consumption Survey;" Oregon Institute of Technology, Geo-Heat Center; and Energy Information Administration, Form EIA-63-A, "Annual Solar Thermal Collector Manufacturers Survey" and Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey." **Commercial:** 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," and Oregon Institute of Technology, Geo-Heat Center. **Industrial:** 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," and Form EIA-906, "Power Plant Report;" Oregon Institute of Technology, Geo-Heat Center; and Government Advisory Associates, *Resource Recovery Yearbook and Methane Recovery Yearbook* (various issues).
Transportation: Bureau of Alcohol, Tobacco and Firearms, fuel ethanol production and import data, U.S. Bureau of Census, Schedule B, Commodity Number 2207.20.0000, "Ethyl Alcohol, Denatured of Any Strength," Energy Information Administration, Form-EIA-819M, "Monthly Oxygenate Telephone Report," and Form EIA-814, "Monthly Imports Report." **Electric Power:** 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," and Form EIA-906, "Power Plant Report."

Table B2. Renewable Electricity Net Generation by Energy Source and Census Division, 2001
(Thousand Kilowatthours)

Division	Geothermal	Conventional Hydroelectric	MSW/ Landfill Gas	Other Biomass [a]	Solar	Wind	Wood/ Wood Waste	Total
Total	**13,740,503**	**216,961,046**	**19,931,044**	**1,833,508**	**542,755**	**6,737,337**	**35,199,916**	**294,946,110**
East North Central		4,843,669	1,938,744	241,996		72,564	2,808,688	9,905,662
East South Central		19,158,420	52,572	21,241			6,393,352	25,625,584
Middle Atlantic		24,751,948	5,396,893	47,157		31,714	1,099,422	31,327,133
Mountain	1,352,616	27,093,428	43,243	88,203	489	413,802	598,758	29,590,540
New England		5,511,935	4,225,494	393,963		12,133	4,889,089	15,032,613
Pacific Contiguous	12,181,295	108,920,230	2,122,841	457,001	542,271	3,588,325	5,089,990	132,901,953
Pacific Noncontiguous	206,592	1,446,415	401,526	55,657		3,075		2,113,265
South Atlantic		9,714,978	4,821,835	245,889			8,472,258	23,254,959
West North Central		8,694,534	876,744	109,319		1,428,214	574,709	11,683,520
West South Central		6,825,489	51,151	173,082	-5	1,187,510	5,273,652	13,510,879

[a] Agriculture byproducts/crops, sludge waste, tires, and other biomass solids, liquids and gases.
Note: Blank cell indicates the division has no data to report for that energy source. Totals may not add due to independent rounding.
Sources: Energy Information Administration, Form EIA-906, "Power Plant Report."

Figure B1. U.S. Census Regions and Divisions



Source: Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

Table B3. Industrial Biomass Energy Consumption and Electricity Net Generation by Primary Purpose of Business and Energy Source, 2001

Industry	Energy Source	Code	Biomass Energy Consumption (Trillion Btus)			Net Generation (Million Kilowatthours)
			Total	For Electricity	For Useful Thermal Output	
Total			**1,592.920**	**379.614**	**1,213.305**	**27,703**
Agriculture, Forestry and Mining	**Agricultural Byproducts/Crops**	**AB**	**10.445**	**2.602**	**7.843**	**204**
Manufacturing	**Total**		**1,515.475**	**377.012**	**1,138.462**	**27,499**
Food and Kindred Products	Total		49.212	2.467	46.745	196
	Agricultural Byproducts/Crops	AB	42.162	0.393	41.769	29
	Municipal Solid Waste	MSW	3.986	1.335	2.651	119
	Other Biomass Gases	OBG	0.511	0.164	0.347	19
	Tires	TDF	0.384	0.135	0.249	11
	Wood/Wood Waste Solids	WDS	2.169	0.440	1.729	19
Lumber	Total		269.783	29.505	240.278	1,648
	Sludge Waste	SLW	0.024	0.010	0.014	*
	Wood/Wood Waste Liquids	WDL	3.124	1.725	1.399	135
	Wood/Wood Waste Solids	WDS	266.635	27.770	238.866	1,513
Paper and Allied Products	Total		1,144.422	343.358	801.064	25,524
	Agricultural Byproducts/Crops	AB	0.091	0.020	0.071	2
	Black Liquor	BLQ	757.749	226.292	531.457	16,268
	Landfill Gas	LFG	0.219	0.100	0.119	5
	Municipal Solid Waste	MSW	1.033	0.821	0.213	30
	Other Biomass Liquids	OBL	0.041	0.021	0.021	3
	Other Biomass Solids	OBS	2.097	1.031	1.066	65
	Sludge Waste	SLW	3.558	1.104	2.454	100
	Tires	TDF	5.831	1.191	4.640	139
	Wood/Wood Waste Liquids	WDL	12.771	4.342	8.429	374
	Wood/Wood Waste Solids	WDS	361.031	108.437	252.595	8,539
Chemicals and Allied Products	Total		21.583	0.758	20.826	32
	Landfill Gas	LFG	0.195	0.037	0.158	3
	Municipal Solid Waste	MSW	1.271	0.095	1.176	9
	Other Biomass Liquids	OBL	0.103	0.015	0.088	2
	Wood/Wood Waste Solids	WDS	20.014	0.611	19.403	18
Other [a]	Total		30.474	0.925	29.549	99
Nonspecified [b]	**Total**		**67.000**		**67.000**	
	Landfill Gas	LFG	62.000		62.000	
	Municipal Solid Waste	MSW	5.000		5.000	

[a] Other includes Apparel; Petroleum Refining; Rubber and Misc. Plastic Products; Transportation Equipment; Stone, Clay, Glass, and Concrete Products; Furniture and Fixtures; and related industries.
[b] Primary purpose of business is not specified.
* = Less than 500 kilowatthours.
Note: Blank cell indicates the industry has no data to report. Totals may not equal sum of components due to independent rounding.
Sources: Energy Information Administration, Form EIA-860B, " Annual Electric Generator Report - Nonutility;" Government Advisory Associates, *Resource Recovery Yearbook and Methane Recovery Yearbook* (various issues); and analysis conducted by the Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels.

Table B4. Industrial Biomass Electricity Net Generation by Census Division and Energy Source, 2001
(Thousand Kilowatthours)

Energy Source	Census Division										
	East North Central	East South Central	Middle Atlantic	Mountain	New England	Pacific Contiguous	Pacific Noncontiguous	South Atlantic	West North Central	West South Central	Total
Total	**1,751,320**	**6,200,344**	**622,672**	**560,611**	**2,049,408**	**2,302,097**	**174,702**	**8,072,201**	**598,212**	**5,371,488**	**27,703,056**
Agricultural Byproducts/Crops						23,843	55,657	132,632	7,665	14,486	234,283
Black Liquor	1,160,128	3,612,302	314,596	268,818	806,225	746,600		5,640,623	271,597	3,447,020	16,267,908
Landfill Gases	68,519	3,353				2,389		4,727			78,988
Municipal Solid Waste							119,045	39,240			158,285
Other Biomass Gases	4,264		10,166						8,797		23,227
Other Biomass Liquids			1,623		2,838						4,461
Other Biomass Solids	19,939				36,571				6,314	2,026	64,850
Sludge Waste	4,877	13,756			27,404	17,172		12,570	728	23,858	100,365
Tires	10,764	7,485	32,365		35,999			6,028		57,466	150,107
Wood/Wood Waste Liquids	246		39,710	57,024	91,132	143,035		96,761		80,663	508,572
Wood/Wood Waste Solids	482,583	2,563,448	224,212	234,770	1,049,239	1,369,058		2,139,620	303,112	1,745,969	10,112,010

Note: Blank cell indicates the division has no data to report for that energy source. Totals may not add due to independent rounding.
Sources: Energy Information Administration, Form EIA-906, "Power Plant Report."

Table B5. Net Generation and Fuel Consumption at Power Plants Consuming Coal and Biomass by State and Plant Name, 2001

State	Company Name	Plant Name	County	Net Electricity Generation (Kilowatthours)	Energy Consumed (MMBtu)	Energy Consumed from Biomass (MMBtu)	Percent of Energy Consumed from Biomass	Percent of Energy Consumed from Coal	Percent of Energy Consumed from Other
AL	Bowater Newport Coosa Pines Op	U S Alliance Coosa Pines	Talladega	264,363,000	12,918,027	5,460,550	42.27	57.73	0.00
AL	Georgia-Pacific Corp	Naheola Mill	Choctaw	477,602,448	15,332,362	10,985,776	71.65	16.59	11.75
AL	International Paper Co	International Paper Co	Autauga	519,234,000	16,973,708	11,965,869	70.50	10.94	18.56
AL	International Paper Co-Courtland	Courtland Mill	Lawrence	652,702,002	30,623,004	19,462,946	63.56	7.38	29.07
AL	Mobile Energy Service Holdings	Mobile Energy Services Co LLC	Mobile	485,112,047	7,860,156	3,528,136	44.89	55.11	0.00
AL	Smurfit-Stone Corp	Smurfit Stone Corp	Escambia	339,780,000	7,525,561	7,191,723	95.56	0.03	4.40
AL	Weyerhaeuser Co	Weyerhaeuser Pine Hill Operations	Wilcox	462,578,555	7,753,771	2,914,412	37.59	10.06	52.35
AR	Domtar Industries Inc	Ashdown	Little River	624,507,892	29,620,245	22,903,281	77.32	11.20	11.48
AZ	Tucson Electric Power Co	Irvington	Pima	1,645,666,000	17,354,398	340,915	1.96	40.99	57.05
CA	FPL Energy Operating Services Inc	Port of Stockton District Energy Facility	San Joaquin	260,039,000	3,245,194	9,086	0.28	98.93	0.79
CT	Covanta Mid-Connecticut Inc	Mid Connecticut Facility	Hartford	499,707,662	7,899,231	7,815,719	98.94	1.06	0.00
FL	International Paper Co-Escambi	Pensacola Florida	Escambia	394,269,000	20,696,322	14,739,024	71.22	18.19	10.59
FL	Jefferson Smurfit Corp	Jefferson Smurfit Corp	Nassau	650,926,000	19,927,724	12,164,847	61.04	32.35	6.61
FL	Lakeland City of	McIntosh	Polk	3,449,742,000	36,384,071	244,996	0.67	61.89	37.44
FL	Orlando Utilities Comm	Stanton	Orange	6,394,664,000	62,997,844	1,022,850	1.62	98.29	0.09
FL	Stone Container Corp-Panama City	Stone Container Corp Panama City Mill	Bay	243,459,002	7,922,371	3,715,099	46.89	23.87	29.24
GA	Durango-Georgia Paper Co	Durango-Georgia Paper Co	Camden	270,471,000	11,121,510	2,564,923	23.06	37.11	39.82
GA	Georgia Pacific Corp	Cedar Springs	Early	681,819,001	26,796,333	19,040,200	71.06	20.99	7.95
GA	Hercules Inc	Hercules Inc Brunswick Plant	Glynn	27,242,000	2,233,989	1,579,815	70.72	0.93	28.36
GA	Inland Paperboard & Pack'g Inc	Inland Paperboard Packaging Rome Linerboard Mill	Floyd	411,119,000	20,038,508	13,266,633	66.21	29.21	4.58
GA	International Paper Co	International Paper Co Savannah	Chatham	967,788,001	26,099,722	14,194,882	54.39	32.19	13.43
GA	International Paper Co-Augusta	International Paper Augusta Mill	Richmond	476,159,573	24,189,678	16,324,470	67.49	21.77	10.74
GA	Riverwood Intl USA Inc	Riverwood International USA Inc	Bibb	263,431,001	9,582,507	6,037,712	63.01	19.86	17.13
HI	Hawaiian Coml & Sugar Co Ltd	Hawaiian Coml&Sugar Co	Maui	189,318,325	6,135,810	3,986,293	64.97	24.67	10.36
IA	Interstate Power and Light	6th Street	Linn	169,060,000	3,489,795	181,868	5.21	66.61	28.18
IA	Interstate Power and Light	Prairie Creek	Linn	992,590,000	10,247,717	236,677	2.31	96.25	1.44
IA	University of Iowa	University of Iowa Main Power Plant	Johnson	89,460,000	3,187,044	27,231	0.85	82.11	17.04
IL	Ameren Energy Generating Co	Coffeen	Montgomery	3,659,838,000	38,983,387	80,701	0.21	99.71	0.09
IL	Archer Daniels Midland Co	Decatur	Macon	903,681,338	32,142,793	383,820	1.19	98.81	0.00
LA	International Paper Co	Louisiana Mill	Morehouse	500,606,000	20,292,544	14,915,044	73.50	3.37	23.13
LA	IPC-Mansfield Mill	Mansfield Mill	Desota	747,403,819	24,868,875	18,720,157	75.28	3.91	20.81
ME	IPC Bucksport	Bucksport Maine	Hancock	729,877,004	9,496,396	2,374,087	25.00	26.88	48.12
ME	Rumford Cogeneration Co	Rumford Cogeneration Co	Oxford	675,796,869	15,762,899	11,167,415	70.85	29.15	0.00
ME	S D Warren Co - Somerset	S D Warren Co 2	Cumberland	414,287,572	6,973,736	3,968,764	56.91	37.69	5.40
MI	International Paper Co-Quinnes	Quinnesec Michigan	Dickinson	220,116,000	10,994,875	9,523,677	86.62	2.15	11.23
MI	Louisiana Pacific Co	Louisiana Pacific Corp	Alpena	49,434,110	1,445,849	800,999	55.40	36.51	8.09
MI	Mead Paper Corp	Mead Paper	Delta	686,769,000	17,833,114	9,984,139	55.99	27.45	16.56

See footnotes at end of table.

Table B5. Net Generation and Fuel Consumption at Power Plants Consuming Coal and Biomass by State and Plant Name, 2001 (Continued)

State	Company Name	Plant Name	County	Net Electricity Generation (Kilowatthours)	Energy Consumed (MMBtu)	Energy Consumed from Biomass (MMBtu)	Percent of Energy Consumed from Biomass	Percent of Energy Consumed from Coal	Percent of Energy Consumed from Other
MI	S D Warren Co	S D Warren Co 1 Muskegon	Muskegon	163,660,000	3,571,440	433,058	12.13	78.95	8.92
MI	TES Filer City Station LP	TES Filer City Station	Manistee	433,103,000	5,414,375	306,597	5.66	94.34	0.00
MI	Wyandotte Municipal Serv Comm	Wyandotte	Wayne	257,391,000	3,593,588	154,725	4.31	94.80	0.89
MN	Rapids Energy Center	Rapids Energy Center	Itasca	142,515,000	4,109,765	2,715,658	66.08	20.11	13.81
MN	Stora Enso North America	Duluth Paper Mill	St Louis	43,926,000	1,372,465	1,301,634	94.84	4.32	0.84
MO	Anheuser-Busch Inc	Anheuser Busch Inc St Louis Brewery	St Louis City	109,549,000	4,197,530	336,566	8.02	85.89	6.09
MO	Union Electric Co	Sioux	St Charles	5,645,812,000	57,080,307	523,452	0.92	89.88	9.20
MO	University of Missouri-Columbia	University of Missouri Columbia Power Plant	Boone	137,367,912	3,834,880	55,400	1.44	93.16	5.39
NC	Blue Ridge Paper Products Inc	Canton North Carolina	Haywood	337,659,643	20,269,904	9,127,426	45.03	54.41	0.56
NC	Corn Products Intl Inc	Corn Products Winston Salem	Forsyth	20,181,000	2,324,701	2,168,876	93.30	5.32	1.39
NC	International Paper Co-Buckspt	Roanoke Rapids North Carolina	Halifax	169,349,560	11,527,677	7,773,059	67.43	23.57	9.00
NC	International Paper Co-Riegel	International Paper Riegelwood Mill	Columbus	473,108,000	26,856,453	19,785,678	73.67	1.53	24.80
NC	Weyerhaeuser Co	Plymouth NC	Martin	731,086,298	26,117,235	18,386,456	70.40	26.55	3.05
NE	Nebraska Public Power District	Sheldon	Lancaster	1,371,688,000	15,312,121	588	0.00	99.95	0.04
NY	AES Greenidge	AES Greenidge	Yates	944,486,738	10,907,485	169,800	1.56	98.20	0.24
NY	Black River Power LLC	Black River Power LLC Electric Generation Facility	Jefferson	421,486,000	5,841,335	52,672	0.90	96.30	2.79
OH	Mead Paper Corp	Mead Paper Division	Ross	558,456,704	19,188,969	10,525,418	54.85	44.24	0.91
PA	International Paper Co	Lock Haven Mill	Clinton	159,360,000	3,911,982	783,468	20.03	79.97	0.00
PA	P H Glatfelter Co	P H Glatfelter Co	York	614,307,135	15,384,590	6,891,660	44.80	54.31	0.89
PA	Willamette Industries-Johnsonburg	Johnsonburg Mill	Elk	244,415,786	8,084,609	4,198,936	51.94	43.46	4.60
SC	International Paper Co-GT Mill	Georgetown Mill	Georgetown	507,983,954	21,601,122	17,019,822	78.79	12.60	8.61
SC	Stone Container Corp	Stone Container Corp Florence Mill	Florence	644,928,973	20,219,204	13,512,793	66.83	24.39	8.78
TN	Bowater Newsprint Calhoun Ops	Bowater Newsprint Calhoun Operations	McMinn	449,848,678	33,762,101	29,190,428	86.46	12.74	0.80
TN	Packaging Corp of America	Packaging Corp of America	Hardin	367,306,001	9,386,567	6,780,776	72.24	22.46	5.30
TN	Willamette Industries Inc	Willamette Industries Kingsport Mill	Sullivan	143,886,003	8,445,477	6,593,224	78.07	16.46	5.47
VA	Bassett Furniture Industl Inc	Bassett Table Co	Henry	1,989,000	169,918	166,158	97.79	2.21	0.00
VA	Bassett Furniture Industl Inc	J D Bassett Manufacturing Co	Henry	1,609,000	153,498	148,363	96.65	3.35	0.00
VA	Georgia Pacific Corp	Big Island	Bedford	56,655,005	5,107,153	2,180,852	42.70	23.16	34.14
VA	International Paper	Printing & Communication Papers Franklin Mill	Isle of Wight	725,086,003	34,071,843	20,639,051	60.58	18.30	21.13
VA	Smurfit-Stone Container Corp	St Laurent Paper Products Corp	King William	570,977,000	20,547,456	14,660,519	71.35	16.29	12.36
VA	Southeastern Public Serv Auth	SPSA Power Plant	Portsmouth	200,034,000	6,156,661	5,384,373	87.46	2.88	9.66
VA	Stone Container Corp	Stone Container Corp Hopewell Mill	Hopewell	357,706,000	9,613,300	7,357,678	76.54	21.71	1.75
WA	Tacoma City of	City of Tacoma Steam Plant	Pierce	115,662,800	3,033,942	1,984,157	65.40	34.07	0.53
WA	Weyerhaeuser Co	Longview WA	Cowlitz	306,731,998	19,112,707	13,592,098	71.12	10.80	18.08
WI	Fraser Paper Co	Fraser Paper Inc	Price	36,846,000	944,317	589,615	62.44	37.56	0.00
WI	Georgia-Pacific Corp	Nekoosa Mill	Wood	91,217,003	3,346,250	1,723,590	51.51	35.87	12.62
WI	International Paper Co-Thilmny	Thilmany Pulp Paper	Outagamie	197,911,000	7,572,429	3,205,212	42.33	41.04	16.63

See footnotes at end of table.

Table B5. Net Generation and Fuel Consumption at Power Plants Consuming Coal and Biomass by State and Plant Name, 2001 (Continued)

State	Company Name	Plant Name	County	Net Electricity Generation (Kilowatthours)	Energy Consumed (MMBtu)	Energy Consumed from Biomass (MMBtu)	Percent of Energy Consumed from Biomass	Percent of Energy Consumed from Coal	Percent of Energy Consumed from Other
WI	Madison Gas & Electric Co	Blount St	Dane	443,626,000	6,231,352	223,688	3.59	77.18	19.23
WI	Mosinee Paper Corp	Wausau Mosinee Paper Corp Pulp & Paper Division	Marathon	125,682,460	3,304,402	1,780,451	53.88	38.75	7.37
WI	Northern States Power Co	Bay Front	Ashland	331,254,000	4,425,494	1,394,842	31.52	62.62	5.86
WI	Packaging Corp of America	Packaging Corp of America Tomahawk Mill	Lincoln	140,778,995	17,254,261	13,962,580	80.92	16.75	2.33
WI	State of Wisconsin	Waupun Correctional Inst Central Generating Plant	Dodge	4,049,572	272,280	24,937	9.16	90.84	0.00
WI	State of Wisconsin	UW Madison Charter St Plant	Dane	53,481,000	5,219,073	394,058	7.55	66.30	26.15
WI	Stora Enso North America	Biron Mill	Wood	224,973,375	4,918,729	204,000	4.15	93.08	2.77
WI	Stora Enso North America	Whiting Mill	Portage	21,231,002	1,478,254	184,499	12.48	75.76	11.76
WI	Stora Enso North America	Wisconsin Rapids Pulp Mill	Wood	380,318,000	23,193,940	18,187,931	78.42	14.09	7.49
WI	Stora Enso North America	Niagara Mill	Marinette	110,974,000	2,944,574	372,600	12.65	66.29	21.06
WI	Wisconsin Power & Light Co	Edgewater	Sheboygan	4,844,573,000	50,155,509	737,809	1.47	98.36	0.16
WI	Wisconsin Power & Light Co	N Dewey	Grant	1,072,048,000	10,910,822	15,099	0.14	99.83	0.03
WV	Monongahela Power Co	Albright	Preston	1,363,785,000	16,475,159	12,155	0.07	99.78	0.15
WV	Monongahela Power Co	Willow Is	Pleasants	1,126,533,000	12,494,604	255,061	2.04	97.69	0.26
				58,489,214,819	**1,238,374,879**	**541,994,282**			

MMBtu = One million British thermal units.
Note: State abbreviations are documented on the United States Postal Service website: http://www.usps.com/ncsc/lookups/usps_abbreviations.htm.
Source: Energy Information Administration, Form EIA-860, "Annual Electric Generator Report," and Form EIA-906," Power Plant Report."

Table B6. Average Heat Content of Selected Biomass Fuels

Fuel Type	Heat Content	Units
Agricultural Byproducts	8.248	Million Btu/Short Ton
Black Liquor	11.758	Million Btu/Short Ton
Digester Gas	0.619	Million Btu/Thousand Cubic Feet
Landfill Gas	0.490	Million Btu/Thousand Cubic Feet
Methane	0.841	Million Btu/Thousand Cubic Feet
Municipal Solid Waste	9.945	Million Btu/Short Ton
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
Tires	26.865	Million Btu/Short Ton
Utility Poles	12.500	Million Btu/Short Ton
Waste Alcohol	3.800	Million Btu/Barrel
Wood/Wood Waste	9.961	Million Btu/Short Ton

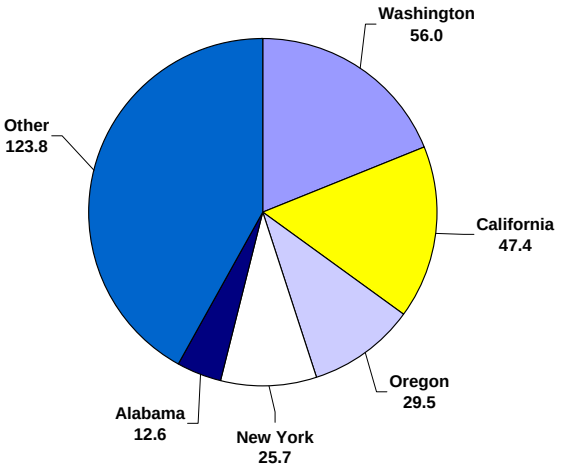
Source: Energy Information Administration, Form EIA-860B (1999), "Annual Electric Generator Report - Nonutility 1999."

Appendix C

Renewable Electric Generation, Capacity and Market Share by State for 2000 and 2001

Tables C1-12 present renewable electric generation and net summer capacity by State and the District of Columbia for 2000 and 2001. The five leading States for renewable electric power sector net generation and net summer capacity in 2001 were Washington, Oregon, California, New York and Alabama (Figure C1).[13] The leading states for electric power sector hydroelectric generation were the same as for renewable generation. The high proportion of hydroelectric generation reflects the fact that electric utilities have long had sizeable hydroelectric generating operations. While Washington was first in the electric power sector's hydroelectric generation with 26 percent of the market, California dominated the sector's generation from biomass (15 percent), wind (52 percent), geothermal (89 percent) and solar (almost 100 percent), although solar generation was minimal. All but Delaware, Mississippi, and the District of Columbia had electric power sector renewable generation in 2001.

Figure C1. Renewable Net Generation by State, 2001 (Billion Kilowatthours)



Source: Table C6 of this report.

The five leading states for commercial and industrial sector renewable generation with 46 percent of the market were Alabama, Georgia, Maine, North Carolina, and Louisiana. The main energy source for this electricity was wood and wood waste in the industrial sector. Ten states and the District of Columbia had no renewable generation in the commercial and industrial sectors. The five leading states for commercial and industrial sector renewable net summer capacity were Alabama, Georgia, Maine, North Carolina and Virginia.

The renewable market share of total U.S. electric generation in different states ranged from a high of 83 percent in Idaho to less than 1 percent in a few states in 2001 (Table C13). Because of the hydro component some of the percentages are significantly lower than in a typical year due to low water levels in 2001. In 2000, for example Idaho's renewable market share was over 96 percent. The market share of non-hydro renewable generation was highest in Maine at 21 percent in 2001 and second highest in California at 11 percent.

According to the Database of State Incentives for Renewable Energy (DSIRE), which is funded by the U.S. Department of Energy and managed by the North Carolina Solar Center, there are 15 states with state renewable portfolio standards (RPS) (Table C14).[14] Not all RPS are mandatory requirements; in a few states such as Hawaii and Illinois, the standards were established just as goals and hence are only voluntary.

[13] The electric power sector includes electric utilities and independent power producers whose primary purpose of business is the production and sale of electricity.

[14] For details, see the Database of State Incentives for Renewable Energy website: http://www.dsireusa.org/ (September 22, 2003).

Table C1. Renewable Electric Power Sector Net Generation by State, 2000
(Thousand Kilowatthours)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		5,817,631					142,414	5,960,045
Alaska		1,001,819						1,001,819
Arizona		8,354,216						8,354,216
Arkansas		2,370,483						2,370,483
California	12,308,471	38,325,758	1,808,535	390,896	493,334	3,518,023	2,454,181	59,299,198
Colorado		1,454,415		*5,586*				*1,460,001*
Connecticut		526,312	1,956,675	196,460				2,679,446
Delaware			18,838					18,838
District of Columbia								
Florida		86,769	3,030,124	404,522			400,589	3,922,003
Georgia		2,459,222	7,482					2,466,703
Hawaii	262,053	43,216	349,904			17,003		672,176
Idaho		10,966,695					39,075	11,005,770
Illinois		141,631	611,019	266,135				1,018,785
Indiana		588,276	88,146					676,422
Iowa		904,010	70,700			493,820		1,468,531
Kansas		15,332						15,332
Kentucky		2,324,568						2,324,568
Louisiana		532,290		63,767				596,057
Maine		2,294,743	241,599	101,192			1,409,375	4,046,909
Maryland		1,732,619	628,293					2,360,912
Massachusetts		1,052,851	*2,049,539*	223			*122,106*	*3,224,719*
Michigan		1,400,804	690,365	64,215			1,044,637	3,200,023
Minnesota		683,872	772,606			724,524		2,181,001
Mississippi								
Missouri		599,920	73,095					673,015
Montana		9,623,257						9,623,257
Nebraska		1,500,724		6,606				1,507,330
Nevada	1,370,791	2,429,468						3,800,259
New Hampshire		1,244,367	244,270				785,276	2,273,913
New Jersey		14,036	*1,350,149*					*1,364,184*
New Mexico		221,152		8,464				229,616
New York		24,818,618	1,992,364	512		10,345	382,674	27,204,514
North Carolina		2,191,697	98,144				371,686	2,661,527
North Dakota		2,122,561						2,122,561
Ohio		583,048	26,849				44,023	653,920
Oklahoma		2,276,933						2,276,933
Oregon		38,115,630	95,300			66,699	268,490	38,546,118
Pennsylvania		2,290,232	1,733,746	3,974		9,813	194,376	4,232,140
Rhode Island		4,867	115,239					120,106
South Carolina		1,532,632						1,532,632
South Dakota		5,715,508						5,715,508
Tennessee		5,876,058	29,227				146	5,905,431
Texas		828,963	*60,439*		41	492,146		*1,381,589*
Utah	151,843	746,125	9,110					907,077
Vermont		1,200,923				12,249	329,760	1,542,932
Virginia		699,405	*105,497*	1,883			334,960	*1,141,746*
Washington		80,160,637	205,290	29,348			429,353	80,824,628
West Virginia		698,216		14,432				712,648
Wisconsin		1,754,151	210,390	75,939		2,728	162,952	2,206,160
Wyoming		1,011,035				245,911		1,256,946
Total	**14,093,158**	***271,337,693***	***18,672,933***	***1,634,155***	**493,375**	**5,593,261**	***8,916,073***	***320,740,647***

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Revised data are in italics. Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding. Electric power sector includes electric utilities and independent power producers.

Sources: Energy Information Administration, Form EIA-759, “Monthly Power Plant Report”' and Form EIA-860B, “Annual Electric Generator Report-Nonutility.”

Table C2. Renewable Commercial and Industrial Sector Net Generation by State, 2000
(Thousand Kilowatthours)

	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Wood/ Wood Waste	Total
Alabama		4,018	24,994	3,904,739	3,933,752
Alaska					
Arizona			4,583		4,583
Arkansas			*7,456*	1,586,581	*1,594,037*
California	8,028	*129,092*	281,810	1,119,320	*1,538,250*
Colorado			12,328		12,328
Connecticut					
Delaware					
District of Columbia					
Florida		7,223	189,444	1,658,444	1,855,111
Georgia	21,575	9,749	72,109	3,015,459	3,118,892
Hawaii	60,242		188,445		248,688
Idaho				444,183	444,183
Illinois	2,197		*31,238*		*33,434*
Indiana		*41,737*			*41,737*
Iowa			17,862		17,862
Kansas					
Kentucky				12,293	12,293
Louisiana			31,116	2,697,569	2,728,685
Maine	*1,296,073*	*179,516*	58,562	1,831,623	*3,365,774*
Maryland		10,504	33	179,580	190,117
Massachusetts	12,308		24,948		37,257
Michigan	26,875	340,375	3,830	746,172	1,117,252
Minnesota	247,511	16,909	7,707	522,348	794,475
Mississippi			218	1,680,086	1,680,303
Missouri			9,758		9,758
Montana				46,923	46,923
Nebraska			9,908		9,908
Nevada					
New Hampshire	*182,846*			77,112	*259,958*
New Jersey			14,166		14,166
New Mexico					
New York	90,954	234,873	3,863	257,651	587,341
North Carolina	946,119		11,232	1,292,505	2,249,856
North Dakota			7,975		7,975
Ohio				576,519	576,519
Oklahoma		2,431		145,756	148,187
Oregon				272,867	272,867
Pennsylvania		220,650	70,292	497,612	788,554
Rhode Island					
South Carolina	858	62,534	6,147	1,351,052	1,420,590
South Dakota					
Tennessee	520,151	7,415	2,163	760,698	1,290,427
Texas			65,734	1,152,246	1,217,980
Utah					
Vermont	20,167			17,763	37,930
Virginia	12,578	355,483	4,067	1,342,209	1,714,338
Washington	102,252		16,029	811,545	929,825
West Virginia	452,687				452,687
Wisconsin	231,483	9,503	14,201	677,938	933,125
Wyoming					
Total	***4,234,903***	***1,632,010***	***1,192,216***	**28,678,793**	**35,737,923**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass solids, liquids and gases.

Note: Revised data are in italics. Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

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

Table C3. Total Renewable Net Generation by State, 2000
(Thousand Kilowatthours)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		5,817,631	4,018	24,994			4,047,153	9,893,797
Alaska		1,001,819						1,001,819
Arizona		8,354,216		4,583				8,358,799
Arkansas		2,370,483		*7,456*			1,586,581	*3,964,520*
California	12,308,471	38,333,786	*1,937,626*	672,706	493,334	3,518,023	3,573,501	*60,837,447*
Colorado		1,454,415		*17,914*				*1,472,329*
Connecticut		526,312	1,956,675	196,460				2,679,446
Delaware			18,838					18,838
District of Columbia								
Florida		86,769	*3,037,346*	593,966			2,059,033	*5,777,114*
Georgia		*2,480,796*	*17,230*	72,109			3,015,459	*5,585,595*
Hawaii	262,053	*103,459*	349,904	188,445		17,003		*920,863*
Idaho		10,966,695					483,258	11,449,952
Illinois		*143,827*	611,019	*297,373*				*1,052,219*
Indiana		588,276	129,883					718,159
Iowa		904,010	70,700	17,862		493,820		1,486,393
Kansas		15,332						15,332
Kentucky		2,324,568					12,293	2,336,861
Louisiana		532,290		94,883			2,697,569	3,324,742
Maine		*3,590,816*	421,116	159,754			3,240,998	*7,412,683*
Maryland		1,732,619	638,797	33			179,580	2,551,029
Massachusetts		1,065,159	*2,049,539*	*25,172*			*122,106*	*3,261,976*
Michigan		1,427,679	1,030,740	68,045			1,790,809	4,317,274
Minnesota		931,383	789,515	7,707		724,524	522,348	2,975,476
Mississippi				218			1,680,086	1,680,303
Missouri		599,920	73,095	9,758				682,773
Montana		9,623,257					46,923	9,670,179
Nebraska		1,500,724		16,514				1,517,238
Nevada	1,370,791	2,429,468						3,800,259
New Hampshire		*1,427,213*	244,270				862,388	*2,533,871*
New Jersey		14,036	1,350,149	14,166				1,378,350
New Mexico		221,152		8,464				229,616
New York		24,909,572	2,227,237	4,376		10,345	640,325	27,791,855
North Carolina		*3,137,815*	98,144	11,232			*1,664,192*	*4,911,383*
North Dakota		2,122,561		7,975				2,130,536
Ohio		583,048	26,849				620,542	1,230,439
Oklahoma		2,276,933	2,431				145,756	2,425,120
Oregon		38,115,630	95,300			66,699	541,357	38,818,985
Pennsylvania		2,290,232	1,954,396	74,266		9,813	691,988	5,020,695
Rhode Island		4,867	115,239					120,106
South Carolina		1,533,490	62,534	6,147			1,351,052	2,953,222
South Dakota		5,715,508						5,715,508
Tennessee		6,396,209	36,642	2,163			760,844	7,195,858
Texas		828,963	*60,439*	65,734	41	492,146	1,152,246	*2,599,568*
Utah	151,843	746,125	9,110					907,077
Vermont		1,221,090				12,249	347,523	1,580,862
Virginia		*711,984*	*460,980*	5,950			*1,677,170*	*2,856,083*
Washington		80,262,889	205,290	*45,376*			1,240,897	*81,754,453*
West Virginia		1,150,903		14,432				1,165,335
Wisconsin		1,985,634	219,893	*90,140*		2,728	840,890	*3,139,285*
Wyoming		1,011,035				245,911		1,256,946
Total	**14,093,158**	***275,572,597***	***20,304,943***	***2,826,371***	**493,375**	**5,593,261**	***37,594,866***	***356,478,569***

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Revised data are in italics. Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, Form EIA-759, “Monthly Power Plant Report”’ and Form EIA-860B, “Annual Electric Generator Report-Nonutility.”

Table C4. Renewable Electric Power Sector Net Generation by State, 2001
(Thousand Kilowatthours)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		8,356,382					217,434	8,573,816
Alaska		1,345,665				950		1,346,615
Arizona		7,623,565	33,601		489			7,657,655
Arkansas		2,548,251						2,548,251
California	12,181,295	25,541,782	1,761,134	257,735	542,271	3,499,738	2,103,213	45,887,167
Colorado		1,494,704		32,103		48,640		1,575,447
Connecticut		286,373	1,566,661	211,403				2,064,436
Delaware								
District of Columbia.								
Florida		147,718	2,984,991	55,474			217,388	3,405,571
Georgia		2,567,158	19,407					2,586,565
Hawaii	206,592	50,282	282,481			2,125		541,480
Idaho		7,223,127					38,147	7,261,274
Illinois		141,017	572,158	69,108				782,283
Indiana		570,692	89,188					659,880
Iowa		845,153	96,733			487,864		1,429,750
Kansas		25,561				39,832		65,393
Kentucky		3,855,508						3,855,508
Louisiana		732,217		60,053				792,270
Maine		1,710,244	227,986	55,565			1,702,579	3,696,374
Maryland		1,183,518	590,841					1,774,359
Massachusetts		694,267	1,929,386	202			129,768	2,753,623
Michigan		1,535,575	733,956	43,887		280	1,102,876	3,416,574
Minnesota		645,392	761,617			897,017		2,304,026
Mississippi								
Missouri		1,104,135		51,592				1,155,727
Montana		6,613,472						6,613,472
Nebraska		1,124,122		8,347		2,630		1,135,099
Nevada	1,199,874	2,513,722						3,713,596
New Hampshire		897,883	225,933				754,196	1,878,012
New Jersey		18,001	1,290,277					1,308,278
New Mexico		237,320		18,652				255,972
New York		23,014,433	1,856,366			20,540	322,903	25,214,242
North Carolina		1,861,019	99,503				359,711	2,320,233
North Dakota		1,332,076						1,332,076
Ohio		510,785	27,888				38,971	577,644
Oklahoma		2,344,690						2,344,690
Oregon		28,644,556	87,408			88,587	327,243	29,147,794
Pennsylvania		1,650,004	1,821,467	2,047		11,174	198,000	3,682,692
Rhode Island		3,143	103,616					106,759
South Carolina		1,224,923						1,224,923
South Dakota		3,431,865				871		3,432,736
Tennessee		6,542,616	33,824				167	6,576,607
Texas		1,200,331	51,151		-5	1,187,510		2,438,987
Utah	152,742	508,407	9,642					670,791
Vermont		868,281				12,133	351,073	1,231,487
Virginia		1,012,892	671,611				5,018	1,689,521
Washington		54,674,085	174,845	30,272			400,841	55,280,043
West Virginia		513,309	25,139				1,198	539,646
Wisconsin		1,899,964	383,134	77,602		72,284	23,073	2,456,057
Wyoming		879,111				365,162		1,244,273
Total	**13,740,503**	**213,749,295**	**18,511,944**	**974,042**	**542,755**	**6,737,337**	**8,293,800**	**262,549,676**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding. Electric power sector includes electric utilities and independent power producers.

Source: Energy Information Administration, Form EIA-906, “Power Plant Report.”

Table C5. Renewable Commercial and Industrial Sector Net Generation by State, 2001
(Thousand Kilowatthours)

	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Wood/ Wood Waste	Total
Alabama		3,353	21,094	3,954,822	3,979,269
Alaska					
Arizona			5,347		5,347
Arkansas			7,375	1,504,696	1,512,071
California		99,454	151,822	1,220,565	1,471,841
Colorado			32,101		32,101
Connecticut					
Delaware					
District of Columbia					
Florida		4,727	169,851	1,610,851	1,785,429
Georgia	29,267	9,352	6,213	2,974,339	3,019,170
Hawaii	50,468	119,045	55,657		225,170
Idaho				495,186	495,186
Illinois	3,012	68,519	18,281		89,812
Indiana		37,064	4,264		41,328
Iowa			15,465		15,465
Kansas					
Kentucky				9,552	9,552
Louisiana			46,839	2,640,656	2,687,495
Maine	934,879	171,912	102,812	1,827,564	3,037,167
Maryland		17,908	29	11,939	29,876
Massachusetts	8,237		23,982		32,219
Michigan	26,343	8,824	20,335	597,385	652,887
Minnesota	186,230	18,394	7,041	574,709	786,374
Mississippi			146	1,432,117	1,432,264
Missouri			10,835		10,835
Montana				65,425	65,425
Nebraska			8,374		8,374
Nevada					
New Hampshire	92,698			104,573	197,271
New Jersey			12,745		12,745
New Mexico					
New York	69,510	230,778		179,783	480,071
North Carolina	734,689	29,888	8,889	1,282,619	2,056,084
North Dakota			7,665		7,665
Ohio				364,101	364,101
Oklahoma				230,696	230,696
Oregon				373,877	373,877
Pennsylvania		198,005	32,365	398,736	629,106
Rhode Island					
South Carolina	520	49,202	537	866,107	916,366
South Dakota					
Tennessee	403,914	15,395		779,259	1,198,568
Texas			58,815	897,605	956,420
Utah					
Vermont	15,930			19,335	35,265
Virginia	1,330	319,266	4,896	1,143,088	1,468,581
Washington	59,807		17,172	664,252	741,231
West Virginia	438,635				438,635
Wisconsin	156,281	18,013	8,519	682,281	865,095
Wyoming					
Total	**3,211,750**	**1,419,100**	**859,466**	**26,906,116**	**32,396,433**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass solids, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Source: Energy Information Administration, Form EIA-906, "Power Plant Report."

Table C6. Total Renewable Net Generation by State, 2001
(Thousand Kilowatthours)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		8,356,382	3,353	21,094			4,172,256	12,553,086
Alaska		1,345,665				950		1,346,615
Arizona		7,623,565	33,601	5,347	489			7,663,002
Arkansas		2,548,251		7,375			1,504,696	4,060,322
California	12,181,295	25,541,782	1,860,588	409,557	542,271	3,499,738	3,323,777	47,359,008
Colorado		1,494,704		64,204		48,640		1,607,548
Connecticut		286,373	1,566,661	211,403				2,064,436
Delaware								
District of Columbia								
Florida		147,718	2,989,718	225,325			1,828,239	5,191,000
Georgia		2,596,425	28,759	6,213			2,974,339	5,605,735
Hawaii	206,592	100,750	401,526	55,657		2,125		766,650
Idaho		7,223,127					533,333	7,756,460
Illinois		144,029	640,677	87,389				872,095
Indiana		570,692	126,252	4,264				701,208
Iowa		845,153	96,733	15,465		487,864		1,445,215
Kansas		25,561				39,832		65,393
Kentucky		3,855,508					9,552	3,865,060
Louisiana		732,217		106,892			2,640,656	3,479,765
Maine		2,645,123	399,898	158,376			3,530,143	6,733,541
Maryland		1,183,518	608,749	29			11,939	1,804,235
Massachusetts		702,504	1,929,386	24,184			129,768	2,785,842
Michigan		1,561,918	742,780	64,222		280	1,700,261	4,069,461
Minnesota		831,622	780,011	7,041		897,017	574,709	3,090,400
Mississippi				146			1,432,117	1,432,264
Missouri		1,104,135		62,427				1,166,562
Montana		6,613,472					65,425	6,678,897
Nebraska		1,124,122		16,721		2,630		1,143,473
Nevada	1,199,874	2,513,722						3,713,596
New Hampshire		990,581	225,933				858,769	2,075,283
New Jersey		18,001	1,290,277	12,745				1,321,023
New Mexico		237,320		18,652				255,972
New York		23,083,943	2,087,144			20,540	502,686	25,694,313
North Carolina		2,595,708	129,391	8,889			1,642,330	4,376,317
North Dakota		1,332,076		7,665				1,339,741
Ohio		510,785	27,888				403,072	941,745
Oklahoma		2,344,690					230,696	2,575,386
Oregon		28,644,556	87,408			88,587	701,120	29,521,671
Pennsylvania		1,650,004	2,019,472	34,412		11,174	596,736	4,311,798
Rhode Island		3,143	103,616					106,759
South Carolina		1,225,443	49,202	537			866,107	2,141,289
South Dakota		3,431,865				871		3,432,736
Tennessee		6,946,530	49,219				779,426	7,775,175
Texas		1,200,331	51,151	58,815	-5	1,187,510	897,605	3,395,407
Utah	152,742	508,407	9,642					670,791
Vermont		884,211				12,133	370,408	1,266,752
Virginia		1,014,222	990,877	4,896			1,148,106	3,158,102
Washington		54,733,892	174,845	47,444			1,065,093	56,021,274
West Virginia		951,944	25,139				1,198	978,281
Wisconsin		2,056,245	401,147	86,121		72,284	705,354	3,321,152
Wyoming		879,111				365,162		1,244,273
Total	**13,740,503**	**216,961,046**	**19,931,044**	**1,833,508**	**542,755**	**6,737,337**	**35,199,916**	**294,946,110**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Source: Energy Information Administration, Form EIA-906, “Power Plant Report.”

Table C7. Renewable Electric Power Sector Net Summer Capacity by State, 2000
(Megawatts)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		3,014						3,014
Alaska		396						396
Arizona		2,705			1			2,706
Arkansas		1,395						1,395
California	2,529	10,306	262	57	384	1,541	427	15,506
Colorado		644		14		15		673
Connecticut		142	215	29				386
Delaware								
District of Columbia								
Florida		47	484	70			124	725
Georgia		2,333	2					2,335
Hawaii	33	13	62			12		119
Idaho		2,695					6	2,701
Illinois		32	103	21				156
Indiana		59	26					84
Iowa		136	6			197		339
Kansas		3						3
Kentucky		814						814
Louisiana		182		13				195
Maine		469	33				291	793
Maryland		531	122					653
Massachusetts		250	290				46	586
Michigan		261	114			1	161	536
Minnesota		149	145			271	92	657
Mississippi								
Missouri		543						543
Montana		2,734						2,734
Nebraska		162		1		3		166
Nevada	196	1,053						1,248
New Hampshire		412	28				100	540
New Jersey		13	199					211
New Mexico		82		2				84
New York		4,348	307			18	38	4,711
North Carolina		1,501	20				47	1,568
North Dakota		497						497
Ohio		164	94				7	264
Oklahoma		793						793
Oregon		9,142	37	3		25	37	9,245
Pennsylvania		700	259	11		10	28	1,008
Rhode Island		4	15					19
South Carolina		1,296						1,296
South Dakota		1,678						1,678
Tennessee		2,230	5			2	7	2,243
Texas		697	8		1	173		880
Utah	35	269	1					305
Vermont		285				1	72	357
Virginia		758	130				85	972
Washington		21,417	39	4			132	21,592
West Virginia		135						135
Wisconsin		463	58	2		12	29	564
Wyoming		298				96		394
Total	**2,793**	**78,247**	**3,064**	**226**	**386**	**2,377**	**1,728**	**88,821**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding. Electric power sector includes electric utilities and independent power producers.

Sources: Energy Information Administration, Form EIA-860A, “Annual Electric Generator Report-Utility” and Form EIA-860B, “Annual Electric Generator Report-Nonutility.”

Table C8. Renewable Commercial and Industrial Sector Net Summer Capacity by State, 2000
(Megawatts)

	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Wood/ Wood Waste	Total
Alabama				457	457
Alaska					
Arizona					
Arkansas			2	346	348
California	5	13	56	210	284
Colorado			5		5
Connecticut					
Delaware					
District of Columbia					
Florida			74	386	460
Georgia	7	5		489	502
Hawaii	13		83		96
Idaho				119	119
Illinois	1		3		4
Indiana		6			6
Iowa			3		3
Kansas					
Kentucky				4	4
Louisiana			5	286	291
Maine	242	28		336	607
Maryland		4		3	6
Massachusetts	5		16		21
Michigan	5	67		124	195
Minnesota	51	4		102	156
Mississippi				263	263
Missouri					
Montana				10	10
Nebraska			2		2
Nevada					
New Hampshire	31			16	47
New Jersey			1		1
New Mexico					
New York	18	40			58
North Carolina	359			125	484
North Dakota			9		9
Ohio				8	8
Oklahoma		16		60	76
Oregon				131	131
Pennsylvania		30		56	86
Rhode Island					
South Carolina	1	12		219	232
South Dakota					
Tennessee	170	7		5	181
Texas			9	168	177
Utah					
Vermont	5			4	9
Virginia	4	83	6	269	361
Washington	44			161	205
West Virginia	104				104
Wisconsin	48	3		57	107
Wyoming					
Total	**1,112**	**317**	**275**	**4,413**	**6,117**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Source: Energy Information Administration, Form EIA-860B, “Annual Electric Generator Report-Nonutility.”

Table C9. Total Renewable Net Summer Capacity by State, 2000
(Megawatts)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		3,014					457	3,471
Alaska		396						396
Arizona		2,705			1			2,706
Arkansas		1,395		2			346	1,743
California	2,529	10,311	275	113	384	1,541	637	15,791
Colorado		644		18		15		678
Connecticut		142	215	29				386
Delaware								
District of Columbia								
Florida		47	484	144			510	1,185
Georgia		2,341	7				489	2,837
Hawaii	33	26	62	83		12		215
Idaho		2,695					125	2,819
Illinois		33	103	24				159
Indiana		59	32					91
Iowa		136	6	3		197		343
Kansas		3						3
Kentucky		814					4	818
Louisiana		182		18			286	486
Maine		711	61				627	1,399
Maryland		531	126				3	659
Massachusetts		255	290	16			46	607
Michigan		265	181			1	285	732
Minnesota		200	149	0		271	194	813
Mississippi							263	263
Missouri		543						543
Montana		2,734					10	2,744
Nebraska		162		4		3		168
Nevada	196	1,053						1,248
New Hampshire		443	28				115	587
New Jersey		13	199	1				212
New Mexico		82		2				84
New York		4,366	347			18	38	4,769
North Carolina		1,860	20				171	2,051
North Dakota		497		9				506
Ohio		164	94				15	272
Oklahoma		793	16				60	869
Oregon		9,142	37	3		25	168	9,376
Pennsylvania		700	289	11		10	84	1,094
Rhode Island		4	15					19
South Carolina		1,297	12				219	1,528
South Dakota		1,678						1,678
Tennessee		2,400	12			2	11	2,425
Texas		697	8	9	1	173	168	1,057
Utah	35	269	1					305
Vermont		289				1	76	366
Virginia		761	212	6			354	1,334
Washington		21,461	39	4			293	21,797
West Virginia		240						240
Wisconsin		511	61	2		12	86	671
Wyoming		298				96		394
Total	**2,793**	**79,359**	**3,381**	**502**	**386**	**2,377**	**6,141**	**94,939**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, Form EIA-860A, “Annual Electric Generator Report-Utility” and Form EIA-860B, “Annual Electric Generator Report-Nonutility.”

Table C10. Renewable Electric Power Sector Net Summer Capacity Source by State, 2001
(Megawatts)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		3,014						3,014
Alaska		399						399
Arizona		2,705	4		1			2,710
Arkansas		1,392						1,392
California	2,003	10,326	241	58	390	1,558	424	14,998
Colorado		642		10		51		703
Connecticut		138	234	26				398
Delaware								
District of Columbia								
Florida		47	437	140			67	691
Georgia		2,334	2					2,336
Hawaii	33	19	62	62		11		187
Idaho		2,638					12	2,650
Illinois		34	110	40				184
Indiana		58	11					70
Iowa		131	109			318		559
Kansas		2				112		114
Kentucky		821						821
Louisiana		192		12				204
Maine		458	30				279	766
Maryland		530	118					648
Massachusetts		809	273				26	1,108
Michigan		251	100			1	160	512
Minnesota		145	114			303	92	654
Mississippi								
Missouri		543						543
Montana		2,680						2,680
Nebraska		162		2		4		167
Nevada	148	1,052						1,199
New Hampshire		398	31				92	521
New Jersey		12	181					194
New Mexico		82		2				84
New York		4,098	276			18	37	4,429
North Carolina		1,501	14	2			45	1,561
North Dakota		497						497
Ohio		163	94				7	264
Oklahoma		793						793
Oregon		9,118	14	3		158	36	9,329
Pennsylvania		736	312			34	28	1,110
Rhode Island		4	15					19
South Carolina		1,294						1,294
South Dakota		1,678				3		1,681
Tennessee		2,239	5			2	7	2,253
Texas		697	9		1	925		1,632
Utah	33	253	1					287
Vermont		272					72	345
Virginia		754	93				84	930
Washington		21,422	38	4		180	136	21,781
West Virginia		142						142
Wisconsin		453	57	1		45	29	585
Wyoming		297				141		438
Total	**2,216**	**78,424**	**2,985**	**362**	**392**	**3,864**	**1,631**	**89,874**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding. Electric power sector includes electric utilities and independent power producers.

Source: Energy Information Administration, Form EIA-860, “Annual Electric Generator Report.”

Table C11. Renewable Commercial and Industrial Sector Net Summer Capacity by State, 2001
(Megawatts)

	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Wood/ Wood Waste	Total
Alabama				432	432
Alaska					
Arizona					
Arkansas			2	269	270
California	5	12	36	207	260
Colorado			1		1
Connecticut					
Delaware					
District of Columbia					
Florida			73	245	318
Georgia	7	5		403	415
Hawaii	7		20		27
Idaho				70	70
Illinois	1	12	4		16
Indiana		10			10
Iowa			3		3
Kansas					
Kentucky				51	51
Louisiana			2	239	241
Maine	224	23		388	635
Maryland		3		62	65
Massachusetts	5		16		21
Michigan	2	67		128	196
Minnesota	29	3		77	108
Mississippi				255	255
Missouri					
Montana				11	11
Nebraska			3		3
Nevada					
New Hampshire	31			9	40
New Jersey			1		1
New Mexico					
New York	15	33			49
North Carolina	366			194	560
North Dakota			10		10
Ohio				7	7
Oklahoma		16		60	75
Oregon				123	123
Pennsylvania		28		56	84
Rhode Island					
South Carolina	1	10		222	233
South Dakota					
Tennessee	165	7		56	227
Texas			1	100	101
Utah					
Vermont	5			4	8
Virginia	4	76		318	397
Washington	31			158	189
West Virginia	101				101
Wisconsin	63	4		109	176
Wyoming					
Total	**1,060**	**307**	**173**	**4,250**	**5,790**

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, Form EIA-860,"Annual Electric Generator Report."

Table C12. Total Renewable Net Summer Capacity by State, 2001
(Megawatts)

	Geothermal	Hydroelectric Conventional	MSW/ Landfill Gas	Other Biomass[a]	Solar	Wind	Wood/ Wood Waste	Total
Alabama		3,014					432	3,446
Alaska		399						399
Arizona		2,705	4		1			2,710
Arkansas		1,392		2			269	1,662
California	2,003	10,331	253	94	390	1,558	631	15,259
Colorado		642		11		51		704
Connecticut		138	234	26				398
Delaware								
District of Columbia								
Florida		47	437	213			312	1,009
Georgia		2,341	7				403	2,751
Hawaii	33	25	62	82		11		214
Idaho		2,638					81	2,720
Illinois		35	122	44				200
Indiana		58	21					79
Iowa		131	109	3		318		562
Kansas		2				112		114
Kentucky		821					51	872
Louisiana		192		15			239	445
Maine		681	53				667	1,401
Maryland		530	121				62	713
Massachusetts		814	273	16			26	1,129
Michigan		253	166			1	288	708
Minnesota		173	117			303	169	762
Mississippi							255	255
Missouri		543						543
Montana		2,680					11	2,691
Nebraska		162		5		4		170
Nevada	148	1,052						1,199
New Hampshire		429	31				101	561
New Jersey		12	181	1				195
New Mexico		82		2				84
New York		4,113	309			18	37	4,477
North Carolina		1,867	14	2			239	2,122
North Dakota		497		10				507
Ohio		163	94				14	271
Oklahoma		793	16				60	868
Oregon		9,118	14	3		158	160	9,453
Pennsylvania		736	340			34	83	1,194
Rhode Island		4	15					19
South Carolina		1,295	10				222	1,526
South Dakota		1,678				3		1,681
Tennessee		2,404	12			2	62	2,480
Texas		697	9	1	1	925	100	1,732
Utah	33	253	1					287
Vermont		277					76	353
Virginia		758	168				402	1,328
Washington		21,453	38	4		180	294	21,970
West Virginia		243						243
Wisconsin		516	61	1		45	138	761
Wyoming		297				141		438
Total	**2,216**	**79,484**	**3,292**	**535**	**392**	**3,864**	**5,882**	**95,664**

[a] Agriculture byproducts/crops, sludge waste, tires and other biomass, liquids and gases.

Note: Blank cell indicates the state has no data to report for that energy source. Totals may not equal sum of components due to independent rounding.

Source: Energy Information Administration, Form EIA-860, “Annual Electric Generator Report.”

Table C13. Renewable Market Share of Net Generation by State, 2000 and 2001
(Thousand Kilowatthours)

	2000			2001		
	Total State Generation	Percent Renewable	Percent Nonhydro Renewable	Total State Generation	Percent Renewable	Percent Nonhydro Renewable
Alabama	124,405,343	8.0	3.3	125,345,122	10.0	3.3
Alaska	6,156,525	16.3		6,743,770	20.0	*
Arizona	88,946,578	9.4	*	89,911,270	8.5	*
Arkansas	43,875,767	9.0	3.6	47,192,036	8.6	3.2
California	*208,082,483*	29.2	10.8	198,596,086	23.8	11.0
Colorado	*44,165,546*	3.3	*	46,876,013	3.4	0.2
Connecticut	*32,967,568*	8.1	6.5	30,490,640	6.8	5.8
Delaware	*5,987,452*	0.3	0.3	6,807,686		
District of Columbia	144,374			123,239		
Florida	*191,815,839*	3.0	3.0	190,945,341	2.7	2.6
Georgia	*123,877,412*	4.5	2.5	118,316,772	4.7	2.5
Hawaii	*10,593,405*	8.7	7.7	10,633,095	7.2	6.3
Idaho	11,910,442	96.1	4.1	9,346,940	83.0	5.7
Illinois	178,496,081	0.6	0.5	179,249,272	0.5	0.4
Indiana	*127,819,518*	0.6	0.1	122,569,679	0.6	0.1
Iowa	*41,542,011*	3.6	1.4	40,658,513	3.6	1.5
Kansas	44,815,905	*		44,748,522	0.1	0.1
Kentucky	93,006,083	2.5	*	95,417,624	4.1	*
Louisiana	92,865,635	3.6	3.0	87,894,382	4.0	3.1
Maine	*14,047,948*	52.8	27.2	19,564,815	34.4	20.9
Maryland	51,145,380	5.0	1.6	49,062,340	3.7	1.3
Massachusetts	*38,697,880*	8.4	5.7	38,478,433	7.2	5.4
Michigan	*104,209,596*	4.1	2.8	111,845,612	3.6	2.2
Minnesota	51,423,339	5.8	4.0	48,523,228	6.4	4.7
Mississippi	*37,614,562*	4.5	4.5	53,446,452	2.7	2.7
Missouri	76,593,939	0.9	0.1	79,544,875	1.5	0.1
Montana	*26,451,826*	36.6	0.2	24,232,483	27.6	0.3
Nebraska	*29,109,864*	5.2	0.1	30,485,214	3.8	0.1
Nevada	*35,484,916*	10.7	3.9	33,875,970	11.0	3.5
New Hampshire	*15,031,497*	16.9	7.4	15,074,629	13.8	7.2
New Jersey	*58,085,216*	2.4	2.3	59,421,254	2.2	2.2
New Mexico	*34,022,021*	0.7		33,611,642	0.8	0.1
New York	*138,079,074*	20.1	2.1	143,914,537	17.9	1.8
North Carolina	122,274,356	4.0	1.5	117,495,853	3.7	1.5
North Dakota	*31,311,195*	6.8		30,332,072	4.4	*
Ohio	*149,060,281*	0.8	0.4	142,261,810	0.7	0.3
Oklahoma	55,571,957	4.4	0.3	55,249,448	4.7	0.4
Oregon	*51,789,974*	75.0	1.4	45,051,910	65.5	1.9
Pennsylvania	201,687,980	2.5	1.4	196,576,594	2.2	1.4
Rhode Island	*5,971,544*	2.0	1.9	7,501,894	1.4	1.4
South Carolina	*93,346,237*	3.2	1.5	89,158,988	2.4	1.0
South Dakota	9,697,337	58.9		7,400,743	46.4	
Tennessee	*95,838,583*	7.5	0.8	96,221,985	8.1	0.9
Texas	*377,742,363*	0.7	0.5	372,580,008	0.9	0.6
Utah	*36,609,073*	2.5	0.4	35,853,751	1.9	0.5
Vermont	6,303,014	25.1	5.7	5,480,612	23.1	7.0
Virginia	*77,189,371*	3.7	2.8	74,104,744	4.3	2.9
Washington	*108,236,877*	75.5	1.4	83,048,665	67.5	1.6
West Virginia	*92,865,175*	1.3		81,836,725	1.2	
Wisconsin	*59,644,419*	5.3	1.9	58,763,433	5.7	2.2
Wyoming	*45,494,281*	2.8	0.5	44,776,941	2.8	0.8
Total	***3,802,105,042***	9.4	2.1	**3,736,643,659**	7.9	2.1

[a] Agriculture byproducts/crops, sludge waste. Tires and other biomass solids, liquids and gases.

* = Less than one-half percent.

Note: Revised data are in italics. Blank cell indicates the state has no data to report. Totals may not equal sum of components due to independent rounding.

Sources: Energy Information Administration, Form EIA-759, “Monthly Power Plant Report,” Form EIA-860B, “Annual Electric Generator Report-Nonutility,” and Form EIA-906, “Power Plant Report.”

Table C14. Renewable Portfolio Standards by State, 2003

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

Note: In a few states, such as Hawaii and Illinois, the renewable portfolio standard (RPS) is voluntary. Blank cell indicates there is no state RPS.

Source: North Carolina Solar Center, Database of State Incentives for Renewable Energy (DSIRE) website: http://www.dsireusa.org (September 22, 2003).

Appendix D

Renewable Energy Data Limitations

This appendix provides information about the quality of renewable energy data presented in this report. Information pertinent to renewable energy source data quality, in general, is presented first, followed by discussion of electric and non-electric data sources by fuel type.

Renewable energy projects pose special data collection challenges. One challenge is the dispersed nature of many renewable energy forms, such as a photovoltaic (PV) system for generating electricity that may operate in a stand-alone fashion in a remote location. If the facility is not connected to an electricity grid, there is no Federal regulatory requirement to report its operating information. Tracking down hundreds or thousands of such facilities, each with a small power output, is very difficult.

Another challenge involves tracking renewable energy supplies. Conventional energy supplies, such as petroleum, are easily tracked because the distribution networks (usually pipelines) are limited and well-defined. This permits one to make reasonable assumptions about fuel consumption, assuming stocks can be reasonably estimated.[15] The same cannot be said for many renewable energy supplies. Often a large number of energy consumers must be surveyed in order to make reasonable inferences about renewable energy consumption. Wood, for example, is gathered by tens of thousands of entities—millions if residential use is considered—for fuel uses not reportable for regulatory purposes. Thus, obtaining accurate data on wood energy consumption would entail conducting large end use consumption surveys.

Finally, some renewable energy sources are byproducts (such as pulping liquor) of non-energy processes. To track such uses, information must be solicited from respondents not generally in the energy supply chain.

Electricity

As noted in Chapter 1, 68 percent of renewable energy consumption measured by EIA is used to produce electric power. It is, therefore, important to examine the coverage quality of EIA renewable electricity data. Between 1998 and 2000, EIA renewable electricity generation was derived from two principal sources: Form EIA-759, "Monthly Power Plant Report," and Form-EIA-860B, "Annual Electric Generator Report - Nonutility."[16] Form EIA-759 was sent to all electric utilities, while the EIA-860B was required of all nonutility generating plants exceeding 1 megawatt capacity. [17]

Beginning in 2001, the source for renewable electricity generation is Form EIA-906, "Power Plant Report." The EIA-906 is required from all regulated and unregulated electric power plants exceeding 1 Megawatt. For generation capacity, the source is Form EIA-860, "Annual Electric Generator Report." Because of the difficulty in surveying off-grid electric applications, the above surveys do not, in practice, cover off-grid power plants (although they may be covered in EIA's Manufacturing Energy Consumption Survey (MECS)[18]).

Because electric utilities are easily identified and have mandatory regulatory reporting requirements, complete coverage of utility-generated electricity is usually assured. As part of the electric power industry restructuring, some utilities are selling off generating assets. Every effort is made to assure that the new owner continues to report on the appropriate EIA survey. In contrast, nonutilities (i.e., QFs and IPPs) are required only to file regulatory reports at the time of their intention to become a grid electricity-producing facility. Over time, QF

[15] Even if stock data are only approximate, conventional energy stocks are normally a small percentage of production.

[16] Prior to 1998, the Form EIA-860B report was called the Form EIA-867, "Annual Nonutility Power Producer Report."

[17] Nonutility power plants include independent power producers whose primary business is the production of electricity for the wholesale market, and combined heat and power plants for which power production is a side element to the primary business.

[18] Because the MECS is based on the Bureau of the Census' Annual Survey of Manufacturers, EIA does not know the identity of MECS respondents.

ownerships change frequently. These factors, combined with the large number of QF applications, make tracking these facilities difficult. Accordingly, EIA has developed the 1 megawatt capacity threshold, below which power plants are not surveyed.

The EIA is currently undertaking an extensive effort to improve its coverage of renewable energy facilities. EIA is comparing its list of renewable electric generating plants with the National Renewable Energy Laboratory's "Renewable Electric Plant Information System" (REPiS), the list of wind plants maintained by the American Wind Energy Association, and other sources. As a consequence of this work, the final 2002 data collection for plant capacity and operations will include additional renewable plants and more plants will likely be added for 2003 and 2004 data collections.[19]

Non-Electric Renewable Energy Consumption

Overview

The primary application for renewable energy other than making electricity is creating heat for industrial processes, buildings, or water. Most non-electric consumption data are gathered on two EIA consumption surveys: the Manufacturing Energy Consumption Survey (MECS), and the Residential Energy Consumption Survey (RECS). MECS is based on the U.S. Bureau of the Census' Census of Manufacturing. As far as renewable energy is concerned, MECS provides consumption estimates of total industrial energy and various categories of biomass, including wood. MECS data was used from the 1991, 1994, and 1998 surveys. EIA fielded the MECS survey again in early 2003 for 2002 consumption data.

RECS is based on an area probability sample of households selected by EIA. For renewable energy, it provides estimates of residential wood energy consumption. RECS data was available for 1990, 1993, and 1997. During intervening years, EIA estimated energy consumption by assessing industry trends, housing developments, and changes in weather conditions.

There are three other non-electric applications for renewable energy: solar heating, alcohol transportation fuels, and geothermal energy. Solar energy for non- electric applications is derived from the EIA Solar Collector Manufacturing Survey, Form EIA-63A/B (formerly CE-63A/B). The survey does not collect energy "consumption" data, but rather production statistics on various types of solar and photovoltaic energy units. EIA applies additional assumptions regarding their application to estimate the amount of heat energy derived from installed solar/PV panels. Alcohol fuel consumption information is provided by the Form EIA-819M, "Monthly Oxygenate Telephone Report," and Form EIA-814, "Monthly Imports Report." Geothermal non-electric energy information is taken from data provided by the Oregon Institute of Technology, Geo-Heat Center.

Biomass

Wood is the principal component of biomass energy. Information on non-electric wood energy consumption is derived from the MECS and RECS sample surveys.

Although some questions about MECS coverage have been raised, no formal analysis of current data exists to support this concern. According to 1983 U.S. Forest Service statistics on wood harvested for fuelwood, he Pulp and Paper Industry subgroup of the Forest Products Industry group consumed only 42 percent of total sector wood energy, not including black liquor (a byproduct fuel). MECS surveys the smaller-populated Pulp and Paper Industry intensively but only randomly samples the larger-populated remainder of the Forest Products Industry. For a variety of reasons, it is difficult to trace wood energy supply to wood consumed for energy. RECS covers wood consumption only for the primary residence of those surveyed; thus, wood consumption by second homes is omitted. This could cause residential wood energy consumption to be understated by about 5 percent, but EIA has adjusted the data presented in this report to avoid the undercount.

Of the nearly 2.7 quadrillion Btu of biomass energy estimated to have been consumed in 2002, roughly three-fourths represents estimates linked to RECS and MECS. For MECS, 1998 estimated industrial biomass consumption has an appropriate relative standard error of 3 percent.[20] The RECS estimate of residential biomass energy consumption has a relative standard error of 10.3 percent.[21] Estimates of industrial and residential biomass energy consumption made for subsequent years, are also subject to nonsampling error. Nonsampling error also is present in the estimates of biomass energy consumption made for the agricultural and mining sectors.

Cross-checks of Form EIA-819M information on alcohol fuels with data from the Bureau of Alcohol, Tobacco, and Firearms and the U.S. Department of Transportation have not revealed any major deficiencies in the Form EIA-819M data.

[19] See http://www.eren.doe.gov/repis/ (November 6, 2002).

[20] Energy Information Administration, http://www.eia.doe.gov/emeu/mecs/contents.html (September 12, 2003). EIA fields the MECS survey as Form EIA-846.

[21] Energy Information Administration, Residential Energy Consumption Survey, DOE/EIA-0632(97) (Washington, DC, November 1997).

Geothermal

EIA does not collect data on non-electric applications of geothermal energy such as crop drying and groundwater heat pumps. A study prepared for the U.S. Department of Energy by the Oregon Institute of Technology, Geo-Heat Center, indicated that non-electric uses of geothermal energy amounted to nearly 23.1 trillion Btu in 2002 (Table D1). Sixty percent of this energy was provided by geothermal heat pumps.

Table D1. Geothermal Direct Use of Energy and Heat Pumps, 1990-2002
(Quadrillion Btu)

	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

Source: John Lund, Oregon Institute of Technology, Geo-Heat Center (Klamath Falls, Oregon, March 2003), unpublished data.

Wind, Solar, and Photovoltaics

EIA does not collect information on direct energy uses of wind (e.g., water-pumping). No comprehensive source of such information is known.

The solar manufacturing data collected on Forms EIA-63A and EIA-63B are subject to various limitations including: (1) coverage (the list of respondents may not be complete or, on the other hand, there may be double counting); (2) nonresponse (some of those surveyed may not respond, or they may not provide all the information requested); and (3) adjustments (errors may be made in estimating values for missing data).

EIA collects solar data only on terrestrial systems; it does not collect data on satellite and military applications. The total value of U.S. photovoltaic shipments in 2002 according to the Form EIA-63B was $342 million. Based on anecdotal information for 2002, shipments ranging from about 220 million to $240 million went for satellite applications. Military applications cannot be estimated due to classified information and budgetary accounting. These figures do not include possible inventories held by distributors, retailers, and installers.

The universe of solar/PV survey respondents is a census of those U.S.-based companies involved in manufacturing and/or importing solar collectors and photovoltaic cells and modules. Care has been taken to establish the survey frames accurately. The frames of potential respondents are compiled from previous surveys and from information in the public domain. However, because the solar collector and photovoltaic cell and module industries are subject to sporadic entry and exit of manufacturers and importers, the frame may exclude some small companies that have recently entered or reentered the industry. From 1993 through 2002, EIA received survey forms from all known potential solar thermal and photovoltaic respondents.

Geothermal Heat Pump Manufacturing Activity

The EIA has collected information on geothermal heat pumps using its survey the Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey," for every year between 1997 and 2002 except for 2001 when no data was collected. The principal data collected are the number and type of heat pumps shipped and their capacity ratings.

The data collected on Form EIA-902 are subject to various sources of error. These sources are: (1) coverage (the list of respondents may not be complete or, on the other hand, there may be double counting); (2) non- response (all that are surveyed may not respond or may not provide all information requested); (3) respondents (respondents may commit errors in reporting the data); (4) processing (the data collection agency may omit or incorrectly transcribe a submission); (5) concept (the data collection elements may not measure the items they were intended to measure); and (6) estimation (errors may be made in estimating values for missing data). Because the survey is a census survey, the estimates shown in this report are not subject to sampling error. Although it is not possible to present estimates of nonsampling error, precautionary steps were taken at each stage of the survey design to minimize the possible occurrence of these errors.

In order to improve accuracy and the quality of data collected from U.S. geothermal heat pump manufacturers in 1999, EIA modified the Form EIA-902 by adding a new data element which requested respondents to report all ARI-320 heat pumps that were shipped in 1999, as well as the number of ARI-320 geothermal heat pump units that were manufactured to be connected to ground, ground water, or surface water connection for heat exchange. This modification clarifies for the manufacturer the type of ARI-320 applications manufacturers should report as geothermal and would separate out units that would be connected to a boiler/cooling tower. Respondents were asked to report the total number of heat pumps shipped and the number of only the ARI-320 geothermal heat pumps shipped. ARI-320 units may be connected either to a "boiler/ cooling tower" configuration or to ground/ground water.

Ground/ground water connections are geothermal applications, while boiler/cooling tower configurations are traditional water-to-water exchange uses.

An additional modification to the Form EIA-902 was to combine both the ARI-325 and ARI-330 units into one reporting category. Many ARI-325 geothermal heat pumps are dual-rated to qualify as ARI-330 units. Which rating is appropriate depends on the installed application, information not necessarily known when the manufacturer shipped the unit. Therefore, the sum of ARI-325 and ARI-330 units may be regarded as an accurate total, whereas manufacturers would estimate the number of units in each category based upon heuristic information.

Appendix E

Renewable Energy Federal Legislation:
108th Session of the U.S. Congress

This appendix presents the summary of Federal bills before the current Congress (listed in numeric order) which deal with renewable energy in the United States. The bills are presented first by the United States Senate, followed by the bills introduced in the United States House of Representatives. All information reproduced here has been abstracted from the Library of Congress Internet website, http://thomas.loc.gov/home/thomas2.html, as of October 24, 2003. Further information about these proposals and their status can be accessed at this site.

Copies of the proposed bills listed can be obtained from EIA's renewable energy web site at http://www.eia.doe.gov/cneaf/solar.renewables/page/legislation/renewleg.html, where links for bills are provided.

Senate Bills

S. 199 - (No Short Title)

Introduced: January 21, 2003, by Senator Carl Levin

Purpose: To amend the Solid Waste Disposal Act to authorize the Administrator of the Environmental Protection Agency to carry out certain authorities relating to the importation of municipal solid waste under the Agreement Concerning the Transboundary Movement of Hazardous Waste between the United States and Canada.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: It shall be unlawful for any person to import, transport, or export municipal solid waste, for final disposal or incineration.

The authority of the Administrator shall be to: a) perform the functions of the Designated Authority for the United States with respect to the importation and exportation of municipal solid waste; and b) implement and enforce the agreement.

Consent for the importation of MSW shall be given based on: a) the substantial weight of the views of each State into which the MSW is to be imported; and b) considering the views of the local government to which jurisdiction over the location of the MSW is to be disposed of; and c) taking into consideration the impact of the importation on--1) continued public support for, and adherence to, State and local recycling programs; 2) landfill capacity, as provided in comprehensive waste management plans; 3) air emissions resulting from increased vehicular traffic; 4) road deterioration resulting from increased vehicular traffic; and 5) public health and the environment.

If a person is in violation or has violated the compliance orders, a civil penalty will be issued against the person for any past or current violations; or compliance must be met immediately by a specified date. The civil action which may include either a temporary or a permanent injunction will occur in the United States district court for the district in which the violation occurred.

Penalties shall not exceed $25,000 per day of noncompliance for each violation.

Any order issued for violation becomes final unless, not later than 30 days after the order, the person(s) against the order submits a request for a public hearing.

A public hearing shall be promptly conducted, with subpoenas granted for attendance and testimony of witnesses; and the production of relevant papers, books, and documents.

If the person(s) fail to take corrective action specified in the order, a civil penalty of not more than $25,000 for each day of continued noncompliance will be enforced.

Current Status: Referred to the Committee on Environment and Public Works on January 21, 2003.

S. 207 - (No Short Title)

Introduced: January 23, 2003, by Senator Gordon Smith

Purpose: To amend the Internal Revenue Code of 1986 to provide a 10-year extension of the credit for producing electricity from wind.

Renewable Energy Source(s): wind

Summary: Section 45 (c)(3)(A)of the Internal Revenue Code of 1986 (relating to wind facilities) is amended from January 1, 2004 to January 1, 2014.

Current Status: Referred to the Committee on Finance on January 23, 2003.

S.358 - (No Short Title)

Introduced: February 11, 2003, by Senator Blanche Lincoln

Purpose: To amend the Internal Revenue Code of 1986 to modify the credit for the production of fuel from nonconventional sources for the production of electricity to include landfill gas.

Renewable Energy Source(s): landfill gas

Summary: Section 29 of the Internal Revenue Code of 1986 (credit for producing fuel from a nonconventional source) is amended as follows---extension and modification for facilities producing qualified fuels from landfill gas. A facility producing a qualified fuel from landfill gas placed in service after June 30, 1998, and before January 1, 2008—this section applies to fuel produced at the facility during the 5-year period beginning on the date the facility was placed in service or the date of the enactment.

A landfill gas facility is a facility using landfill gas to produce electricity, owned by the taxpayer, placed originally in service before January 1, 2008.

Current Status: Referred to the Committee on Finance on February 11, 2003.

S.359 - Waste to Energy Utilization Act of 2003

Introduced: February 11, 2003, by Senator Lincoln Blanche

Purpose: To amend the Internal Revenue Code of 1986 to modify the credit for the production of electricity to include electricity produced from municipal solid waste.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: Section 45 (c)(3) of the Internal Revenue Code of 1986 (relating to qualified facility) is amended as follows---municipal solid waste facility. A facility or unit using municipal solid waste to produce electricity.

The facility must be owned by the taxpayer and originally placed in service on or before the date of enactment and before January 1, 2008.

Current Status: Referred to the Committee on Finance on February 11, 2003.

S.383- Canadian Waste Import Ban Act of 2003

Introduced: February 12, 2003, by Senator Debbie Stabenow

Purpose: To amend the Solid Waste Disposal Act to prohibit the importation of Canadian municipal solid waste without State consent.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: No person may import into any State, and no solid waste management facility may accept, Canadian municipal waste for the purpose of disposal or incineration.

The Governor of a State may elect to opt out of the ban and consent to the importation and acceptance by the State of Canadian municipal solid waste, if the Governor submits a notice of that election to the Administrator of the United States Environmental Protection Agency.

The Administrator, in determining whether or not to consent to importation will: a) obtain consents from each State into which the Canadian municipal solid waste is to be imported; and b) consider the impact of the importation on homeland security, public health, and the environment..

Current Status: Referred to the Committee on Environment and Public Works on February 12, 2003.

S.395 - Bipartisan Renewable, Efficient Energy with Zero Effluent (BREEZE) Act

Introduced: February 13, 2003, by Senator Charles E. Grassley

Purpose: To amend the Internal Revenue Code of 1986 to provide a 3-year extension of the credit for producing electricity from wind.

Renewable Energy Source(s): wind

Summary: Section 45(c)(3)(A) of the Internal Revenue Code of 1986 is amended from January 1, 2004 to now January 1, 2007.

Current Status: Referred to the Committee on Finance on February 13, 2003.

S.421 - Renewable Energy Production Incentive Reform Act

Introduced: February 14, 2003, by Senator Maria Cantwell

Purpose: To reauthorize and revise the Renewable Energy Production Incentive program.

Renewable Energy Source(s): all renewables

Summary: Section 1212(a) of the Energy Policy Act of 1992 (42 U.S.C. 13317 (a) is amended as follows—if there are insufficient appropriations to make full payments for electric production from all qualified renewable energy facilities in any given year, 60 percent of appropriated funds for that year shall be assigned to the facilities that use solar, wind, geothermal, or closed-loop biomass technologies to generate electricity. The remaining 40 percent shall be assigned to other projects. A qualified renewable energy facility shall be a not-for-profit electric cooperative; a public utility; a State, Commonwealth, territory or possession of the United States; the District of Columbia or political subdivision; or an Indian tribal government.

The window of eligibility during the 10 fiscal year period, beginning with the first full fiscal year after the date of enactment shall be after October 1, 2003, and before October 1, 2013.

Authorization of appropriations of sums will be deemed necessary to carry out this section for fiscal years 2003 through 2013. Funds shall remain available until expended.

Current Status: Referred to the Committee on Energy and Natural Resources on February 14, 2003.

S. 424 - Tribal Energy Self-Sufficiency Act

Introduced: February 14, 2003, by Senator Jeff Bingaman

Purpose: To establish, reauthorize, and improve energy programs relating to Indian tribes.

Renewable Energy Source(s): all renewables

Summary:

Title I- Indian Energy

Renewable Energy Study (Section 105)
Not later than 2 years after the date of enactment, and once every 2 years following, the Secretary of Energy shall submit to the Committee on Energy and Natural Resources and the Committee on Indian Affairs of the Senate and the Committee on Energy and Commerce and the Committee on Resources of the House of Representatives a report on renewable energy. The report will: a) describe energy consumption and renewable energy development potential on Indian lands; b) identify barriers to the development of renewable energy by Indian tribes (including Federal policies and regulations); and c) make recommendations regarding the removal of stated barriers.

In an effort to encourage Indian tribal energy developments, each Administrator (the Administrator of the Bonneville Power Administration (BPA) and the Administrator of the Western Area Power Administration (WAPA)) shall take actions that are appropriate for this purpose. Each administrator shall: a) consider the unique relationship that exists between the Federal Government and Indian tribes; b) provide power allocations from WAPA to Indian tribes in an effort to match power to load, such that, Indian-owned renewable energy projects can be used effectively to meet loads located on Indian Lands; and c) allow the Administrator of WAPA to purchase renewable or nonrenewable power from Indian tribes.

Technical assistance will be provided to Indian tribes seeking to use a high-voltage transmission system for delivery of electric power.

Each Administrator shall give priority in funding to Indian tribes that have limited financial capability to acquire assistance.

Not later than 2 years after the date of enactment, the Secretary of Energy shall submit to the Committee on Energy and Natural Resources and the Committee on Indian Affairs of the Senate and the Committee on Energy and Commerce and the Committee on Resources of the House of Representatives a power allocation study report. The report shall: a) describe the use by Indian tribes of Federal power allocations of WAPA (or power sold by the Southwestern Power Administration) and BPA to or for the benefit of Indian tribes in service areas of those administrations; and b) identify--1) the quantity of power allocated to Indian tribes by WAPA; 2) the quantity of power sold to Indian tribes by other power marketing administrations; and 3) barriers that impede tribal access to and use of Federal power, including an assessment of opportunities; and identify measures to remove those barriers and to improve the ability of power marketing administrations to facilitate the use of Federal power by Indian tribes.

Authorization of appropriations shall be $750,000 for each of fiscal years 2003 through 2013.

Feasibility Study for Combined Wind and Hydropower Demonstration Project (Section 107)
The Secretary of Energy, in coordination with the Secretary of the Army and the Secretary of the Interior, shall conduct a study of the cost and feasibility of developing a demonstration project that would use wind energy generated by Indian tribes and hydropower generated by the Army Corps of Engineers on the Missouri River to supply firming power to the Western Area Power Administration.

The study shall: a) determine the feasibility of the blending of wind energy and hydropower generated from the Missouri River dams operated by the Army Corps of Engineers; b) review historical purchase requirements and projected purchase requirements for firming and the patterns of availability and use of firming energy; c) assess the wind energy resource potential on tribal land and projected cost savings through a blend of wind and hydropower over a 30-year period; d) include a preliminary interconnection study and a determination of resource adequacy of the Upper Great Plains Region of WAPA; e) determine seasonal capacity needs and associated transmission upgrades for integration of tribal wind generation; and f) include an independent tribal engineer as a study team member.

Not later than 1 year after the date of enactment, the Secretary of Energy and Secretary of the Army shall submit to Congress a report that describes the results of the study. The study shall include--a) an analysis of the potential energy cost savings to the customers of WAPA through the blend of wind and hydropower; b) an evaluation of whether a combined wind and hydropower system can reduce reservoir fluctuation, enhance efficient and reliable energy production, and provide Missouri River management flexibility; and c) recommendations for a demonstration project that could be carried out by WAPA in partnership with an Indian tribal government or tribal government energy consortium to demonstrate the feasibility and potential of using wind energy produced on Indian land to supply firming energy to WAPA or any other Federal power marketing agency.

Authorization of appropriations shall be $500,000, to remain available until expended. All cost incurred by WAPA shall be nonreimbursable.

Title II—Renewable Energy and Rural Construction Grants

Renewable Energy Production Incentive (Section 201)
Section 1212(b) of the Energy Policy Act of 1992 (42 U.S.C. 13317(b) is amended regarding a qualified renewable energy facility. Such a facility shall be: a) a nonprofit electrical cooperative; b) a public utility; c) State; d) territory or possession of the United States; e) District of Columbia; f) Indian tribal government (or a subdivision of an Indian tribal government).

Section 1212(c) of the Energy Policy Act of 1992 (42 U.S.C. 13317(c) regarding the window of eligibility is amended to 10 fiscal years, beginning with the first full fiscal year after the date of enactment and before October 1, 2013.

Section 1212 (e)(1) of the Energy Policy Act of 1992 (U.S.C. 13317(e)(1) is to include landfill gas, incremental hydropower, and ocean energy resources.

Title III—Energy Efficiency and Assistance to Low-Income Consumers

Low-Income Community Energy Efficiency Pilot Program (Section 301)
Grants may be provided to local governments, nonprofit and tribal entities. Indian tribes shall include an Alaskan Native village, Regional Corporation, and Village Corporation (as defined under the Alaska

Native Claims Settlement Act (43 U.S.C. 1601 et seq.).

The grants will: a) improve energy efficiency; b) identify and develop alternative renewable and distributed energy supplies; and c) increase energy conservation to low-income rural and urban communities.

Grants shall be provided on a competitive basis for: a) investments that develop alternative renewable and distributed energy supplies; b) energy efficiency projects and energy conservation programs; c) studies and other activities that improve energy efficiency in low-income rural and urban communities; d) planning and development assistance for increasing the energy efficiency of buildings and facilities; and e) technical and financial assistance to local government and private entities on developing new renewable and distributed sources of power or combined heat and power generation.

Authorized for appropriations shall be $20,000,000 for each of fiscal years 2003 through 2005.

Current Status: Referred to the Committee on Indian Affairs on March 19, 2003.

S. 431 - Municipal Solid Waste Interstate Transportation and Local Authority Act of 2003

Introduced: February 24, 2003, by Senator George V. Voinovich

Purpose: To amend the Solid Waste Disposal Act to impose certain limits on the receipt of out-of-State municipal solid waste.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: Subtitle D of the Solid Waste Disposal Act (42 U.S.C. 6941 et seq) is amended as follows—authority to prohibit or limit receipt of out-of-State municipal solid waste at existing facilities.

Only the following shall be considered to specifically authorize a facility to receive out-of-State MSW: a) an authorization to receive MSW from any place within a fixed radius surrounding the facility that includes an area outside the State; b) an authorization to receive MSW from any place of origin in the absence of any provision limiting those places of origin to places inside the State; c) an authorization to receive MSW from a specifically identified place or places outside the State; or d) a provision that uses such a phrase as “regardless of origin” or “outside the State” in reference to MSW.

Either of the following, by itself, shall not be considered to specifically authorize a facility to receive out-of-State MSW: a) a general reference to the receipt of MSW from outside the jurisdiction of the affected local government; and b) an agreement to pay a fee for the receipt of out-of-State MSW.

In order to qualify as an authorization to receive out-of-State MSW, a provision does not need to be in any particular form; a provision shall qualify as long as the provision clearly and affirmatively states the approval or consent of the affected local government or State for receipt of MSW from places of origin outside the State.

Subtitle D of the Solid Waste Disposal Act (42 U.S.C. 6941 et seq.) is amended as follows—congressional authorization of State and local government control over movement of municipal solid waste and recyclable materials.

Any State or political subdivision is authorized to exercise flow control authority to direct the movement of MSW and recyclable materials voluntarily relinquished by the owner or generator to particular waste management facilities, or facilities for recyclable materials.

The conditions to be met are: a) the waste and recyclable materials are generated within the jurisdictional boundaries of such State or political subdivision; b) the flow control authority is imposed through the adoption or execution of a law, ordinance, regulation, resolution, or other legally binding provision or official act of the State or political subdivision that—1) was in effect on the suspension date; 2) was in effect prior to the issuance of an injunction or other order by a court based on a ruling that such law, ordinance, regulation, resolution, or other legally binding provision or official act violated the Commerce Clause of the United States Constitution; or 3) was in effect immediately prior to suspension or partial suspension thereof by legislative or official administrative action of the State or political subdivision expressly because of the existence of an injunction or other court order of the type issued by a court of competent jurisdiction; c) the State or a political subdivision has for one or more of such designated facilities—1) on or before the suspension date, presented eligible bonds for sale; 2) on or before the suspension date, issued a written public declaration or regulation stating that bonds would be issued and held hearings regarding such issuance, and subsequently presented eligible bonds for sale within 180 days of the declaration or regulation; or d) on or before the suspension date, executed a legally binding contract or agreement that-- 1) was in effect as of the suspension date; 2) obligates the delivery of a minimum quantity of MSW or recyclable materials to one or more such designated waste management facilities or facilities for recyclable materials; and 3) either-- a) obligates the State or political subdivision to pay for that minimum quantity of waste or recyclable materials even if the stated minimum quantity of such waste or recyclable materials is not delivered within a required timeframe; or b) otherwise imposes liability for damages resulting from such failure.

In addition to any other flow control authority authorized, a solid waste district or a political subdivision of a State may exercise flow control authority for a period of 20 years after the date of enactment, for MSW and recyclable materials that are generated within its jurisdiction if: a) the solid waste district, or a political subdivision within such district, is required through a recyclable materials recycling program to meet a MSW reduction goal of at least 30 percent by the year 2005, and uses revenues generated by the exercise of flow control authority strictly to implement programs to manage MSW and recyclable materials, other than incineration programs; and b) prior to the suspension date, the solid waste district, or a political subdivision within such district--1) was responsible under State law for the management and regulation of the storage, collection, processing, and disposal of solid wastes within its jurisdiction; 2) was authorized by State statute (enacted prior to January 1, 1992) to exercise flow control authority, and subsequently adopted or sought to exercise the authority through a law, ordinance, regulation, regulatory proceeding, contract, franchise, or other legally binding provision; and c) was required by State statute (enacted prior to January 1, 1992) to develop and implement a solid waste management plan consistent with the State solid waste management plan, and the district solid waste management plan was approved by the appropriate State agency prior to September 15, 1994.

Current Status: Referred to the Committee on Environment and Public Works on February 24, 2003.

S.464 - Renewable Energy Incentives Act

Introduced: February 27, 2003, by Senator Harry M. Reid

Purpose: To amend the Internal Revenue Code of 1986 to modify and expand the credit for electricity produced from renewable resources and waste products.

Renewable Energy Source(s): all renewables

Summary: Modifications to credit for electricity produced from renewable energy resources and waste products has been amended from 1.5 cents to 1.8 cents.

Alternative resources have been amended to include solar, open-loop biomass, geothermal,

incremental geothermal, incremental hydropower, and landfill gas.

Current Status: Referred to the Committee on Finance on February 27, 2003.

S.488 - (No Short Title)

Introduced: February 27, 2003, by Senator Byron L. Dorgan

Purpose: To amend the Internal Revenue Code of 1986 to provide a 5-year extension of the credit for electricity produced from wind.

Renewable Energy Source(s): wind

Summary: Section 45(c)(3)(A) of the Internal Revenue Code of 1986 (relating to wind facilities) is amended from calendar year 2004 to calendar year 2009.

Current Status: Referred to the Committee on Finance on February 27, 2003.

S.494 - (No Short Title)

Introduced: February 27, 2003, by Senator Michael D. Crapo

Purpose: To amend the Internal Revenue Code of 1986 to include agricultural and animal waste sources as a renewable energy resource.

Renewable Energy Source(s): biomass

Summary: Section 45(c)(1) of the Internal Revenue Code of 1986 is amended to include agricultural and animal waste sources.

In the case of a facility using agricultural and animal waste to produce electricity—qualified refers to any facility of the taxpayer originally placed in service after December 31, 1999 and before January 1, 2007; and regarding any other facility, after the date of enactment and before January 1, 2007.

Current Status: Referred to the Committee on Finance on February 27, 2003.

S. 597 - Energy Tax Incentives Act of 2003

Introduced: March 11, 2003, by Senator Charles E. Grassley

Purpose: To amend the Internal Revenue Code of 1986 to provide energy tax incentives.

Renewable Energy Source(s): wind, geothermal, biomass, solar

Summary: A three year extension (from January 1, 2004 to January 1, 2007) will be given for the production of electricity from wind and poultry waste. The extension shall apply to electricity sold after the date of enactment.

A credit for electricity produced from biomass (closed-loop biomass facility) will be given to a taxpayer who originally owned the qualified facility and placed it in service after December 31, 1992, and before January 1, 2007. A credit will also be given if owned by the taxpayer and originally placed in service before January 1, 1993, and modified to use closed-loop biomass to co-fire with coal or other biomass before January 1, 2007, as approved under the Biomass Power for Rural Development Programs or under a pilot project of the Commodity Credit Corporation.

The ten-year period for a qualified facility shall be treated as beginning no earlier than the date of enactment.

A credit for electricity produced from swine and bovine waste nutrients, geothermal energy and solar energy, shall be given to a taxpayer for the qualified facility originally placed in service after the date of enactment and before January 1, 2007.

Any credit given to a qualified facility owned by the taxpayer may be transferred or used by an organization that is exempt from taxes, a public utility that is exempt from taxes, any State or political subdivision, the District of Columbia, any possession of the United States or any Indian tribal government.

Current Status: Referred to the Committee on Finance on March 11, 2003.

S.759 - Small Wind Energy Systems Act of 2003

Introduced: April 1, 2003, by Senator Richard J. Durbin

Purpose: To amend the Internal Revenue Code of 1986 to provide a tax credit for individuals and businesses for the installation of certain wind energy property.

Renewable Energy Source(s): wind

Summary: Subpart A of part IV of subchapter A of chapter 1 of the Internal Revenue Code of 1986 is amended as follows—residential small wind energy systems.

A qualified wind energy property expenditure is an expenditure for a wind energy property installed on or in connection with a dwelling unit located in the United States and used as a residence by the taxpayer, including all necessary installation fees and charges.

A qualified wind energy property carries at least a 5-year warranty covering defects in design, material, or workmanship, and, for any qualifying wind turbine that is not installed by the taxpayer, at least a 5-year limited warranty covering defects in installation.

A qualifying wind turbine generates 75 kilowatts of rated capacity or less, which at the time of manufacture, and not more than one year from the date of purchase, meets the latest performance rating standards published by the American Wind Association or the International Electrotechnical Commission and which is used to generate electricity.

This section shall not apply to property installed in taxable years beginning after December 31, 2008.

Subparagraph (A) of section 48 (a)(3) of the Internal Revenue Code of 1986 is amended as follows---credit for business installation of small wind energy property.

For any qualified wind energy property placed in service during the taxable year, the credit determined with respect to property shall not exceed an amount equal to 30 percent of the basis of the property (including all necessary installation fees and charges) and $1,000 for each kilowatt of capacity.

The effective date shall apply to property placed in service after December 31, 2003.

Current Status: Referred to the Committee on Finance on April 1, 2003.

S.944 - Renewable Energy Investment Act of 2003

Introduced: April 29, 2003, by Senator James M. Jeffords

Purpose: To enhance national security, environmental quality, and economic stability by increasing the

production of clean, domestically produced renewable energy as a fuel source for the national electric system.

Renewable Energy Source(s): all renewables sources, except hydro

Summary: For each calendar year beginning with calendar year 2006, each retail electric supplier shall submit, not later than April 30th of each year, renewable energy credits. The renewable energy credits shall be in an amount equal to the required annual percentage of the retail electric supplier's total amount of kilowatthours of nonhydropower electricity sold to consumers during the previous calendar year.

A renewable energy credit for any given year not used to satisfy the minimum requirement for that year may be carried over for use within the next 2 years.

The amount of electricity generated by renewable energy sources shall not be less than: a) 5 percent for calendar years 2006 through 2009; b) 10 percent for calendar years 2010 through 2014; c) 15 percent for calendar years 2015 through 2019; and d) 20 percent for calendar year 2020 and thereafter.

Not later than 1 year after the data of enactment, the renewable energy credit program shall be established to issue, monitor the sale or exchange of, and to track renewable energy credits.

An entity that generates electric energy through the use of a renewable energy resource may apply for the issuance of renewable energy credits. An application should include the type of renewable energy resource used to produce the electric energy; the State in which the electric energy was produced; and any other information deemed appropriate.

An entity applying, may receive 1 renewable energy credit for each kilowatthour of renewable energy generated in any State from the date of enactment, and each year thereafter. A renewable energy credit will vest with the owner of the system or facility that generates the renewable energy unless the owner explicitly transfers the renewable energy credit.

Three renewable energy credits shall be issued for each kilowatthour of distributed generation.

To be eligible for a renewable energy credit, the unit of electricity generated through the use of a renewable energy resource shall be sold for retail consumption or used by the generator.

The Secretary of Energy shall offer renewable energy credits for sale at the lesser of 3 cents per kilowatthour or 110 percent of the average market value of renewable energy credits for the applicable compliance period.

On January 1 of each year after calendar year 2006, an adjustment for inflation shall be given to the price charged per renewable energy credit for that calendar year.

No States shall be prohibited from requiring additional renewable energy generation in the State under any renewable energy programs conducted by the State.

Any retail electric supplier that does not submit renewable energy credits shall be liable for the payment of a civil penalty. The civil penalty shall be calculated on the basis of the number of renewable energy credits not submitted, multiplied by the lesser of 4.5 cents or 300 percent of the average market value of renewable energy credits for the compliance period.

Not later than 1 year after the date of enactment, the Secretary shall establish a State renewable energy grant program. The program shall promote State renewable energy production and use. Funds will be made available to States for: a) renewable energy research and development; b) loan guarantees to encourage construction of renewable energy facilities; c) consumer rebate or other programs to offset costs of small residential or small commercial renewable energy systems including solar hot water; or d) promotion of distributed generation.

Preference for the funds shall be given to: a) States that have a disproportionately small share of economically sustainable renewable energy generation capacity; and b) State grant programs that are most like to stimulate or enhance innovative renewable energy technologies.

Current Status: Referred to the Committee on Energy and Natural Resources on April 29, 2003.

S.1149 - Energy Tax Incentives Act of 2003

Introduced: May 23, 2003, by Senator Charles E. Grassley

Purpose: To amend the Internal Revenue Code of 1986 to provide energy tax incentives.

Renewable Energy Source(s): wind, geothermal, biomass

Summary:

Title I—Renewable Electricity Production Tax Credit

Subsection (c) of section 45 (relating to electricity produced from certain renewable resources) is amended as follows—extension and expansion of credit for electricity produced from certain renewable resources. Qualified energy resources now include wind, closed-loop biomass, biomass (other than closed-loop), geothermal energy, solar energy, small irrigation power, biosolids and sludge, and municipal solid waste.

A closed-loop qualified facility must be owned by the taxpayer, originally placed in service after December 31, 1992, and before January 1, 2007.

A wind qualified facility must be owned by the taxpayer, originally placed in service afer December 31, 1993, and before January 1, 2007.

A biomass qualified facility, originally placed in service after the date of enactment of the Energy Tax Incentives Act of 2003 and before January 1, 2007.

A facility using geothermal or solar energy to produce electricity must be owned by the taxpayer, originally placed in service after the date of enactment of the Energy Tax Incentives Act of 2003, and before January 1, 2007.

A small irrigation power facility, a biosolids and sludge facility, and a municipal solid waste facility, must be owned by the taxpayer, originally placed in service after the date of enactment of the Energy Tax Incentives Act of 2003, and before January 1, 2007.

Current Status: Placed on Senate Legislative Calendar under General Orders; Calendar No. 113 on May 23, 2003.

S. 1476 - Wind Power Tax Incentives Act of 2003

Introduced: July 28, 2003, by Senator Tom Harkin

Purpose: To amend the Internal Revenue Code of 1986 to encourage investment in facilities using wind to produce electricity.

Renewable Energy Source(s): wind

Summary: Section 469 of the Internal Revenue Code of 1986 is amended as follows—offset of passive activity losses and credits of an eligible taxpayer from wind energy facilities.

Section 38(c) of the Internal Revenue Code of 1986 is amended as follows—credit for wind energy facilities of an eligible taxpayer allowed against minimum tax.

Amendments made shall apply to taxable years ending after the date of enactment.

Current Status: Referred to the Committee on Finance on July 28, 2003.

House Bills

H.R.6 - Energy Policy Act of 2003

Introduced: April 7, 2003, by Congressman W. J. Tauzin

Purpose: To enhance energy conservation and research and development, to provide for security and diversity in the energy supply for the American people.

Renewable Energy Source(s): net metering, wind, solar, bioenergy, biopower, biomass, geothermal, ocean thermal, fuel cells, open-loop biomass, closed-loop biomass, landfill gas and municipal solid waste (MSW).

Summary:

Division A—Energy and Commerce
Title VI—Electricity
Subtitle F—Renewable Energy

Section 16071. Net Metering
Section 16072. Renewable Energy Production Incentive
Section 16073. Renewable Energy on Federal Lands
Section 16074. Assessment of Renewable Energy Resources

Net Metering (Section 16071)
The Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2621)(d) is amended as follows: each utility shall make available upon request net metering services to any electric consumer that the electric utility serves.

The Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2625) is amended to indicate changes in certain aspects of net metering, such as rates and charges; measurement; electric energy supplied exceeding electric energy generated; electric energy generated exceeding electric energy supplied; safety and performance; as well as additional control and testing requirements.

Renewable Energy Production Incentive (Section 16072)
Amends the incentive payments portion of The Energy Policy Act of 1992 (42 U.S.C. 13317) (a). If there are insufficient appropriations to make full payments for electric production from all qualified renewable energy facilities in any given year, the Secretary shall assign 60 percent of appropriated funds for that year to facilities that use solar, wind, geothermal, or closed-loop (dedicated energy crops) biomass technologies to generate electricity, and assign the remaining 40 percent to other projects. The Secretary may, after transmitting to the Congress an explanation of the reasons may alter the percentage requirements.

The Energy Policy Act of 1992 (42 U.S.C. 13317(b) is amended regarding what geographical location qualifies as a renewable energy facility to include a not-for-profit electric cooperative, a public utility, a State, Commonwealth, territory or possession of the United States or the District of Columbia, or a political subdivision, or an Indian tribal government.

The eligibility window of The Energy Policy Act of 1992 (42 U.S.C. 13317(c) is amended by stating after October 1, 2003, and before October 1, 2013.

The Energy Policy Act of 1992 (42 U.S.C. 13317(e) is amended to include landfill gas.

Renewable Energy on Federal Lands (Section 16073)
A report to Congress shall be submitted within 24 months after the date of enactment. The Secretary of the Interior, in cooperation with the Secretary of Agriculture, shall develop and report to Congress recommendations on opportunities to develop renewable energy on public lands under the jurisdiction of the Secretary of the Interior, and to develop renewable energy on the National Forest System lands under the jurisdiction of the Secretary of Agriculture.

The report shall include: a) 5-year plans developed by the Secretary of the Interior and the Secretary of Agriculture, for encouraging the development of wind and solar energy consistent with applicable law and management plans; and b) an analysis of—(1) the use of rights-of-ways, leases, or other methods to develop wind and solar energy on such lands; (2) the anticipated benefits of grants, loans, tax credits, or other provisions to promote wind and solar energy development on such lands; and (3) any issues that the Secretary of the Interior or the Secretary of Agriculture have encountered in managing projects on such lands, or believe are likely to arise in relation to the development of wind or solar energy on such lands; and (4) a list, developed in consultation with the Secretary of Energy and the Secretary of Defense, of lands under the jurisdiction of the Department of Energy or Defense that would be suitable for development for wind or solar energy, and any recommended statutory and regulatory mechanisms for such developments.

Also, under Section 16073, a study by the National Academy of Sciences shall be conducted within 90 days of this enactment. The Secretary of Interior shall contract with the National Academy of Sciences to: (1) study the potential for the development of wind, solar, and ocean energy on the Outer Continental Shelf; (2) assess existing Federal authorities for the development of such resources; and (3) recommend statutory and regulatory mechanisms for such development.

The results of the study shall be transmitted to the Congress within 24 months after the date of the enactment.

Assessment of Renewable Energy Resources (Section 16074)
An assessment of resources shall occur not later than 3 months after the date of enactment and each year thereafter. The Secretary of Energy shall review the available assessments of renewable energy resources within the United States, including solar, wind, biomass, ocean, geothermal, and hydroelectric energy resources, and undertake new assessments as necessary, taking into account changes in market conditions, available technologies, and other relevant factors.

One year after the date of enactment, the Secretary of Energy shall publish a report based on the assessments. The report shall contain: (1) a detailed inventory describing the available amount and characteristics of the renewable energy resources; and (2) other information the Secretary believes would be useful in developing such renewable energy resources, including descriptions of surrounding terrain, population and load centers, nearby energy infrastructure, location of energy and water resources, and available estimates of the costs needed to develop each resource, together with an identification of any barriers to providing adequate transmission for remote sources of renewable energy resources to current and emerging markets, recommendations for removing or addressing such barriers, and ways to provide access to the grid that do not unfairly disadvantage renewable or other energy producers.

Division B—Science
Title I—Research and Development
Subtitle C—Renewable Energy

Renewable Energy (Section 21301)
Authorized funds to be appropriated for renewable energy research, development, demonstration, and commercial application activities for the following fiscal years: a) fiscal year 2004 in the amount of $380,000,000; b) fiscal year 2005 in the amount of $420,000,000; c) fiscal year 2006 in the amount of $460,000,000; and d) fiscal year 2007 in the amount of $499,000,000.

To carry out Bioenergy, and Other Biopower programs (sections 21311 and 21706), the following sums are authorized to be appropriated for the following fiscal years: a) fiscal year 2004, in the amount of $135,425,000; b) fiscal year 2005, in the amount of $155,600,000; c) fiscal year 2006, in the amount of $167,650,000 and d) fiscal year 2007, in the amount of $180,000,000.

Limits on the use of funds are as follows: 1) none of the funds may be used for Renewable Support and Implementation; 2) bioenergy funds authorized shall not be less than $5,000,000 for each fiscal year made available as grants to Historically Black Colleges and Universities, Tribal Colleges and Hispanic-Serving Institutions; 3) shall demonstrate the use of advanced wind power technologies, biomass, geothermal energy systems, and other renewable energy technologies for the purpose of assisting in the delivery of electricity to rural and remote locations; 4) for each fiscal year, of the funds authorized not less than $4,000,000 shall be made available for the Regional Field Verification Program of the Department; and 5) of the funds authorized, such sums as may be necessary made available, for the demonstration projects of off-steam pumped storage hydropower.

Division B—Science
Title I—Research and Development
Subtitle C—Renewable Energy
Part 2-Bioenergy

Bioenergy Programs (Section 21311)
The Secretary shall conduct a program of research, development, demonstration, and commercial application for bioenergy to include: (1) biopower energy systems; (2) biofuels; (3) integrated applications of both biopower and biofuels; (4) cross-cutting research and development in feedstocks; and (5) economic analysis.

Miscellaneous Projects (21321)
The Secretary shall conduct research, development, demonstration, and commercial application programs for the following: (1) ocean energy, including wave energy; (2) the combined use of renewable energy technologies with one another and with other energy technologies, including the combined use of wind power and coal gasification technologies; and (3) hydrogen carrier fuels.

With an arrangement from the National Academy of Sciences a study shall be conducted on: (a) the feasibility of various methods of renewable generation of energy from the ocean, including energy from waves, tides, currents, and thermal gradients; and (b) the research, development, demonstration, and commercial application activities required to make marine renewable energy generation competitive with other forms of electricity generation.

One year after the date of enactment, the Secretary shall submit the study to Congress, along with recommendations for implementation.

Renewable Energy In Public Buildings (Section 21322)
A demonstration and technology transfer program shall be established for the demonstration of innovative technologies for solar and other renewable energy sources in buildings owned or operated by a State or local government, and for the dissemination of information to interested parties.

No more than 40 percent of the incremental costs of solar or other renewable energy projects shall be provided with Federal funding.

The requirements for applications regarding awards shall be: a) a demonstration of continued commitment in the use of solar and other renewable energy sources in buildings that the applicants own or operate and b) the applicants are to state how they expect any award received to further their transition to a more significant use of renewable energy.

Division B—Science
Title III—Biomass Energy

Grants to Improve the Commercial Value of Forest Biomass for Electric Energy, Useful Heat, Transportation Fuels, Petroleum-Based Product Substitutes, and Other Commercial Purposes (Section 30301)

The biomass commercial use grant program will be made available to any person that owns or operates a facility that uses biomass as a raw material to produce electric energy, sensible heat, transportation fuels, or substitutes for petroleum-based products to offset the cost incurred to purchase biomass.

Grants will not exceed $20 per green ton of biomass delivered.

Monitoring of the grants recipient activities shall be conducted by the Secretary concerned, which will be made up of the Secretary of Agriculture with respect to the National Forest Systems land and the Secretary of Interior with respects to the Federal lands under jurisdiction of the Secretary of the Interior and Indian lands.

The Secretary concerned, may require full and correct disclosure of the use of grant funds and all transactions involved in the purchase of biomass. Upon notice by a representative of the Secretary concerned, a grant recipient shall afford the representative reasonable access to the facility that purchases or uses biomass and an opportunity to examine the inventory and records of the facility.

Also, included in the legislation is an improved biomass use grant program. This program would make grants to persons to offset the cost of projects seeking to develop or research opportunities to improve the use of, or add value to, biomass. Preference shall be given to persons in preferred communities.

The grant recipient shall not only be a person that owns or operates a facility that uses biomass as a raw material to produce electric energy, sensible heat, transportation fuels, or substitutes for petroleum-based products to offset the cost incurred to purchase biomass, but also the consideration will be given to the anticipated public benefits of the project, including the potential to develop thermal or electric energy resources or affordable energy, opportunities for the creation or expansion of small businesses and micro-businesses, and the potential for new job creation.

The amount shall not exceed $100,000 for the improved biomass use grant program.

Authorization of appropriations shall be $50,000,000 for fiscal years 2004 through 2014 for this section (Section 30301) of the legislation.

Not later than October 1, 2010, the Secretary of Agriculture, in consultation with the Secretary of the Interior, shall submit to the Committee on Energy and Natural Resources and the Committee on Agriculture, Nutrition, and Forestry of the Senate and the Committee on Resources and the Committee on Agriculture of the House of Representatives a report describing the results of the grant programs.

The report shall include: (a) an identification of the size, type, and the use of biomass by persons that receive grants under this section; (b) the distance between the land from which the biomass was removed and the facility that used the biomass; and (c) the economic impacts, particularly new job creation, resulting from the grants to and operation of the eligible operations.

Division B—Science
Title VI—Geothermal Energy

Competitive Lease Sale Requirements (Section 30601)
Section 4 of the Geothermal Steam Act of 1970 (30 U.S.C. 1003) is amended by the leasing procedures relating to nominations, competitive lease sales required, noncompetitive leasing and pending lease applications.

Special Provisions Regarding Direct Use of Low Temperature Geothermal Energy Resources (Section 30602)
Section 4 of the Geothermal Steam Act of 1970 (30 U.S.C. 1003) is further amended with regards to the leasing of low temperature geothermal resources; limitation on lease areas; annual payments; and exemption for use of low temperature resources.

Royalties and Near-Term Production Incentives (Section 30603)
Section 5 of the Geothermal Steam Act of 1970 (30 U.S.C. 1004) is amended regarding the royalties, near-term production incentives, state shares, the 4-year application, the no effect on state portions, and the existing royalties leases.

Consultation Regarding Geothermal Leasing and Permitting on Public Lands (Section 30604)
Not later than 6 months after the date of the enactment, the Secretary of the Interior and the Secretary of Agriculture shall enter into and submit to the Congress a memorandum of understanding regarding leasing and permitting, for geothermal development, of public lands under their respective administrative jurisdictions.

The lease and permit applications shall include provisions that will identify known geothermal areas on public lands within the National Forest System and when necessary review management plans to consider leasing under the Geothermal Steam Act of 1970 (30 U.S.C. 1001 et seq.) as a land use; (2) establish an administrative procedure for processing geothermal lease applications (3) provide a 14 days review period for an application for a lease, if sufficient information is given, the application will be processed, if sufficient information is not given a written notice will be sent to the lease applicant, along with the returned application that has not been processed; 4) within 30 days of receiving a lease application, a written notice will be sent to the lease applicant regarding the status of the application, with a timeframe regarding the completion of the application; and 5)establishing an administrative procedure for processing geothermal development permits, including lines of authority, steps in permit processing, and timeframes for permit processing.

The memorandum of understanding shall develop a 5-year plan for leasing under the Geothermal Steam Act of 1970 (30 U.S.C. 1001 et seq.) of public land in the National Forest System. The plan for geothermal leasing shall be updated every 5 years.

Also, a data retrieval system shall be established that is capable of tracking lease and permit applications and requests and providing to the applicant or requester information as to their status within the Departments of the Interior and Agriculture, including an estimate of the time required for administrative action.

A review and report to Congress by the Secretary of Interior shall be given within 3 years after the date of enactment. The report will give the status of all moratoria on and withdraws from leasing under the Geothermal Steam Act of 1970 (30 U.S.C. 1000 et seq.) of known geothermal resource areas.

Assessment of Geothermal Energy Potential (Section 30607)
The Secretary of Interior, acting through the Director of the United States Geological Survey, shall update the 1978 Assessment of Geothermal Resources, and submit that updated assessment to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate, within 3 years after the date of the enactment and as the availability of data and developments in technology warrant.

Cooperative or Unit Plants (Section 30608)
The Geothermal Steam Act of 1970, section 18 (U.S.C.1017) is amended with regards to adoption of plan by lessees; requirement of plans under new leases; modification of rate of prospecting, development and production; exclusion from determination of holding or control; and pooling of certain lands.

A plan review will occur not more than 5 years after approval of any cooperative or unit plan of development or operation, and every 5 years following. Each plan shall be reviewed, and after notice with an opportunity to comment, plans will be eliminated that are not reasonably necessary for cooperative or unit operations, which will be found lacking in the purpose of conserving and properly managing geothermal resources.

At the discretion of the Secretary, approval to prescribe, operate, drill or develop contracts to one or more lessees of geothermal leases, with one or more persons, associations, or corporations.

Title IX—Miscellaneous Provisions

Permitting of Wind Energy Development Projects on Public Lands (Section 30905)
The Secretary of the Interior shall process right-of-way applications for wind energy site testing and monitoring facilities on public lands administered by the Bureau of Land Management.

The Secretary of the Interior may not impose rent and other charges with respect to any wind energy development project on public lands that, in the aggregate, exceed 50 percent of the maximum amount of rent that could be charged with respect to that project under the terms of the Bureau of Land Management Instruction Memorandum.

Termination shall be the date on which the Secretary of Interior determines that there exists at least 10,000 megawatts of electricity generating capacity from non-hydropower renewable energy resources on public lands or at the end of the 10-year period beginning with the date of enactment.

No State's share of rent or other charges with respect to any wind energy development project on public lands shall be affected.

Sense of the Congress Regarding Generation Capacity of Electricity from Renewable Energy Resources on Public Lands (Section 30906)
Within the next 10 years, after the date of enactment, the Secretary of Interior will seek to have approved non-hydropower renewable energy projects located on public lands with a generating capacity of at least 10,000 megawatts of electricity.

Assessment of Ocean Thermal Energy Resources (30907)
The Secretary of the Interior shall review resource assessments not later than 3 months after the date of enactment and every year thereafter. The review of ocean thermal energy resources, will be resources other than of the Outer Continental Shelf, which is subject to a moratorium on leasing for energy exploration or development that are available in the United States and its territories and possessions. The review shall take into account changes in market conditions, available technologies, as well as other relevant factors.

A report will be published 1 year after the date of enactment and each year thereafter on: a) the detailed inventory of the available amount and characteristics of ocean thermal energy resources; (b) estimates of the costs of actions needed to develop and accelerate efforts to commercialize ocean thermal energy conversion; and (c)other information that would be useful in developing ocean thermal energy resources.

Division D—Tax
Title I—Conservation

Credit for Residential Solar Energy Property (Section 41001)
A credit against the tax imposed for an individual shall be allowed for the taxable year in an amount equal to: a) 15 percent of the qualified photovoltaic property expenditures made by the taxpayer during the year and b) 15 percent of the qualified solar water heating property expenditures made by the taxpayer during the year.

The maximum credit allowed shall not exceed $2,000 for each system of property relating to photovoltaics and $2,000 for each system of property relating to solar water heaters.

Safety certifications for solar water heaters, would be certified for performance and safety by the non-profit Solar Rating Certification Corporation or comparable entities endorsed by the government of the State in which the property is installed and for photovoltaic systems, the systems must meet appropriate fire and electric code requirements. No credit shall be allowed without safety certification.

Special rules regarding dollar amounts will be applied to joint occupancy, tenant-stockholders in cooperative housing corporations, condominiums and an allocation in certain cases where 80 percent or less of use is for nonbusiness purposes.

Extension and Expansion of Credit for Electricity Produced from Renewable Resources (Section 41002)
Credit for wind and closed-loop biomass facilities have been extended from 2004 to 2007.

Credit for open-loop biomass, landfill gas facilities, and trash combustion facilities, as it relates to "qualified facilities" : a) for a open-loop biomass facility to produce electricity, the facility must be owned by the taxpayer before January 1, 2007; b) for a landfill gas facility producing electricity from biodegradation of municipal solid waste, the facility must be owned by the taxpayer before January 1, 2007; and c) for a trash combustion facility which burns municipal solid waste to produce electricity, the facility must be owned by the taxpayer before January 1, 2007.

Credit for Qualified Fuel Cell Power Plants (Section 41003)
For business property a qualified fuel cell power plant, is a fuel cell power plant that has an electricity-only generation efficiency greater than 30 percent.

Nonbusiness Qualified Fuel Cell Power Plant (Section 25D)
A nonbusiness qualified fuel cell power plant is installed on or in connection with a dwelling unit, located in the United States, and is used by the taxpayer as a place of residence. The taxpayer shall be allowed a credit against the tax imposed for the taxable year of an amount equal to 10 percent of the qualified fuel cell power plant expenditures, which are paid or incurred during that year.

The credit allowed shall not exceed $500 for each ½ kilowatt of capacity of the power plant reduced by the aggregate energy credits allowed with respect to all prior taxable years.

Current Status: Congressman Edward J. Markey moved that the House instruct conferees on October 21, 2003.

H.R. 109 - Residential Solar Energy Tax Credit Act

Introduced: January 7, 2003, by Congressman J.D. Hayworth

Purpose: To amend the Internal Revenue Code of 1986 to allow a credit for residential solar energy property.

Renewable Energy Source(s): solar, photovoltaic (PV)

Summary: Residential solar energy properties shall have a tax credit of 15 percent for qualified photovoltaic property expenditures and 15 percent tax credit for qualified solar water heating property expenditures. The maximum credit allowed for both will be $2,000 each. This credit shall not apply after December 31, 2008.

Current Status: Referred to the House Committee on Ways and Means on January 7, 2003.

H.R. 130 - Biofuels Energy Independence Act of 2003

Introduced: January 7, 2003, by Congresswoman Marcy Kaptur

Purpose: To provide for a Biofuels Feedstocks Energy Reserve, and to authorize the Secretary of Agriculture to make and guarantee loans for the production, distribution, development, and storage of biofuels.

Renewable Energy Source(s): biofuels

Summary:

Title I—National Biofuels Development

Loans and Guarantees (Section 101)
The Secretary of Agriculture may make and guarantee loans for the production, distribution, development and storage of biofuels.

Eligibility for the loans will reflect the applicant as being a farmer, member of an association of farmers, member of a farm cooperative, municipal entity, nonprofit corporation, State or Territory, as well as being unable to obtain sufficient credit elsewhere to finance the actual needs of applicants at reasonable rates and terms.

The loan guarantee eligibility precludes loan eligibility.

Interest rates on loans shall be the rate of interest on obligations issued by the United States for a similar period of time. The repayment period shall be not less than 5 years and not more than 20 years.

A revolving fund shall be established by the Secretary of Agriculture. The fund shall make loans available and deposit all monies received on the loan accounts. Payments shall be made from amounts received.

Limits on authorization of appropriations are costs restricted to section 502 (5) of the Federal Credit Reform Act of 1990. Loans and loan guarantees are appropriated to the revolving fund sums as may be necessary for fiscal years 2003 through 2010.

Title II—Biofuels Feedstock Energy Reserve Program

Biofuels Feedstocks Energy Reserve—a reserve of agriculture commodities to be established and administered by the Secretary of Agriculture. The program would a) provide feedstocks to support and further the production of energy from biofuels and b) support the biofuels energy industry when production is at risk of declining due to reduced feedstocks or significant commodity price increases.

Purchases may be made of agricultural commodities at commercial rates, in order to establish, maintain, or enhance the Biofuels Feedstocks Energy Reserve when—(a) the commodities are in abundant supply; and (b) there is need for adequate carryover stocks to ensure a reliable supply of the commodities to meet the purposes of the reserve; or (c) it is otherwise necessary to fulfill the needs and purposes of the biofuels energy reserve program.

Purchases for the Biofuels Feedstock Energy Reserve shall be limited to a) the type and quantity necessary to provide not less than 1-year's utilization for renewable energy purposes; and (b) additional quantities to provide incentives for research and development of new renewable fuels and bio-energy initiatives.

Release of stocks shall occur whenever the market price of a commodity held in the Biofuels Feedstocks Energy Reserve exceeds 100 percent of the economic cost of producing the commodity (as determined by the Economic Research Service using the best available information, and based on a 3-year moving average). The Secretary of Agriculture shall release stocks of the commodity from the reserve at cost of acquisition in amounts determined at the discretion of the Secretary.

Storage payments shall be made to producers for the storage of the commodities purchased for the Biofuels Feedstock Energy Reserve program. The payments shall be a) at the discretion of the Secretary of Agriculture in terms of amounts, conditions and time-frame when deemed appropriate to encourage producers to participate in the program; and b) reflect local, commercial storage rates, which will be subject to appropriate conditions concerning quality management.

The time of announcement for the terms and conditions of storage payment for a crop of a commodity shall be a) for wheat, December 15 of the year in which the crop of wheat was harvested; b) for feed grains, March 15 of the year following the year in which the crop of corn was harvested; and c) other commodities, the dates to be determined by the Secretary of Agriculture.

The Secretary of Agriculture shall review standards concerning the quality of a commodity to be stored in the Biofuels Feedstock Energy Reserve program. The Secretary shall use the Commodity Credit Corporations to carry out this section of the legislation. Not later than 60 days after enactment, the regulation shall be issued by the Secretary as necessary.

Current Status: Referred to the Subcommittee on Department Operations, Oversight, Nutrition and Forestry on February 4, 2003.

H.R. 382 - Solid Waste International Transportation Act of 2003

Introduced: January 27, 2003, by Congressman Mike Rogers

Purpose: To authorize States to prohibit or impose certain limitations on the receipt of foreign municipal solid waste.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: A State may enact a law or laws prohibiting or imposing limitations on the receipt and disposal of foreign municipal solid waste.

Regarding the effect on interstate and foreign commerce per the authorization of this section of the legislation, no State action taken shall be considered to impose an undue burden on interstate and foreign commerce or to impair, restrain or discriminate against interstate and foreign commerce.

Waste included will be: a) all waste materials discarded for disposal by households, including single and multifamily residences, and hotels and motels; and (b) all waste materials discarded for disposal that were generated by commercial, institutional, municipal, and industrial sources.

Waste not included will be: a) any solid waste identified or listed as a hazardous waste, except for household hazardous waste; b) any solid waste, including contaminated soil and debris, resulting from—1) a response action taken under section 104 or 106 of the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9604 or 9606); 2) a response action taken under a State law with authorities comparable to the authorities of such section 104 or 106; c) recyclable materials that have been separated, at the source of the waste, from waste otherwise destined for disposal or that have been managed separately from waste destined for disposal; d) scrap rubber to be used as a fuel source; e) materials and products returned from a dispenser or distributor to the manufacturer or an agent of the manufacturer for credit, evaluation, and possible reuse; f) any solid waste that is—1) generated by an industrial facility; and 2) transported for the purpose of treatment, storage, or disposal to a facility or unit thereof that is owned or operated by the generator of the waste, located on property owned by the generator or a company with which the generator is affiliated, or the capacity of which is contractually dedicated exclusively to a specific generator, so long as the disposal area complies with local and State land use and zoning regulations applicable to the disposal site; g) any medical waste that is segregated from or not mixed with solid waste; h) sewage sludge and residuals from any sewage treatment plant; and i) combustion ash generated by resource recovery facilities or municipal incinerators, or waste from manufacturing or processing (including pollution control) operations not essentially the same as waste normally generated by households.

Current Status: Committee hearings held on July 23, 2003.

H.R. 411 – (No Short Title)

Introduced: January 28, 2003, by Congressman John D. Dingell

Purpose: To direct the Administrator of the Environmental Protection Agency to carry out certain authorities under an agreement with Canada respecting the importation of municipal solid waste.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: Subtitle D of the Solid Waste Disposal Act (42 U.S.C. 6941 et. Seq) is amended as follows—Canadian Transboundary Movement of Municipal Solid Waste prohibits persons from importing, transporting, as well as exporting municipal solid waste for final disposal, or, incineration to be in violation of the Agreement Between the Government of the United States of America and the Government of Canada Concerning the Transboundary Movement of Hazardous Waste.

Upon enactment, the Administrator will perform the function of the Designated Authority of the United States with matters dealing with the importation and exportation of MSW. The Administrator shall implement and enforce the notice and consent provisions. When considering whether to consent to the importation of MSW, the Administrator shall: a) give substantial weight to the views of the State or States into which the MSW is to be imported, and consider

the views of the local government with jurisdiction over the location where the waste is to be disposed; and b) consider the impact of the importation on—1) continued public support for and adherence to State and local recycling programs; 2) landfill capacity as provided in comprehensive waste management plans; 3) air emissions from increased vehicular traffic; 4) road deterioration from increased vehicular traffic; and 5) public health and the environment.

Compliance will be enforced by the Administrator, who will determine if any person has violated or is in violation. An order can be issued assessing civil penalty for any past or current violations, requiring compliance immediately or within a specified time period or both. A civil action in the United States district court in which the violation occurred for appropriate relief, including a temporary or permanent injunction, is also a course of action available to the Administrator.

Current Status: Committee hearing held on July 23, 2003.

H.R.570 - (No Short Title)

Introduced: February 5, 2003, by Congressman Mark Foley

Purpose: To amend the Internal Revenue Code of 1986 to provide a 5-year extension of the credit for electricity produced from wind.

Renewable Energy Source(s): wind

Summary: Section 45 (c)(3)(A) of the Internal Revenue Code of 1986, regarding wind facilities is amended from calendar year 2004 to calendar year 2009.

Current Status: Referred to the House Committee on Ways and Means on February 5, 2003.

H.R.671 - Renewable Energy Production Incentive Reform Act

Introduced: February 11, 2003, by Congresswoman Mary Bono

Purpose: To reauthorize and revise the Renewable Energy Production Incentive program.

Renewable Energy Source(s): solar, wind, biopower, geothermal, closed-loop biomass

Summary: Section 1212 (a)of the Energy Policy Act of 1992 (U.S.C. 1337(a) is amended as follows—if there is insufficient appropriations to make full payments for electric production from all qualified renewable energy facilities in any given year, the Secretary shall assign 60 percent of appropriated funds for that year to facilities that use solar, wind, geothermal, or closed-loop (dedicated energy crops) biomass technologies to generate electricity, and assign the remaining 40 percent to other projects.

A qualified renewable facility is a not-for-profit electric cooperative, a public utility as specified in section 115 of the Internal Revenue Code of 1986, a State, Commonwealth, territory, or possession of the United States or the District of Columbia, a political subdivision or an Indian tribal government.

The eligibility window will be during the 10 fiscal year period beginning with the first full fiscal year after the enactment, from October 1, 2003 and before October 1, 2013.

Authorization of appropriations necessary to carry out this provision shall be fiscal years 2003 through 2023.

Current Status: Referred to the Subcommittee on Energy and Air Quality on February 26, 2003.

H.R. 694 - Residential Solar Energy Act of 2003

Introduced: February 11, 2003, by Congressman Jim McDermott

Purpose: To amend the Internal Revenue Code of 1986 to provide an interest-free source of capital to cover the costs of installing residential solar energy equipment.

Renewable Energy Source(s): solar

Summary: Any taxpayer who holds a Residential Solar Energy Bond, on a credit allowance date of that bond, occurring during the taxable year the bond was issued, shall be allowed a tax credit.

The amount of credit determined with respect to the credit allowance date shall be 25 percent of the annual credit of the bond. Credit allowance dates are March 15th, June 15th, September 15th and December 15th.

The annual credit is determined by the applicable credit rate multiplied by the outstanding face value of the Residential Solar Bond.

The applicable credit rate is the rate equal to an average market yield on outstanding long-term corporate debt obligations. In the case of a Residential Solar Bond issued, during the 3-month period ending on a credit allowance date—-the credit allowance will be determined by the credit allowance date being at a ratable portion of the credit based on the portion of the 3-month period when the bond is outstanding. When the bond is redeemed a similar rule shall apply.

The national Residential Solar Energy Bond limitation is $24,000,000,000

The Secretary of Energy shall allocate the limitations of the national Residential Solar Energy Bond for calendar years 2004, 2005, 2006, and 2007 to qualified utilities. Priorities shall be given to utilities which provide subsidies for the purchase and installation by residential customers of photovoltaic cells on their residences. Any allocations made to a qualified utility not used within 6 months after the date of enactment may be reallocated by the Secretary of Energy.

The effective date of obligations issued shall be after December 1, 2003

Not later than January 1, 2004, the guidelines specifying the criteria used in approving applications shall be developed and published by the Secretary of Energy in the Federal Register.

Current Status: Referred to the House Committee on Ways and Means on February 11, 2003.

H.R. 790 - Home and Farm Wind Energy Systems Act of 2003

Introduced: February 13, 2003, by Congressman Tom Cole

Purpose: To amend the Internal Revenue Code of 1986 to provide credits for individuals and businesses for the installation of certain wind energy property.

Renewable Energy Source(s): wind

Summary: Subpart B of Part IV of Subchapter A of Chapter 1 of the Internal Revenue Code of 1986 is amended as follows—a credit against the tax imposed for the taxable year in an amount equal to 30 percent (10 percent after December 31, 2013) of the paid amount or the amount incurred by the taxpayer for a qualified wind energy property placed in service or installed during that taxable year.

No credit shall be allowed unless at least 50 percent of the energy produced annually by the qualified wind energy property is consumed on the site on which the property is placed in service or installed.

A qualified wind energy property is a qualifying wind turbine if: a) in the case of an individual, the property is installed on or in connection with a dwelling unit which is located in the United States and which is owned and used as the taxpayer's principal residence, (b) the original use of which commences with the taxpayer, and (c) the property carries at least a 5-year limited warranty covering defects in design, material, or workmanship, and, for property that is not installed by the taxpayer, at least a 5-year limited warranty covering defects in installation.

Special rules apply for tenants-stockholders in cooperative housing corporations, and individuals who own condominiums and are members of condominium management associations.

The credit allowed shall apply to property placed in service on or installed after December 31, 2003.

Current Status: Referred to the House Committee on Ways and Means on February 13, 2003.

H.R.804 - Biomass Energy Equity Act of 2003

Introduced: February 13, 2003, by Congressman Wally Herger

Purpose: To amend the Internal Revenue Code of 1986 to extend and modify the credit for electricity produced from biomass.

Renewable Energy Source(s): biomass

Summary: Paragraph (3) of Section 45(c) of the Internal Revenue Code of 1986 is amended as follows—a facility using closed-loop biomass to produce electricity must be: a) owned by the taxpayer and originally placed in service after December 31, 1992 and before January 1, 2008; or b) owned by a taxpayer and originally placed in service on or before December 31, 1992, and modified to use close-loop biomass to co-fire with coal before January 1, 2008.

Current Status: Referred to the House Committee on Ways and Means on February 13, 2003.

H.R.991 - Renewable Fuel Equity Act

Introduced: February 27, 2003, by Congressman Duncan Hunter

Purpose: To amend the Internal Revenue Code of 1986 to expand the renewable resources production tax credit to include additional forms of renewable energy, and to expand the investment tax credit to include equipment used to produce electricity from renewable resources.

Renewable Energy Source(s): geothermal, biomass, solar, photovoltaic, wind

Summary: Section 45(c)(1) of the Internal Revenue Code of 1986 is amended as follows to include—geothermal energy, solar energy, incremental hydropower and biomass (other than closed-loop biomass).

A facility using closed-loop biomass to produce electricity is any facility that is: a) owned by the taxpayer which is originally placed in service after December 31, 1992 and before January 1, 2009 or b) owned by the taxpayer which is originally placed in service before December 31, 1992 and modified to use close-loop biomass to co-fire with coal before January 1, 2009.

Current Status: Referred to the House Committee on Ways and Means on February 27, 2003.

H.R. 1011 - (No Short Title)

Introduced: February 27, 2003, by Congressman George R. Nethercutt, Jr.

Purpose: To amend the Internal Revenue Code of 1986 to provide a 10-year extension of the credit for producing electricity from wind.

Renewable Energy Source(s):	wind
Summary:	Section 45(c)(3)(A) of the Internal Revenue Code of 1986 is amended to January 1, 2014.
Current Status:	Referred to the House Committee on Ways and Means on February 27, 2003.

H.R. 1041 - Distributed Power Hybrid Energy Act

Introduced:	February 27, 2003, by Congressman Mark Udall
Purpose:	To direct the Secretary of Energy to develop and implement a strategy for research, development, demonstration, and commercial application of distributed power hybrid energy systems
Renewable Energy Source(s):	geothermal, biomass, solar, photovoltaic, wind
Summary:	The Secretary of Energy, not later than 1 year after the date of enactment, shall develop and transmit to the Congress a distributed power hybrid systems strategy showing: a) opportunities and priorities that might best be met with distributed power hybrid systems configurations; b) what barriers exist to the use of distributed power hybrid systems; c) what technology gaps need to be closed; and d) what system integration tools are needed to plan, design, build, and operate distributed power hybrid systems for maximum benefits. Not later than 1 year after the date of enactment, and each year thereafter, the Secretary of Energy shall transmit to Congress a report on the use of, and experience with, distributed power hybrid systems in the United States, and the research and development issues remaining to ensure the successful application of distributed power hybrid systems. Authorized to be appropriated to the Secretary of Energy shall be: a) $5,000,000 for fiscal year 2004; b) $10,000,000 for fiscal year 2005; c) $20,000,000 for fiscal year 2006; d) $20,000,000 for fiscal year 2007; and e) $5,000,000 for fiscal year 2008.
Current Status:	Referred to the Subcommittee on Energy on March 7, 2003.

H.R.1099 – (No Short Title)

Introduced:	March 5, 2003, by Congressman Collin Peterson
Purpose:	To amend the Internal Revenue Code of 1986 to allow the $25,000 offset for individuals under the passive loss rules to apply to investments in wind energy facilities.
Renewable Energy Source(s):	wind
Summary:	Paragraph (3) of Section 469 (i) of the Internal Revenue Code of 1986 (relating to $25,000 offset for rental real estate activities) is amended to reflect the exception for wind energy credit with respect to a facility using wind to produce electricity.
Current Status:	Referred to the House Committee on Ways and Means on March 5, 2003.

H.R. 1123- State Waste Empowerment and Enforcement Provision Act of 2003

Introduced:	March 6, 2003, by Congresswoman Jo Ann Davis
Purpose:	To authorize States to regulate the receipt and disposal of out-of-State MSW.
Renewable Energy Source(s):	municipal solid waste (MSW)

Summary: Subtitle D of the Solid Waste Disposal Act (42 U.S.C. 6941 et seq.) is amended as follows—- a) a State may limit or place restrictions on, or otherwise regulate, out-of-State municipal solid waste received or disposed of annually at each landfill or incinerator in the State; and b) in limiting, restricting, or regulating out-of-State MSW.

A State may not, until after the expiration of 2 years after the date of enactment, limit, restrict, or regulate out-of-State MSW received or disposed of annually at a landfill or incinerator in the State.

Current Status: Referred to the Subcommittee on Environment and Hazardous Material on March 17, 2003.

H.R. 1183 - Coastal Zone Renewable Energy Promotion Act of 2003

Introduced: March 11, 2003, by Congressman William D. Delahunt

Purpose: To promote the sensible development of renewable energy in the waters of the coastal zone.

Renewable Energy Source(s): all renewables

Summary:

Title II-Federal Marine Renewable Energy Program

The Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.) is amended as follows—no person may construct or operate a renewable energy facility in waters under jurisdiction of the United States seaward of the coastal zone except in accordance with a license issued.

Any person seeking to apply for a license shall notify in writing of their intent. The letter of intent shall include, but not be restricted to, a description of the proposed renewable energy facility; the specific location where the applicant proposes construction; the time-frame for construction and operation of the facility; and the names of the applicant, owners and operators of the proposed facility.

Within 30 days of receiving the letter of intent, the Secretary of Commerce shall publish in the Federal Register a notice containing the requirements for a license application in the area identified in the notice, also a request for proposals from all persons seeking a license to construct and operate a renewable energy facility in the same location. The time within which proposals must be submitted, shall not be less than 60 days from the date the notice is published in the Federal Register.

Applications received shall be weighted against evaluations with regard to public interest. Consideration of the license, along with thought given to the amount of energy the proposed project will produce, the economic impact to the region where the facility will be located, any environmental impacts, displacement of competing uses and other relevant factors will be addressed to determine which proposed project best serves the public interest.

The license prerequisite are: a) based on recommendations from the Secretary of Defense, the facility will be consistent with national security needs; b) based on recommendations from the Corps of Engineers and the Coast Guard, the facility will not create an obstruction to navigation; c) the application is consistent with the approved management programs of affected states; d) construction or operation of the facility will not unduly restrict access to commercial and recreational fishing areas, including shellfish beds, and recreational boating areas; e) the facility will not adversely affect marine mammals, threatened or endangered species, migratory birds, or designated critical habitat; f) construction or operation of the facility will not adversely affect aesthetic, cultural, or historical resources recognized or protected under Federal law or the laws of the affected coastal States; g) after consultation with the Secretary of Transportation, that the renewable energy facility does not pose a threat to aviation safety; h) as a result of the

Environmental Impact Statement, the facility can be constructed or operated in a manner that minimizes any adverse impact on the marine environment, including the seabed and any other natural resources; I) after consultation with the Secretary of Energy, that the electricity that will be produced by the facility is needed; j) the location of the facility is not within the boundaries of a National Marine Sanctuary or Marine Protected Area; k) the applicant will pay the fees required; and l) the application was determined by the Secretary to best serve the public interest.

The license terms and conditions are: a) in issuing a license for the construction and operation of a renewable energy facility applicant agrees to comply with the conditions the are prescribed in accordance with the provisions of this Act; b) no license issued may be sold, transferred, or materially changed in any other manner without the prior written approval of the Secretary. The Secretary shall ensure that any such sale, transfer or change is consistent with the management plans of affected coastal States before issuing an approval; and c) the Secretary shall establish such bonding requirements or other assurances as may be necessary to assure that, upon revocation, termination, relinquishment, abandonment, transfer, sale, or surrender of the license, the licensee will dispose of or remove all components of the renewable energy facility as directed by the Secretary. The Secretary may also waive the disposal or removal requirements for any submerged component of the renewable energy facility on or below the seabed if he finds that such removal is not otherwise necessary and that such component does not constitute a threat to the environment, or impede navigation, fishing, or use of the seabed.

The legislation also covers hearing and public comment, fees and royalties, property site identification and evaluation.

Within 12 months after the date of enactment, the Secretary shall promulgate the regulations as are necessary to carry out the purposes and objections of this Act. Nothing in this Act shall be construed to displace, supercede, limit, or modify the jurisdiction, responsibility, or authority of any Federal or State agency under any other Federal law.

Current Status: Referred to the Subcommittee on Fisheries Conservation, Wildlife and Oceans on March 25, 2003.

H.R. 1266 – (No Short Title)

Introduced: March 13, 2003, by Congressman Dave Camp

Purpose: To amend the Internal Revenue Code of 1986 to modify the credit for the production of fuel from nonconventional sources and the credit for the production of electricity to include landfill gas.

Renewable Energy Source(s): landfill gas

Summary: Section 29 of the Internal Revenue Code of 1986 (relating to credit for producing fuel from a nonconventional source) is amended as follows—a facility producing fuel from landfill gas placed into service after June 30, 1998 and before January 1, 2008, an extension and modification for these facilities shall apply during the 5-year period beginning on the date the facility was placed in service or the date of the enactment.

A reduction of credit for the production from certain landfill gas facilities, in which installation and operation based on a collection and control system capturing the gas generated within the landfill facility, shall be applied to the gas captured. The reduction will go from $3 to $2 for the taxable year which the system was installed and operating.

The extension period for the unadjusted credit amount for fuels sold will be after 2003.

Current Status: Referred to the House Committee on Ways and Means on March 13, 2003.

H.R.1294 - (No Short Title)

Introduced: March 13, 2003, by Congressman Tom Udall

Purpose: To amend title VI of the Public Utility Regulatory Policies Act of 1978 to establish a Federal renewable energy portfolio standard for certain retail electric utilities.

Renewable Energy Source(s): all renewables

Summary: Title VI of the Public Utility Regulatory Policies Act of 1978 is amended as follows—for the Federal Renewable Portfolio Standards, beginning in calendar year 2005, each retail electric supplier shall submit not later than April 1 of the following calendar year, renewable energy credits in amounts equal to the required annual percentages. The renewable energy generated by biomass cofired with other fules is eligible for two credits if grown on Indian Land.

Required annual percentages for calendar years 2005 through 2025 are as follows: a) 1 percent for calendar year 2006; b) 2 percent for calendar year 2007; c) 3 percent for calendar year 2008; d) 4 percent for calendar year 2009; e) 5 percent for calendar year 2010; f) 6 percent for calendar year 2011; g) 7 percent for calendar year 2012 h) 8 percent for calendar year 2013; i) 9 percent for calendar year 2014; j)10 percent for calendar year 2015; k) 11 percent for calendar year 2016; l) 12 percent for calendar year 2017; m) 13 percent for calendar year 2018; n) 14 percent for calendar year 2019; o) 15 percent for calendar year 2020; p) 16 percent for calendar year 2021; q) 17 percent for calendar year 2022; r) 18 percent for calendar year 2023; s) 19 percent for calendar year 2024; and t) 20 percent for calendar year 2025.

Renewable energy credit may be issued to the retail electric supplier, obtained by purchase or exchange, or, borrowed. A renewable energy credit will be counted toward compliance only once.

The Secretary shall establish, not later than 1 year after the date of enactment, a program to verify and issue renewable energy credits, track sales, exchanges and submissions, as well as provide enforcement.

In order for the renewable energy credits to be issued, an entity generating electricity through the use of a renewable energy source must: a) demonstrate that the electricity being transmitted is onto the grid, or, b) that in the case of a generation offset, that the electric energy offset would have otherwise been consumed on site. The application shall would include the type of renewable energy resource used to produce electricity; the location of the electric energy produced; and any other information deemed appropriate by the Secretary.

Current Status: Referred to the Subcommittee on Energy and Air Quality on March 24, 2003.

H.R.1331 - (No Short Title)

Introduced: March 18, 2003, by Congressman Dennis Moore

Purpose: To amend the Internal Revenue Code of 1986 to extend and modify the credit for producing fuel from a nonconventional source.

Renewable Energy Source(s): landfill gas

Summary: An extension for facilities producing qualified fuel from landfill gas placed in service after June 30, 1998, and before January 1, 2007. This shall apply to facilities producing the fuel during the 5-year period beginning the date the facility was placed in service or the date of the enactment.

Current Status: Referred to the House Committee on Ways and Means on March 18, 2003.

H.R. 1343 - Renewable Energy and Energy Efficiency Act of 2003

Introduced: March 18, 2003, by Congresswoman Lynn C. Woolsey

Purpose: To establish an energy program for the United States that unlocks the potential of renewable energy and energy efficiency.

Renewable Energy Source(s): wind, photovoltaic (PV), solar thermal, geothermal, hydrogen, biomass, biofuels and hydropower

Summary:

Title I—Research, Development, and Demonstration

Enhanced Renewable Energy Research, Development, and Demonstration (Section 101)
Summary: The United States shall have an energy research, development, and demonstration program to enhance renewable energy pertaining to the following renewable energy fuels: a) Wind Power—the program should reduce the cost of wind electricity by 50 percent by 2008, compared to the cost as of the date of the enactment of the Act, so that wind power can be widely competitive with fossil-fuel-based electricity in a restructured electric industry, with concentration within the program on a variety of advanced wind turbine concepts and manufacturing technologies; b) Photovoltaics—the programs should pursue research, development, and demonstration that would lead to photovoltaic systems prices of $3,000 per kilowatt by January 1, 2005, and $1,500 per kilowatt by January 1, 2008. Program activities should include assisting industry in developing manufacturing technologies, giving greater attention to balance of system issues, and expanding fundamental research on relevant advanced materials; c) Solar Thermal electric systems--the program should strengthen ongoing research, development, and demonstration combining high-efficiency and high-temperature receivers with advanced thermal storage and power cycles, with the goal of making solar-only power (including baseload solar power) widely competitive with fossil fuel power by 2017; d) Geothermal—the program should continue work on hydrothermal systems, and reactivate research, development, and demonstration on advanced concepts, giving top priority to high-grade hot dry-rock geothermal energy; and e) Hydrogen-based energy systems—the program should support research, development, and demonstration on hydrogen-using and hydrogen-producing technologies. The program should also coordinate hydrogen-using technology development with proton exchange membrane fuel cell vehicle development activities under the enhanced energy efficiency program.

For biomass energy, the program should triple bioenergy use by 2010; enable commercialization within 5 years after the date of enactment for biomass-based power systems.

For biofuels, the program should accelerate research, development and demonstration on advanced cellulosic conversion.

For hydropower, the program should provide a new generation of turbine technologies that will increase generating capacity and will be less damaging to fish and aquatic ecosystems.

For electric energy and storage, the program should develop high capacity superconducting transmission lines and generators, as well as develop distributed generating systems to accommodate multiple types of energy sources under a common interconnect standard.

Authorization of appropriations to carry out these activities shall be: a) $575,000,000 for fiscal year 2004; b) $651,000,000 for fiscal year 2005; c) $736,000,000 for fiscal year 2006; d) $831,000,000 for fiscal year 2007; and e) $942,000,000 for fiscal year 2008.

An assessment of renewable energy resources shall occur not later than one year after the date of enactment. The Secretary of Energy shall submit to Congress an assessment of all renewable energy resources available for commercial application within the United States.

Assessment of Renewable Energy Resources (Section 104)
The assessment shall include a detailed inventory describing the available amount and characteristics of renewable energy sources, and an estimate of the research, development, demonstration, and commercial applications efforts necessary to develop each resource. The assessment shall also include such other information as the Secretary of Energy believes would

be useful in achieving wider commercial applications of emerging and state-of-the-art renewable energy generation facilities or devices. The technology development information and cost estimates in the assessment shall be updated annually and made available to the public, along with the data used to create the assessment.

Authorization of appropriations shall be $10,000,000 for fiscal year 2004, and such sums as may be necessary for the fiscal years 2005 through 2022.

Title II-Commercial Application

Renewable Energy in Public Buildings (Section 202)
The Secretary of Energy shall establish a program for the demonstration of innovative technologies for solar and other renewable energy sources in buildings owned or operated by a State or local government. The program will also include the dissemination of information resulting from the demonstrations to interested parties.

Federal funding shall be no more than 40 percent of the incremental costs for solar and other renewable energy sources.

Preference shall be granted to projects by municipalities seeking to achieve a significant transition to a renewable energy infrastructure.

Authorization of appropriations shall be: a) $60,000,000 for fiscal year 2004; b) $70,000,000 for fiscal year 2005; c) $80,000,000 for fiscal year 2006; d) $90,000,000 for fiscal year 2007; and e) $100,000,000 for fiscal year 2008.

Current Status: Referred to the Subcommittee on Space and Aeronautics on March 25, 2003.

H.R.1423 - Preserving Our World's Energy and Resources Act of 2003

Introduced: March 25, 2003, by Congressman Eliot L. Engel

Purpose: To amend the Internal Revenue Code of 1986 to expand the energy credit to include investment in property which produces energy from certain renewable sources and expenditures for cool roofing (having a solar reflectance index, as determined by the Lawerence Berkeley National Laboratory, of 65 percent or greater).

Renewable Energy Source(s): geothermal, wind, solar

Summary: Subparagraph(A) of section 48 (a)(3) of the Internal Revenue Code of 1986 (relating to energy property) is amended to include—equipment using wind to generate electricity and cool roof properties.

The energy percentage shall be: a) 25 percent for equipment using solar energy to generate electricity; b) 25 percent for equipment using wind to generate electricity; c) 25 percent for equipment using energy derived from geothermal deposits; and d) 25 percent for cool roof properties.

Current Status: Referred to the Subcommittee on Health on April 10, 2003.

H.R. 1550 - (No Short Title)

Introduced: April 1, 2003, by Congressman Dennis R. Rehberg

Purpose: To authorize the Secretary of the Interior and the Secretary of Agriculture to make grants to improve the commercial value of forest biomass for electric energy, useful heat, transportation fuels, and petroleum-based product substitutes.

Renewable Energy Source(s): biomass

Summary: The Secretary concerned (the Secretary of Agriculture with respect to National Forest System lands; and the Secretary of the Interior with respect to Federal lands under the jurisdiction of the Secretary of the Interior and Indian lands) may make grants to any person that owns or operates a facility that uses biomass as a raw material to produce electric energy, sensible heat, transportation fuels, or substitutes for petroleum-based products to offset the costs incurred to purchase biomass for use by such facility.

The grant may not exceed $20 per green ton of biomass delivered.

The Secretary concerned, under the improved biomass use grant program, may also make grants to persons to offset the cost of projects in developing and researching opportunities to improve the use of, or add value to, biomass. A grant under this program may not exceed $100,000.

Authorization of appropriation for each fiscal year beginning in 2004 through 2014 will be $50,000,000.

The report shall cover the identification of size, type, and use of biomass by persons that receive grants; the distance between the land from which the biomass was removed and the facility that used the biomass; the economic impacts, particularly new jobs created, which resulted from the grants.

Current Status: Referred to the Subcommittee on Energy on April 7, 2003.

H.R.1644 - Energy Policy Act of 2003

Introduced: April 7, 2003, by Congressman Joe Barton

Purpose: To enhance energy conservation and research and development, to provide for security and diversity in the energy supply for the American people.

Renewable Energy Source(s): all renewables

Summary:

Title VI-DOE Programs
Subtitle C—Renewable Energy

Authorization of appropriations for the use of renewable energy are as follows: a) for fiscal year 2004, $460,000,000; b) for fiscal year 2005, $510,000,000; c) for fiscal year 2006, $560,000,000; and d)for fiscal year 2007, $609,000,000.

Authorization of appropriations for the use of bioenergy are as follows: a) for fiscal year 2004, $135,425,000; b) for fiscal year 2005, $155,600,000; c) for fiscal year 2006, $167,650,000; and d) for fiscal year 2007, $180,000,000.

The use of funds regarding bioenergy shall be: a) not less than $5,000,000 for each fiscal year shall be made available for grants to Historically Black Colleges and Universities, Tribal Colleges, and Hispanic-Serving Institutions; b) used to demonstrate the production and use of energy from advanced wind power technology, biomass, geothermal energy systems, and other renewable energy technologies in order to assist in delivering electricity to rural and remote locations; and c) not less than $5,000,000 for each fiscal year shall be made available for demonstration projects of off-stream pumped storage hydropower.

Title VIII-Electricity
Subtitle F—Renewable Energy

Net Metering (Section 7071)
Section 111 (d) of the Public Utility Regulatory Policies Act of 1978 (16 U.S.C. 2621 (d) is amended as follows—a) each electric utility shall make available upon request net metering services to any electric consumer that the electric utility serves; and b) each State regulatory authority shall consider and make a determination concerning whether it is appropriate to implement net metering not later than 1 year after the date of enactment.

Renewable Energy Production Incentive (Section 7072)
If there are insufficient appropriations to make full payments for electric production from all qualified renewable energy facilities in any given year, 60 percent of appropriated funds shall be given for that year to facilities that use solar, wind, geothermal, or closed-loop (dedicated energy crops) biomass technologies to generate electricity. The remaining 40 percent of funds shall be assigned to other projects.

The window of eligibility has been extended to cover October 1, 2003 through October 1, 2013.

Renewable Energy on Federal Lands (Section 7073)
Within 24 months after the date of enactment of this section, the Secretary of the Interior, in cooperation with the Secretary of Agriculture, shall develop and report to the Congress recommendations on opportunities to develop renewable energy on public lands under the jurisdiction of the Secretary of the Interior and National Forest System lands under the jurisdiction of the Secretary of Agriculture.

The report shall include—a) a 5-year plan developed by the Secretary of the Interior and the Secretary of Agriculture, respectively, for encouraging the development of wind and solar energy consistent with applicable law and management plans; and b) an analysis of 1) the use of rights-of-ways, leases, or other methods to develop wind and solar energy on such lands; 2) the anticipated benefits of grants, loans, tax credits, or other provisions to promote wind and solar energy development on such lands; and 3) any issues that the Secretary of the Interior or the Secretary of Agriculture have encountered in managing wind or solar energy projects on such lands, or believe are likely to arise in relation to the development of wind or solar energy on such lands; c) a list, developed in consultation with the Secretary of Energy and the Secretary of Defense, of lands under the jurisdiction of the Department of Energy or Defense that would be suitable for development for wind or solar energy, and any recommended statutory and regulatory mechanisms for such development; and (d) any recommendations pertaining to the issues addressed in the report.

A National Academy of Sciences Study shall begin within 90 days after the date of enactment. The study shall cover: a) the potential for the development of wind, solar, and ocean energy on the Outer Continental Shelf; b) existing Federal authorities for the development of such resources; and c) statutory and regulatory mechanisms for such development.

The results of the study shall be transmitted to the Congress within 24 months after the date of enactment.

Assessment of Renewable Energy Resources (Section 7074)
Not later than 3 months after the date of enactment, and each year thereafter, the Secretary of Energy shall review the available assessments of renewable energy resources available within the United States, including solar, wind, biomass, ocean, geothermal, and hydroelectric energy resources, and undertake new assessments as necessary, taking into account changes in market conditions, available technologies, and other relevant factors.

Not later than 1 year after the date of enactment of this Act, and each year thereafter, the Secretary shall publish a report based on those assessments. The report shall contain—a) a detailed inventory describing the available amount and characteristics of the renewable energy resources; and b) such other information as the Secretary believes would be useful in developing such renewable energy resources, including descriptions of surrounding terrain, population and load centers, nearby energy infrastructure, location of energy and water resources, and available estimates of the costs needed to develop each resource, together with an identification of any barriers to providing adequate transmission for remote sources of renewable energy resources to current and emerging markets, recommendations for removing or addressing such barriers, and ways to provide access to the grid that do not unfairly disadvantage renewable or other energy producers.

Current Status: Placed on Union Calendar, Calendar No. 42 on April 9, 2003.

H.R. 1730 - Solid Waste Interstate Transportation Act of 2003

Introduced: April 10, 2003, by Congressman James C. Greenwood

Purpose: To impose certain limitations on the receipt of out-of-State municipal solid waste.

Renewable Energy Source(s): municipal solid waste (MSW)

Summary: **Receipt and Disposal of Out-of-State Municipal Waste (Section 4011)**
No landfill or incinerator may receive any out-of-State municipal waste for disposal or incineration unless the waste is received by: a) a host community agreement—1) an agreement specifically authorizing the owner or operator to accept, at the landfill or incinerator, out-of-State municipal solid waste; and (2) the owner or operator complies with all of the terms and conditions of the host community agreement.

Authority of states to restrict out-of-State MSW allows for a State to limit the amount of out-of-State MSW received annually at each landfill or incinerator in the State to the limitation amount. No limit may conflict with the provisions of a permit specifically authorizing the owner or operator to accept, at the facility, out-of-State MSW or with a host community agreement entered into between the owner or operator of any such landfill or incinerator and the affected local government.

A State may provide by law that a State permit issued or renewed after the date of enactment for a MSW landfill or incinerator, or for expansion of a MSW landfill or incinerator, shall include a requirement that not more than a specified percentage of the total amount of MSW received annually at the landfill or incinerator may be out-of-State MSW. A percentage limitation established by a State shall not be less than 20 percent.

Current Status: Committee hearings held on July 23, 2003.

H.R.2772 - John Rishel Geothermal Steam Act Amendments of 2003

Introduced: July 17, 2003, by Congressman Jim Gibbons

Purpose: To amend the Geothermal Steam Act of 1970 to promote the development and use of geothermal resources in the United States.

Renewable Energy Source(s): geothermal

Summary: Section 4 of the Geothermal Steam Act of 1970 (30 U.S.C. 1003) is amended as follows—leasing for direct use of geothermal resources regarding land leases. Qualified development and direct utilization of geothermal resources shall be leased to any qualified applicant who applies for the lease under the regulations formulated.

Lands shall be leased to qualified applicants if: a) the Secretary of the Interior publishes a notice of the lands proposed for leasing at lease 60 days before the issuance of the lease; and b) if not

received within the 60 day period beginning on the date of such publication any nomination to include lands concerned in the next competitive lease sale.

The leasing for direct use of geothermal resources shall embrace not more than the minimum amount of acreage to be reasonably necessary for the qualified development and direct utilization of geothermal resources.

In lieu of royalty or rental, a lease for a qualified development and direct utilization of geothermal resources shall provide for payment by the lessee of an annual fee per well of not less than $100, and not more than $1,000.

A royalty on electricity produced using geothermal steam and associated geothermal resources, other than direct use geothermal shall be: a) 1.75 percent of the gross proceeds from the sale of electricity produced during the first 10 years of production under the lease and b) 3.5 percent of the gross proceeds from the sale of electricity produced during each year after the 10-year period.

Regarding state and county royalty shares relating to monies received by the United States with respect to electricity produced in a County or in a State with a geothermal lease shall be: a) the Secretary of Treasury shall pay 75 percent to the State and b) 25 percent by the Secretary of Treasury shall be paid to the County.

All monies received by the United States from sales, bonuses, and royalties shall be paid into the Treasury of the United States. Fifty percent shall be paid to the State within the boundaries of which the leased lands or geothermal resources are or were located, and 20 percent shall be paid to the County within the boundaries of which the leased lands or geothermal resources are or were located.

Not later than 6 months after the date of enactment,, the Secretary of the Interior and the Secretary of Agriculture shall submit to the Congress a memorandum of understanding regarding leasing and permitting, for geothermal development, of public lands under their respective administrative jurisdictions.

The Secretary of the Interior shall review and report to the Congress within 3 years after the date of enactment, regarding the status of all moratoria on and withdrawals from leasing under the Geothermal Steam Act of 1970 (30 U.S.C. 1001 et seq.) of known geothermal resources areas specifying for each area whether the basis for such moratoria or withdrawal still applies.

The Secretary of Interior, acting through the Director of the United States Geological Survey and in cooperation with the States, shall update the 1978 Assessment of Geothermal Resources, and submit that updated assessment to the Committee on Resources of the House of Representatives and the Committee on Energy and Natural Resources of the Senate— a) within 3 years after the date of enactment; and b) every year thereafter as the availability of data and developments in technology warrant.

A geothermal lease shall be for a period of ten years. This term may be extended for 5 years if, for each year after the 5th year of the lease it is determined that: a) the lessee satisfied the work commitment requirements that applied to the lease for that year; or b) the lessee paid the value of any work that was not completed with those requirements.

Work commitment requirements shall not apply to a geothermal lease after the date on which geothermal steam is produced or utilized under the lease in commercial quantities.

Public lands under military jurisdiction—except as otherwise provided in the Geothermal Steam Act of 1970 (30 U.S.C. 1001 et seq.) and other provisions of Federal law applicable to development of geothermal resources within public lands, all public lands under the jurisdiction of a Secretary of a military department shall be open to the operation of such laws and development and utilization of geothermal resources without the necessity for further action by the Secretary or the Congress.

Current Status: Subcommittee hearings held on July 22, 2003.

Appendix F

Revisions to EIA Methodologies

Energy Use Sectors and Consumption

In 2002, the EIA reorganized the way it presents data on electric power producers to reflect the changing structure of the electric power industry. Previously, electric utilities were presented as a separate sector and nonutilities were included in the industrial sector. EIA has created an electric power sector, which includes all entities whose primary purpose of business is the production and sale of electricity, i.e., all electric utilities and independent power producers.[22] The remaining nonutilities are assigned to the industrial or commercial sectors, depending on the primary purpose of their business. This report provides data for generation, capacity, and energy consumption according to the revised sectorial definitions.

To improve accuracy, the EIA also changed its methodology for estimating biomass energy consumption for electricity generation. Previously, EIA applied the fossil fuel equivalent heat rate to biomass net generation to estimate biomass energy consumption for electricity generation.[23] Now, EIA uses estimates based on individual power plant fuel consumption data reported on the EIA electric power surveys. This method applies to all nonutility producers from 1989 forward and electric utilities starting in 2001. Since most of the power producers using biomass are nonutilities, this resulted in a significant difference. Power producers are less efficient in generating electricity from biomass than previously estimated (Table F1).

To derive these estimates, EIA conducted a thorough review of relevant historical nonutility electric power plant operating data. This resulted in revisions for 1989-2000 to plant capacity, electricity generation, energy consumption, and useful thermal output. Historical data provided in the *Renewable Energy Annual 2001* was significantly revised. Because energy consumption at combined-heat-and-power (CHP) plants is not disaggregated, EIA also developed a methodology for dividing plant energy consumption between energy for electricity generation and energy for useful thermal output. The division assumes that CHP plants are on average 80 percent efficient in producing useful thermal output.

Table F1. Comparison of Estimates of Biomass Energy Consumption for Generating Electricity, 1997-1999 (Trillion Btu)

	Prior	REA2001	Difference
1997	567	823	256
1998	548	807	259
1999	596	822	226

Sources: Prior: Energy Information Administration, *Renewable Energy Annual 2000*, DOE/EIA-0603(2001) (Washington, DC, March 2001), Table 3. REA2001: Energy Information Administration, *Renewable Energy Annual 2001*, DOE/EIA-0603(2002) (Washington, DC, November 2002), Table 3.

A detailed explanation of the rationale behind the changes and new methodologies described above for 2002 is found in the *Annual Energy Review 2001*, Appendix H.[24]

Electric Trade

In 2003, the EIA revised its methodology for estimating electricity trade. EIA previously estimated the proportions of traded electricity from fossil fuels and hydropower (and applied the fossil-fuel steam-electric-plant heat rate to convert from kilowatthours to Btu) and from geothermal (and applied the heat rate for geothermal electric plants). EIA no longer has adequate data to estimate proportions by source and is now applying an overall rate of 3,412 Btu per kilowatthour to all traded electricity.

For the first time in *Renewable Energy Annual 2002*, electricity trade is excluded from estimates of renewable energy consumption and net generation. This lowers the estimates of total annual renewable energy consumption by about 110 to 340 trillion Btu and net generation by about 10 to 30 billion kilowatthours depending on the year.[25]

[22] For a detailed description of the sectors by North American Classification System (NAICS) see Energy Information Administration, Annual Energy Review 2001, DOE/EIA-0384(2001) (Washington, DC, November 2002), Appendix G.

[23] The heat rate for fossil-fuel steam electric plants is estimated as 10,201 Btu/kilowatthour for 2000. See Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2002), Table A6.

[24] See Energy Information Administration, *Annual Energy Review 2001*, DOE/EIA-0384(2001) (Washington, DC, November 2002), Appendix H or *Monthly Energy Review*, April 2003, DOE/EIA-0035(2003/04) (Washington, DC, (Washington, DC, May 2003), Appendix D at this website: http://www.eia.doe.gov/emeu/mer/pdf/pages/sec12_d.pdf , (September 11, 2003).

[25] See Energy Information Administration, *Renewable Energy Annual 2001*, DOE/EIA-0603(2001) (Washington, DC, November 2002), Tables 4 and B1 and supporting data.

Appendix G

Selected List of Internet Addresses: Renewable Energy Information by Resource

The list of addresses that follow are current as of Summer 2003. This list should provide a useful start in a search for renewable energy information.

General: Renewables

U.S. Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy
http://www.eere.energy.gov

DOE Office of Energy Efficiency and Renewable Energy Financing Information
http://www.eere.energy.gov/financing/statelocal.html

DOE Renewable Energy Regional Offices
http://www.eere.energy.gov/rso.html

Energy Information Administration
http://www.eia.doe.gov

Database of State Incentives for Renewable Energy
http://www.dsireusa.org

Renewable Energy Policy Project
http://www.crest.org

International Energy Agency
Renewable Energy
http://www.iea.org

National Renewable Energy Laboratory
NREL Publications Database
http://www.nrel.gov/publications

National Renewable Energy Laboratory Analysis
The Bottom Line - Financial Models
http://www.nrel.gov/analysis/financial_models.html

National Association of Regulatory Utility Commissioners (NARUC)
http://www.naruc.org

California Energy Commission
http://www.energy.ca.gov

Green Energy News
http://www.nrglink.com

DOE Green Power Network
http://www.eere.energy.gov/greenpower/

State Renewable Energy News
http://www.nrel.gov/analysis/emaa/projects/sren

Interstate Renewable Energy Council
http://www.irecusa.org

Renewable Energy Businesses and Organizations in the World
http://energy.sourceguides.com/index.shtml

Biomass: Wood

Regional Wood Energy Development Programme in Asia
http://www.rwedp.org

Forest Industry Network
World-wide directory of forestry, logging, harvesting, saw milling equipment, etc. companies and related information.
http://www.forestindustry.com

American Forest and Paper Association
http://www.afandpa.org

Biomass: Biofuels

DOE National Biofuels Program
http://www.ott.doe.gov/biofuels/

U.S. Department of Agriculture Biofuels Information
http://www.nal.usda.gov/ttic/biofuels.htm

DOE BioPower Program
http://www.eere.energy.gov/biopower/main.html

DOE Alternative Fuels Data Center
http://www.afdc.doe.gov

American Bioenergy Association (ABA)
http://www.eco-web.com/cgi-local/sfc?a=index/index.html&b=register/02555.html

Short-Rotation Woody Crops (SRWC) Operations Working Group: a private and public partnership between wood products companies, equipment manufacturers, utility companies, the U.S. Forest Service, the U.S. Department of Energy's Oak Ridge National Laboratory (ORNL), the National Council of the Paper Industry for Air and Stream Improvement (NCASI) and university researchers.
http://www.woodycrops.org

Municipal Solid Waste

U.S. Environmental Protection Agency (EPA), Office of Solid Waste
http://www.epa.gov/osw

The Solid Waste Association of North America
http://www.swana.org

EPA, Municipal Solid Waste: Basic Facts
http://www.epa.gov/epaoswer/non-hw/muncpl/facts.htm

Waste-to-Energy

Integrated Waste Services Association
http://www.wte.org

Geothermal

Idaho National Engineering and Environmental Laboratory Geothermal Energy Web Site
http://geothermal.id.doe.gov

Geo-Heat Center, Oregon Institute of Technology, Geothermal Information and Technology Transfer
http://geoheat.oit.edu

International Geothermal Association
http://iga.igg.cnr.it/index.php

California Energy Commission Geothermal Program
http://www.energy.ca.gov/geothermal/index.html

Geothermal Energy Association
http://www.geo-energy.org

Geothermal Resources Council
http://www.geothermal.org

DOE Geothermal Energy Program
http://www.eere.energy.gov/geothermal/

Wind

Danish Wind Industry Association
http://www.windpower.org/en/core.htm

Wind Info Resources on the Net
http://www.afm.dtu.dk/wind/bookmark.html

British Wind Energy Association
http://www.bwea.com

European Wind Energy Association
http://www.ewea.org

German Wind Energy Association
http://www.wind-energie.de/englischer-teil/english.htm

German Wind Energy Institute
Wind Energy Use in Germany
http://www.dewi.de/statistics.html

Riso National Laboratory Denmark
Wind Energy Department
http://www.risoe.dk/vea

American Wind Energy Association
http://www.awea.org

Windpower Monthly News Magazine
http://www.wpm.co.nz

DOE Wind Energy Program
http://www.eere.energy.gov/wind/

DOE Wind Energy Topics
http://www.eren.doe.gov/RE/wind.html

National Renewable Energy Laboratory=s National Wind Technology Center
http://www.nrel.gov/wind

Wind Powering America
http://www.eere.energy.gov/wind/

Solar Energy

International Solar Energy Society
http://www.ises.org

Solar Thermal

ASME (American Society of Mechanical Engineers) Solar Energy Division
http://www.asme.org/divisions/solar/index.html

The International Society for Optical Engineering Publications: Solar Radiation and Solar Thermal Systems
http://www.spie.org/web/abstracts/oepress/MS54.html

Sandia National Laboratories
National Solar Thermal Test Facility
http://www.sandia.gov/Renewable_Energy
/solarthermal/nsttf.html

Solar Photovoltaic

DOE National Center For Photovoltaics
http://www.nrel.gov/ncpv

PV WEB SITES
http://www.pvpower.com/pvsites.html

BP Solar
http://www.bpsolar.com
NASA Glenn Research Center Photovoltaic and Space Environments Branch
http://powerweb.lerc.nasa.gov/pvsee

NREL: Photovoltaics for Buildings
http://www.nrel.gov/buildings/pv/

Million Solar Roofs Initiative
http://www.millionsolarroofs.org

Solar Electric Power Association
http://www.solarelectricpower.org

Sandia National Laboratories Photovoltaic Systems Program
http://www.sandia.gov/pv

PV Energy Systems, Inc.
http://www.pvenergy.com

Solar Power
http://www.pvinsider.com

Appendix H

State Energy Agencies

The following lists the State Energy Office (or equivalent), the Public Utility Commission (or equivalent), and the State Geologist (when available) for each State, the District of Columbia, Puerto Rico, and Territories.[17]

Alabama

State Energy Office
Terri Adams, Division Director
Department of Economic and
Community Affairs
Science Technology and Energy Division
P.O. Box 5690
Montgomery, AL 36103-5690
(334) 242-5292
Fax: (334) 242-0552
http://www.adeca.alabama.gov/columns
.aspx?m=4&id=19&id2=106

State Geologist
Berry H. (Nick) Tew, Jr.
Geological Survey of Alabama
420 Hackberry Lane (W.B. Jones Hall)
University of Alabama
Tuscaloosa, AL 35486-6999
(205) 349-2852
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[17]This information was obtained from:: National Association of State Energy Officials (NASEO), http://www.naseo.org/members/states.htm, (October 15, 2003); American Association of State Geologists, http://www.kgs.ukans.edu/AASG/AASG.html, (October 15, 2003); National Association of Regulatory Utility Commissioners (NARUC), http://www.naruc.org/resources/state.shtml, (October 15, 2003).

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Appendix I

Green Pricing and Net Metering Programs

Green pricing/marketing programs allow electricity customers to express their willingness to pay for renewable energy development through direct payments on their monthly bills. The EIA first collected information on green pricing on the Form EIA-861 which is a survey of electric industry participants including: electric utilities, wholesale power marketers, energy service providers, and electric power producers. All respondents, not just electric utilities, were asked to report the number of their customers in green pricing programs by state and customer class.

A total of 211 electric industry participants reported over 700,000 customers in green pricing programs in 2002, the second year data was collected (Table I1). The top five states, California, Colorado, Ohio, Pennsylvania, and Texas, had 83 percent of total. Ninety-seven percent of total customers were residential customers. Nearly all electric industry participants reported less than 5 percent of their customer base in green pricing programs; many reported less than 1 percent.

Net metering provisions vary by state and utility, but usually apply only to very small generators that typically use solar or wind energy. This system usually permits a customer operating a small generator to purchase extra electricity when needed. Also, any excess power at the end of the month can be sold back to the utility. Pricing schemes vary by individual utility and customer circumstances. This system facilitates the ease of operating intermittent generators such as those using solar and wind energy and improves their economics. The EIA first collected information on net metering on the Form EIA-861 in much the same manner as it did green pricing.

A total of 98 electric industry participants reported over 5,000 customers in net metering programs in 2002, the second year the data was collected (Table I2). California had over 60 percent of all customers in net metering programs. Over 90 percent of California's net metering customers and 80 percent nationwide were residential customers. Nearly all the electric industry participants reported less than 1 percent of their customers in net metering programs; many reported less than 0.03 percent.

Additional information concerning distributed generation, green pricing and net metering is available on U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy websites. For distributed energy resources, see http://www.eere.energy.gov/der/ (October 2, 2003). For green pricing and net metering, see http://www.eere.energy.gov/greenpower/home.shtml (October 2, 2003).

Table I1. Estimated U.S. Green Pricing Customers by State and Customer Class, 2002

State	Electric Industry [a] Participants	Participating Customers[P]		
		Residential	Non-residential	Total
Alabama				
Alaska				
Arizona	2	3,963	76	4,039
Arkansas				
California	11	54,344	1,287	55,631
Colorado	17	38,412	779	39,191
Connecticut	1	1,056		1,056
Delaware	1	7	1	8
District of Columbia	1	1,682	4	1,686
Florida	2	145	1	146
Georgia	3	416	2	418
Hawaii	3	3,017	23	3,040
Idaho	6	2,044	46	2,090
Illinois	1	8		8
Indiana	7	689	19	708
Iowa	8	4,400	3	4,403
Kansas				
Kentucky	2	6		6
Louisiana				
Maine	1	47		47
Maryland	2	2,550	3	2,553
Massachusetts				
Michigan	4	1,127	62	1,189
Minnesota	50	7,809	113	7,922
Mississippi				
Missouri	1	136		136
Montana	3	238	3	241
Nebraska	3	4,722	87	4,809
Nevada	1	238	3	241
New Hampshire				
New Jersey	2	2,110	116	2,226
New Mexico	2	620	9	629
New York				
North Carolina				
North Dakota	6	644	26	670
Ohio	1	344,907	11,402	356,309
Oklahoma				
Oregon	12	31,819	3,855	35,674
Pennsylvania	3	92,591	131	92,722
Rhode Island				
South Carolina	2	980	172	1,152
South Dakota	7	411	9	420
Tennessee				
Texas	4	47,099	539	47,638
Utah	1	7,510	1,414	8,924
Vermont				
Virginia	1	2,394		2,394
Washington	14	10,788	215	11,003
West Virginia				
Wisconsin	46	17,859	3,054	20,913
Wyoming	4	1,190	25	1,215
Total	**211**	**687,978**	**23,479**	**711,457**

[a] Includes entities with green pricing programs in more than one state.
[P] = Preliminary
Note: Non-residential may include some customers for whom no customer class is specified. Blank cells indicate no data was reported for the state or the number of customers in a class was zero. Totals may not equal the sum of the components due to independent rounding.
Source: Energy Information Administration, Form EIA-861, "Annual Electric Power Industry Report."

Table I2. Estimated U.S. Net Metering Customers by State and Customer Class, 2002

State	Electric Industry [a] Participants	Participating Customers[P]		
		Residential	Non-residential	Total
Alabama				
Alaska				
Arizona	1	14	306	320
Arkansas				
California	9	2,843	173	3,016
Colorado	5	116	33	149
Connecticut	2	13	12	25
Delaware	1	11		11
District of Columbia				
Florida	1	8	1	9
Georgia				
Hawaii	3	12	2	14
Idaho	4	11		11
Illinois	2		12	12
Indiana	1	3		3
Iowa	1	2		2
Kansas	2	2	2	4
Kentucky	1		1	1
Louisiana				
Maine				
Maryland	2	6		6
Massachusetts	3	76	9	85
Michigan	1	2	2	4
Minnesota	14	86	11	97
Mississippi				
Missouri	1	2		2
Montana	2	3		3
Nebraska	1	6	5	11
Nevada	2	37	2	39
New Hampshire	4	45	24	69
New Jersey				
New Mexico	2	8		8
New York	1	19	3	22
North Carolina				
North Dakota	3	4	1	5
Ohio	3		5	5
Oklahoma	2	1	35	36
Oregon	4	12	10	22
Pennsylvania	2	20	15	35
Rhode Island	1	4	1	5
South Carolina	1	424	12	436
South Dakota	1	91	2	93
Tennessee				
Texas	4	6	191	197
Utah				
Vermont	3	42	1	43
Virginia	2	5		5
Washington	6	30	4	34
West Virginia				
Wisconsin	4	109	52	161
Wyoming	1	1		1
Total	**98**	**4,074**	**927**	**5,001**

[a] Includes entities with net metering programs in more than one state.

[P] = Preliminary

Note: Non-residential may include some customers for whom no customer class is specified. Blank cells indicate no data was reported for the state or the number of customers in a class was zero. Totals may not equal the sum of the components due to independent rounding.

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

Appendix J

Respondents to the Geothermal Heat Pump and Solar Equipment Manufacturers' Surveys

Respondents to the Energy Information Administration, Form EIA-902, "Annual Geothermal Heat Pump Manufacturers Survey," for 2002

Addison Products Company
7050 Overland Road
Orlando, FL 32810

Advanced Geothermal Technology
P.O. Box 511
Redding, PA 19607

American Geothermal Heat Pump, Inc.
1037 Old Salem Road
Murfreesboro, TN 37129

Aqua Cal
2737 24th Street North
St. Petersburg, FL 33713

Bard Manufacturing Company
1914 Randolph Drive
Bryan, OH 43506

Climate Master, Inc.
7300 SW 44th Street
Oklahoma City, OK 73125

Econar Energy Systems Corp.
19230 Evans Street
Elks River, MN 55330

ECR Technologies, Inc.
3536 DMG Drive
Lakeland, FL 33811

Enviroteq
2610 Clyde Avenue
State College, PA 16801

FHP Manufacturing Company
60 NW 65th Court
Ft. Lauderdale, FL 33309

Heat Controller
1900 Wellworth Avenue
Jackson, MI 49204

Hydro Delta Corporation
10205 Gravois
St. Louis, MO 63123

Hydro-Temp Corporation
P.O. Box 566
Pocahontas, AR 72455

Mammoth, Inc.
101 West 82nd Street
Chaska, MN 55318

WaterFurnace International, Inc.
9000 Conservation Way
Fort Wayne, IN 46809

Respondents to the Energy Information Administration, Form EIA-63A, "Annual Solar Thermal Collector Manufacturers Survey," for 2002

Air Masters Corp
9100 Olive Street Road
St Louis, MO 63132

Alternative Energy Technologies LLC
1057 N Ellis Rd Unit 4
PO Box 61326
Jacksonville, FL 32254

Aquatherm Industries Inc
1940 Rutgers University Blvd
Lakewood, NJ 08701

Caribe Sol De Puerto Rico
PO Box 1931
Anasco, Puerto Rico 00610

Conserval Systems Inc
4242 #28 Ridge Lea Rd
Buffalo, NY 14226-1016

ENTECH Inc
1077 Chisolm Trail
Keller, TX 76248

FAFCO Inc
435 Otterson Dr
Chico, CA 95928

Haleakala Solar Inc
PO Box 786 2000 Mokulele Hwy
Puunene, HI 96784

Harter Industries
PO Box 502
Holmdel, NJ 07733

Heliocol USA Inc
927 Fern Street #1500
Altamonte-Springs, FL 32701

Heliodyne Inc
4910 Seaport Avenue
Richmond, CA 94804

Industrial Solar Technology
4420 McIntyre Street
Golden, CO 80403

Professional Solar Products
4630 Calle Quetzal
Camarillo, CA 93012

Puerto Rico Solar Products
PO Box 702
Moca, PR 00676

Radco Products Inc
2877 Industrial Parkway
Santa Maria, CA 93455

Refrigeration Research Inc
PO Box 869
Brighton, MI 48116-0869

SAIC Energy Products Division
9455 Towne Centre Dr
San Diego, CA 92121

Sealed Air Corp
3433 Arden Road
Hayward, CA 94545

Solar Development Inc
3634 Reese Ave
Riviera Beach, FL 33404

Solar Living Inc
PO Box 12
Netcong, NJ 07857

SolarRoofs.com
5840 Gibbons Drive Suite G
Carmichael, CA 95608

Sun Trapper Solar Mfg
7417 Reindeer Trail
San Antonio, TX 78238

SunEarth Inc
4315 Santa Ana St
Ontario, CA 91761

Sunwatt Corp
17 Rockwell Rd SE
Jonesport, ME 04649

Techno-Solis Inc
12929 44th Street N
Clearwater, FL 33762

Thermo Technologies
5560 Sterrett Pl, Suite 115
Columbia, MD 21044

Universal Solar Products
PO Box 364027
San Juan, PR 00936-4027

Respondents to the Energy Information Administration, Form EIA-63B, "Annual Photovoltaic Module/Cell Manufacturers Survey," for 2002

American Photovoltaics & Homes Ltd
5951 Riverdale Avenue-Box 1199
Riverdale, NY 10471

AstroPower Inc
300 Executive Dr
Newark, DE 19702

B P Solar Int'l LLC
630 Solarex Court
Frederick, MD 21701

DayStar Technologies Inc
900 Golden Gate Terr, Ste A
Grass Valley, CA 95945

EBARA Solar Inc
13 Airport Rd
Belle Vernon, PA 15012

Evergreen Solar Inc
259 Cedar Hill Street
Marlboro, MA 01752

First Solar LLC
28101 Cedar Park Blvd
Perrysburg, OH 43551

Global Solar Energy, Inc
5575 S Houghton Rd
Tucson, AZ 85747

Kyocera Solar Inc
7812 East Acoma Dr
Scottsdale, AZ 85260

Matrix Solar Technologies
540 A Silver Creek NW
Albuquerque, NM 87121

RWE Schott Solar Inc
4 Suburban Park Drive
Billerica, MA 01821

Sanyo Energy Corporation
2055 Sanyo Avenue
San Diego, CA 92154

Solar Electric Inc
5555 Santa Fe St #D
San Diego, CA 92109

Spire Corporation
One Patriots Park
Bedford, MA 01730-2396

SunPower Corporation
430 Indio Way
Sunnyvale, CA 94086

Sunwatt Corporation
17 Rockwell Rd SE
Jonesport, ME 04649

SunWize Technologies LLC
1155 flatbush Rd
Kingston, NY 12401

Thermo Technologies
5560 Sterrett Pl, Suite 115
Columbia, MD 21044

United Solar Systems Corp
3800 Lapeer Rd
Auburn Hills, MI 48326

Glossary

Alcohol Fuels: Alcohol can be blended with gasoline for use as transportation fuel. It may be produced from a wide variety of organic feedstock. The common alcohol fuels are methanol and ethanol. Methanol may be produced from coal, natural gas, wood and organic waste. Ethanol is commonly made from agricultural plants, primarily corn, containing sugar.

Alternating Current (AC): An electric current that reverses its direction at regularly recurring intervals, usually 50 or 60 times per second.

Amorphous Silicon: An alloy of silica and hydrogen, with a disordered, noncrystalline internal atomic arrangement, that can be deposited in thin-layers (a few micrometers in thickness) by a number of deposition methods to produce thin-film photovoltaic cells on glass, metal, or plastic substrates.

Annualized Growth Rates: Calculated as follows:

$$(x_n / x_1)^{1/n},$$

where x is the value under consideration and n is the number of periods.

Air-Conditioning & Refrigeration Institute (ARI) - 320, 325, 330: ARI heat pump classifications: 320 refers to a water-source heat pump; 325 refers to a ground water-source heat pump; 330 refers to a ground source closed-loop heat pump.

Availability Factor: A percentage representing the number of hours a generating unit is available to produce power (regardless of the amount of power) in a given period, compared to the number of hours in the period.

Biomass: Organic nonfossil material of biological origin constituting a renewable energy source.

Bioenergy: Useful, renewable energy produced from organic matter, which may either be used directly as a fuel or processed into liquids and gases.

Biofuels: Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation.

Biomass gas (Biogas): A medium Btu gas containing methane and carbon dioxide, resulting from the action of microorganisms on organic materials such as a landfill.

Black Liquor (Pulping Liquor): The alkaline spent liquor removed from the digesters in the process of chemically pulping wood. After evaporation, the liquor is burned as a fuel in a recovery furnace that permits the recovery of certain basic chemicals.

Capacity Factor: The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full-power operation during the same period.

Capacity, Gross: The full-load continuous rating of a generator, prime mover, or other electric equipment under specified conditions as designated by the manufacturer. It is usually indicated on a nameplate attached to the equipment.

Capacity, Net Summer: See Net Summer Capacity.

Capital Cost: The cost of field development and plant construction and the equipment required for the generation of electricity.

Cast Silicon: Crystalline silicon obtained by pouring pure molten silicon into a vertical mold and adjusting the temperature gradient along the mold volume during cooling to obtain slow, vertically-advancing crystallization of the silicon. The polycrystalline ingot thus formed is composed of large, relatively parallel, interlocking crystals. The cast ingots are sawed into wafers for further fabrication into photovoltaic cells. Cast-silicon wafers and ribbon-silicon sheets fabricated into cells are usually referred to as polycrystalline photovoltaic cells.

Cogeneration: See combined heat and power.

Combined Cycle: An electric generating technology in which electricity is produced from otherwise lost waste heat exiting from one or more gas (combustion) turbines. The exiting heat is routed to a conventional boiler or to a heat recovery steam generator for utilization by a steam turbine in the production of electricity. Such designs increase the efficiency of the electric generating unit.

Combined Heat and Power (CHP) Plant: A plant designed to produce both heat and electricity from a single heat source. *Note:* This term is being used in place of the term "cogenerator" that was used by EIA in the past. CHP better describes the facilities because some of the plants included do not produce heat and power in a sequential fashion and, as a result, do not meet the legal definition of cogeneration specified in the Public Utility Regulatory Policies Act (PURPA).

Commercial Sector: An energy-consuming sector that consists of service-providing facilities and equipment of: businesses; Federal, State, and local governments; and other private and public organizations, such as religious, social, or fraternal groups. The commercial sector includes institutional living quarters. It also includes sewage treatment facilities. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a wide variety of other equipment. *Note:* This sector includes generators that produce electricity and/or useful thermal output primarily to support the activities of the above-mentioned commercial establishments.

Concentrator: A reflective or refractive device that focuses incident insolation onto an area smaller than the reflective or refractive surface, resulting in increased insolation at the point of focus.

Conventional hydroelectric (hydropower) plant: A plant in which all of the power is produced from natural streamflow as regulated by available storage.

Digester Gas: Biogass that is produced using a digester which is an airtight vessel or enclosure in which bacteria decomposes biomass in water to produce biogas.

Direct Current (DC): An electric current that flows in a constant direction. The magnitude of the current does not vary or has a slight variation.

Distributed Generation (Distributed Energy Resources): Refers to electricity provided by small, modular power generators (typically ranging in capacity from a few kilowatts to 50 megawatts) located at or near customer demand.

Electric power sector: An energy-consuming sector that consists of electricity only and combined heat and power(CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public--i.e., North American Industry Classification System 22 plants.

Electric Utility: A corporation, person, agency, authority, or other legal entity or instrumentality aligned with distribution facilities for delivery of electric energy for use primarily by the public. Included are investor-owned electric utilities, municipal and State utilities, Federal electric utilities, and rural electric cooperatives. A few entities that are tariff based and corporately aligned with companies that own distribution facilities are also included. *Note:* Due to the issuance of FERC Order 888 that required traditional electric utilities to functionally unbundle their generation, transmission, and distribution operations, "electric utility" currently has inconsistent interpretations from State to State.

Electric Utility Restructuring: The introduction of competition into at least the generation phase of electricity production, with a corresponding decrease in regulatory control.

Emissions: Anthropogenic releases of gases to the atmosphere. In the context of global climate change, they consist of radiatively important greenhouse gases (e.g., the release of carbon dioxide during fuel combustion).

Energy Crops: Crops grown specifically for their fuel value. These include food crops such as corn and sugarcane, and nonfood crops such as poplar trees and switchgrass. Currently, two energy crops are under development: short - rotation woody crops, which are fast - growing hardwood trees harvested in five to eight years, and herbaceous energy crops, such as perennial grasses, which are harvested annually after taking two to three years to reach full productivity.

Ethanol (also known as Ethyl Alcohol or Grain Alcohol, CH_3-CH_2OH)**:** A clear, colorless flammable oxygenated hydrocarbon with a boiling point of 173.5 degrees Fahrenheit in the anhydrous state. However it readily forms a binary azetrope with water, with a boiling point of 172.67 degrees Fahrenheit at a composition of 95.57 percent by weight ethanol. It is used in the United States as a gasoline octane enhancer and oxygenate (maximum 10 percent concentration). Ethanol can be used in higher concentrations (E85) in vehicles designed for its use. Ethanol is typically produced chemically from ethylene, or biologically from fermentation of various sugars from carbohydrates found in agricultural crops and cellulosic residues from crops or wood. The lower heating value, equal to 76,000 Btu per gallon, is assumed for estimates in this report.

Evacuated Tube: In a solar thermal collector, an absorber tube, which is contained in an evacuated glass cylinder, through which collector fluids flows.

Flat Plate Pumped: A medium-temperature solar thermal collector that typically consists of a metal frame, glazing, absorbers (usually metal), and insulation and that uses a pump liquid as the heat-transfer medium: predominant use is in water heating applications.

Fuel Cells: One or more cells capable of generating an electrical current by converting the chemical energy of a fuel directly into electrical energy. Fuel cells differ from conventional electrical cells in that the active materials such as fuel and oxygen are not contained within the cell but are supplied from outside.

Fuelwood: Wood and wood products, possibly including coppices, scrubs, branches, etc., bought or gathered, and used by direct combustion.

Generation (Electricity): The process of producing electric energy from other forms of energy; also, the amount of electric energy produced, expressed in watthours (Wh).

Gross Generation: The total amount of electric energy produced by the generating units at a generating station or stations, measured at the generator terminals.

Net Generation: Gross generation less the electric energy consumed at the generating station for station's use.

Geothermal Energy: As used at electric power plants, hot water or steam extracted from geothermal reservoirs in the Earth's crust that is supplied to steam turbines at electric power plants that drive generators to produce electricity.

Geothermal Plant: A plant in which a turbine is driven either from hot water or by natural steam that derives its energy from heat found in rocks or fluids at various depths beneath the surface of the earth. The fluids are extracted by drilling and/or pumping.

Giga: One billion.

Green Pricing/Marketing: In the case of renewable electricity, green pricing represents a market solution to the various problems associated with regulatory valuation of the nonmarket benefits of renewables. Green pricing programs allow electricity customers to express their willingness to pay for renewable energy development through direct payments on their monthly utility bills.

Grid: The layout of an electrical distribution system.

Hardwoods: Usually broad-leaved and deciduous trees.

Heat Pump: A year-round heating and air-conditioning system employing a refrigeration cycle. In a refrigeration cycle, a refrigerant is compressed (as a liquid) and expanded (as a vapor) to absorb and reject heat. The heat pump transfers heat to a space to be heated during the winter period and by reversing the operation extracts (absorbs) heat from the same space to be cooled during the summer period. The refrigerant within the heat pump in the heating mode absorbs the heat to be supplied to the space to be heated from an outside medium (air, ground or ground water) and in the cooling mode absorbs heat from the space to be cooled to be rejected to the outside medium.

Heat Pump (Air Source): An air-source heat pump is the most common type of heat pump. The heat pump absorbs heat from the outside air and transfers the heat to the space to be heated in the heating mode. In the cooling mode the heat pump absorbs heat from the space to be cooled and rejects the heat to the outside air. In the heating mode when the outside air approaches 32° F or less, air-source heat pumps loose efficiency and generally require a back-up (resistance) heating system.

Heat Pump (Geothermal): A heat pump in which the refrigerant exchanges heat (in a heat exchanger) with a fluid circulating through an earth connection medium (ground or ground water). The fluid is contained in a variety of loop (pipe) configurations depending on the temperature of the ground and the ground area available. Loops may be installed horizontally or vertically in the ground or submersed in a body of water.

Heat Pump (efficiency): The efficiency of a heat pump, that is, the electrical energy to operate it, is directly related to temperatures between which it operates. Geothermal heat pumps are more efficient than conventional heat pumps or air conditioners that use the outdoor air since the ground or ground water a few feet below the earth's surface remains relatively constant throughout the year. It is more efficient in the winter to draw heat from the relatively warm ground than from the atmosphere where the air temperature is much colder, and in summer transfer waste heat to the relatively cool ground than to hotter air. Geothermal heat pumps are generally more expensive ($2,000-$5,000) to install than outside air heat pumps. However, depending on the location geothermal heat pumps can reduce energy consumption (operating cost) and correspondingly, emissions by more than 20 percent compared to high-efficiency outside air heat pumps. Geothermal heat pumps also use the waste heat from air-conditioning to provide free hot water heating in the summer.

High-Temperature Collector: A solar thermal collector designed to operate at a temperature of 180 degrees Fahrenheit or higher.

Incentives: Subsidies and other Government actions where the Governments's financial assistance is indirect.

Independent Power Producer (IPP): A corporation, person, agency, authority, or other legal entity or instrumentality that owns or operates facilities for the generation of electricity for use primarily by the public, and that is not an **electric utility**.

Internal Collector Storage (ICS): A solar thermal collector in which incident solar radiation is absorbed by the storage medium.

Industrial Sector: An energy-consuming sector that consists of all facilities and equipment used for producing, processing, or assembling goods. The industrial sector encompasses the following types of activity: manufacturing (NAICS codes 31-33); agriculture, forestry, and fisheries (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); natural gas transmission (NAICS code 2212); and construction (NAICS code 23). Overall energy use in this sector is largely for process heat and cooling and powering machinery, with lesser amounts used for facility heating, air conditioning, and lighting. Fossil fuels are also used as raw material inputs to manufactured products. *Note:* This sector includes generators that produce electricity and/or useful thermal output primarily to support the above-mentioned industrial activities.

Kilowatt (kW): One thousand watts of electricity (See Watt).

Kilowatthour (kWh): One thousand watthours.

Landfill Gas: Gas that is generated by decomposition of organic material at landfill disposal sites. Landfill gas is approximately 50 percent methane.

Levelized Cost: The present value of the total cost of building and operating a generating plant over its economic life, converted to equal annual payments. Costs are levelized in real dollars (i.e., adjusted to remove the impact of inflation).

Limited Liability Corporation (LLC): A company that limits the liability of its participants to the assets they commit to the enterprise.

Liquid Collector: A medium-temperature solar thermal collector, employed predominantly in water heating, which uses pumped liquid as the heat-transfer medium.

Low-Temperature Collectors: Metallic or nonmetallic solar thermal collectors that generally operate at temperatures below 110 degrees Fahrenheit and use pumped liquid or air as the heat transfer medium. They usually contain no glazing and no insulation, and they are often made of plastic or rubber, although some are made of metal.

Marginal Cost: The change in cost associated with a unit change in quantity supplied or produced.

Medium-Temperature Collectors: Solar thermal collectors designed to operate in the temperature range of 140 degrees to 180 degrees Fahrenheit, but that can also operate at a temperature as low as 110 degrees Fahrenheit. The collector typically consists of a metal frame, metal absorption panels with integral flow channels (attached tubing for liquid collectors or integral ducting for air collectors), and glazing and insulation on the sides and back.

Megawatt (MW): One million watts of electricity (See Watt).

Methane: A colorless, flammable, odorless hydrocarbon gas (CH_4) which is the major component of natural gas. It is also an important source of hydrogen in various industrial processes. Methane is a greenhouse gas.

MTBE: Methyl Tertiary Butyl Ether is a fuel oxygenate produced by reacting methanol with isobutylene.

MSW (Municipal Solid Waste): Residential solid waste and some nonhazardous commercial, institutional, and industrial wastes.

Net Metering: Arrangement that permits a facility (using a meter that reads inflows and outflows of electricity) to sell any excess power it generates over its load requirement back to the electrical grid to offset consumption.

Net Photovoltaic Cell Shipment: The difference between photovoltaic cell shipments and photovoltaic cell purchases.

Net Photovoltaic Module Shipment: The difference between photovoltaic module shipments and photovoltaic module purchases.

Net summer capacity: The maximum output, commonly expressed in megawatts (MW), that generating equipment can supply to system load, as demonstrated by a multi-hour test, at the time of summer peak demand (period of May 1 through October 31). This output reflects a reduction in capacity due to electricity use for station service or auxiliaries.

Nonutility Generation: Electric generation by nonutility power producers to supply electric power for industrial, commercial, and military operations, or sales to electric utilities. See **Nonutility Power Producer**.

Nonutility Power Producer: A corporation, person, agency, authority, or other legal entity or instrumentality that owns electric generating capacity and is not an electric utility. Nonutility power producers include qualifying cogenerators, qualifying small power producers, and other

nonutility generators (including independent power producers) without a designated, franchised service area that do not file forms listed in the *Code of Federal Regulations*, Title 18, Part 141.

Operation and Maintenance (O&M) Cost: Operating expenses are associated with operating a facility (i.e., supervising and engineering expenses). Maintenance expenses are that portion of expenses consisting of labor, materials, and other direct and indirect expenses incurred for preserving the operating efficiency or physical condition of utility plants that are used for power production, transmission, and distribution of energy.

Other Biomass: This category of biomass energy includes: agricultural byproducts/crops (agricultural byproducts, straw); other biomass gas (digester gas, methane); other biomass liquids (fish oil, liquid acetonitrite, waste, tall oil, waste alcohol); other biomass solids (medical waste, solid byproducts; sludge waste and tires.

Paper Pellets: paper compressed and bound into uniform diameter pellets to be burned in a heating stove.

Parabolic Dish: A high-temperature (above 180 degrees Fahrenheit) solar thermal concentrator, generally bowl-shaped, with two-axis tracking.

Parabolic Trough: A high-temperature (above 180 degrees Fahrenheit) solar thermal concentrator with the capacity for tracking the sun using one axis of rotation.

Passive Solar: A system in which solar energy alone is used for the transfer of thermal energy. Pumps, blowers, or other heat transfer devices that use energy other than solar are not used.

Peak Watt: A manufacturer's unit indicating the amount of power a photovoltaic cell or module will produce at standard test conditions (normally 1,000 watts per square meter and 25 degrees Celsius).

Peat: Peat consists of partially decomposed plant debris. It is considered an early stage in the development of coal. Peat is distinguished from lignite by the presence of free cellulose and a high moisture content (exceeding 70 percent). The heat content of air-dried peat (about 50 percent moisture) is about 9 million Btu per ton. Most U.S. peat is used as a soil conditioner. The first U.S. electric power plant fueled by peat began operation in Maine in 1990.

Photovoltaic (PV) Cell: An electronic device consisting of layers of semiconductor materials fabricated to form a junction (adjacent layers of materials with different electronic characteristics) and electrical contacts and being capable of converting incident light directly into electricity (direct current).

Photovoltaic (PV) Module: An integrated assembly of interconnected photovoltaic cells designed to deliver a selected level of working voltage and current at its output terminals, packaged for protection against environment degradation, and suited for incorporation in photovoltaic power systems.

Process Heating: The direct process end use in which energy is used to raise the temperature of substances involved in the manufacturing process.

Production Tax Credit (PTC): an inflation - adjusted 1.5 cents per kilowatthour payment for electricity produced using qualifying renewable energy sources.

Public Utility Regulatory Policies Act of 1978 (PURPA): One part of the National Energy Act, PURPA contains measures designed to encourage the conservation of energy, more efficient use of resources, and equitable rates. Principal among these were suggested retail rate reforms and new incentives for production of electricity by cogenerators and users of renewable resources.

Pumped-storage hydroelectric plant: A plant that usually generates electric energy during peak load periods by using water previously pumped into an elevated storage reservoir during off-peak periods when excess generating capacity is available to do so. When additional generating capacity is needed, the water can be released from the reservoir through a conduit to turbine generators located in a power plant at a lower level.

Quadrillion Btu: Equivalent to 10 to the 15th power Btu.

Qualifying Facility (QF): A cogeneration or small power production facility that meets certain ownership, operating, and efficiency criteria established by the Federal Energy Regulatory Commission (FERC) pursuant to the Public Utility Regulatory Policies Act of 1978 (PURPA). (See the Code of Federal Regulations, Title 18, Part 292.)

Renewable Energy Resources: Energy resources that are naturally replenishing but flow-limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include: biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Renewable Portfolio Standard (RPS): a mandate requiring that renewable energy provide a certain percentage of total energy generation or consumption.

Residential Sector: An energy-consuming sector that consists of living quarters for private households. Common uses of energy associated with this sector include space heating, water heating, air conditioning, lighting, refrigeration, cooking, and running a variety of other appliances. The residential sector excludes institutional living quarters.

Ribbon Silicon: Single-crystal silicon derived by means of fabricating processes that produce sheets or ribbons of single-crystal silicon. These processes include edge-defined film-fed growth, dendritic web growth, and ribbon-to-ribbon growth.

Roundwood: Wood cut specifically for use as a fuel.

Silicon: A semiconductor material made from silica, purified for photovoltaic applications.

Single Crystal Silicon (Czochralski): An extremely pure form of crystalline silicon produced by the Czochralski method of dipping a single crystal seed into a pool of molten silicon under high vacuum conditions and slowly withdrawing a solidifying single crystal boule rod of silicon. The boule is sawed into thin wafers and fabricated into single-crystal photovoltaic cells.

Sludge: A dense, slushy, liquid-to-semifluid product that accumulates as an end result of an industrial or technological process designed to purify a substance. Industrial sludges are produced from the processing of energy-related raw materials, chemical products, water, mined ores, sewerage, and other natural and man-made products. Sludges can also form from natural processes, such as the run off produced by rain fall, and accumulate on the bottom of bogs, streams, lakes, and tidelands.

Solar Energy: The radiant energy of the sun, which can be converted into other forms of energy, such as heat or electricity.

Solar Thermal Collector: A device designed to receive solar radiation and convert it into thermal energy. Normally, a solar thermal collector includes a frame, glazing, and an absorber, together with the appropriate insulation. The heat collected by the solar thermal collector may be used immediately or stored for later use.

Solar Thermal Collector, Special: An evacuated tube collector or a concentrating (focusing) collector. Special collectors operate in the temperature (low concentration for pool heating) to several hundred degrees Fahrenheit (high concentration for air conditioning and specialized industrial processes).

Spent liquor: The liquid residue left after an industrial process; can be a component of waste materials used as fuel.

Spent Sulfite Liquor: end product of pulp and paper manufacturing processes that contains lignins and has a high moisture content; often re-used in recovery boilers. Similar to black liquor.

Subsidy: Financial assistance granted by the Government to firms and individuals.

System Benefits Charge (SBC): A non-bypassable fee on transmission interconnection; funds are allocated among public purposes, including the development and demonstration of renewable energy technologies.

Tall oil: The oily mixture of rosin acids, fatty acids, and other materials obtained by acid treatment of the alkaline liquors from the digesting (pulping) of pine wood.

Thermosiphon System: A solar collector system for water heating in which circulation of the collection fluid through the storage loop is provided solely by the temperature and density difference between the hot and cold fluids.

Thin-Film Silicon: a technology in which amorphous or polycrystalline material is used to make photovoltaic (PV) cells.

Transmission System (Electric): An interconnected group of electric transmission lines and associated equipment for moving or transferring electric energy in bulk between points of supply and points at which it is transformed for delivery over the distribution system lines to consumers, or is delivered to other electric systems.

Transportation Sector: An energy-consuming sector that consists of all vehicles whose primary purpose is transporting people and/or goods from one physical location to another. Included are automobiles; trucks; buses; motorcycles; trains, subways, and other rail vehicles; aircraft; and ships, barges, and other waterborne vehicles. Vehicles whose primary purpose is not transportation (e.g., construction cranes and bulldozers, farming vehicles, and warehouse tractors and forklifts) are classified in the sector of their primary use.

Turbine: A machine for generating rotary mechanical power from the energy of a stream of fluid (such as water, steam, or hot gas). Turbines convert the kinetic energy of fluids to mechanical energy through the principles of impulse and reaction, or a mixture of the two.

Useful Thermal Output: The thermal energy made available for use in any industrial or commercial process or used in any heating or cooling application, i.e., total thermal energy made available for processes and applications other than electrical generation.

Watt (Electric): The electrical unit of power. The rate of energy transfer equivalent to 1 ampere of electric current flowing under a pressure of 1 volt at unity power factor.

Watt (Thermal): A unit of power in the metric system, expressed in terms of energy per second, equal to the work done at a rate of 1 joule per second.

Watthour (Wh): The electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for 1 hour.

Wind energy: Energy present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power generators. Wind pushes against sails, vanes, or blades radiating from a central rotating shaft.

Wind power plant: A group of wind turbines interconnected to a common utility system through a system of transformers, distribution lines, and (usually) one substation. Operation, control, and maintenance functions are often centralized through a network of computerized monitoring systems, supplemented by visual inspection. This is a term commonly used in the United States. In Europe, it is called a generating station.

Wood/Wood Waste: This category of biomass energy includes: black liquor; wood/wood waste liquids (red liquor, sludge wood, spent sulfite liquor); wood/wood waste solids (peat, paper pellets, railroad ties, utility poles, wood/wood waste).

Wood energy: Wood and wood products used as fuel, including round wood (cord wood), limb wood, wood chips, bark, sawdust, forest residues, charcoal, pulp waste, and spent pulping liquor.

Wood pellets: Sawdust compressed into uniform diameter pellets to be burned in a heating stove.