Renewable Energy Data Book

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

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Acknowledgements

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Although renewable energy (excluding hydropower) is a relatively small portion of total energy supply both globally and in the U.S., **renewable energy installations in both the world and in the U.S. have nearly doubled between 2000 and 2007**.

Including hydropower, renewable energy represents **10% of total installed capacity and nearly 9% of total generation in the U.S. in 2007**. Installed renewable energy capacity (including hydropower) is 110 gigawatts (GW). Not including hydropower, 2007 renewable electricity installed capacity has reached about 33 GW in the U.S.

In the U.S., growth in sectors like wind and solar photovoltaics (PV) signify an ongoing shift in the composition of our electricity supply. **In 2007, wind capacity installations grew 45% and solar PV grew 40% from the previous year.**

Worldwide, wind energy is the fastest growing renewable energy technology—**between 2000 and 2006 wind energy generation worldwide quadrupled**. The U.S. experienced similar dramatic growth, as installed wind energy capacity increased 6.5 times between 2000 and 2007.

In the U.S., renewable energy has been capturing a growing percent of new capacity additions over the past few years. **In 2007, renewable energy accounted for over 35% of all new capacity installations in the U.S.**—a large contrast from 2004 when all renewable energy captured only 2% of new capacity additions.

In 2006, the U.S. became the world's leading ethanol producer. **Between 2000 and 2007 production of corn ethanol nearly quadrupled, and biodiesel production increased 225 times**. Use of ethanol in the U.S. has also grown substantially and it currently accounts for 4% of the total U.S. gasoline pool, up from 1% in 2000.

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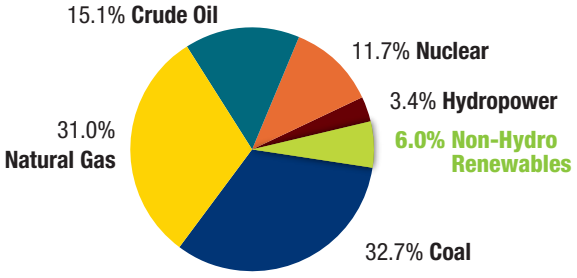
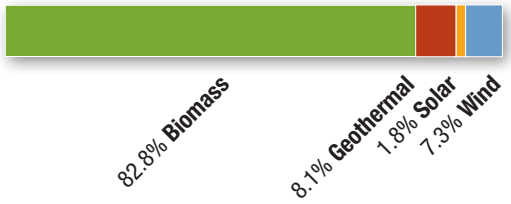
U.S. Energy Production and Consumption (2007)

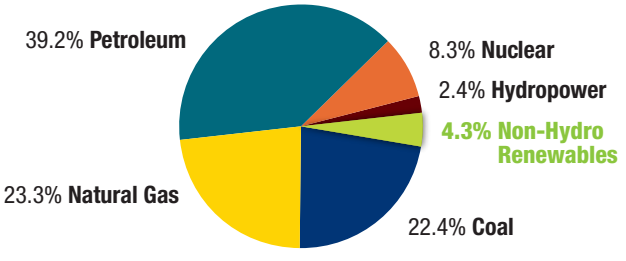
U.S. Energy Production: 71.7 Quadrillion Btu



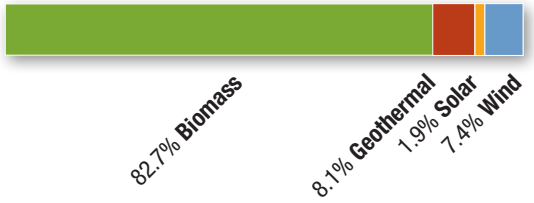
U.S. Non-Hydro Renewable Energy Production: 4.3 Quadrillion Btu



U.S. Energy Consumption: 101.6 Quadrillion Btu



U.S. Non-Hydro Renewable Energy Consumption: 4.4 Quadrillion Btu



Source: EIA; full references are provided starting on p. 121

Note: Since hydropower is considered a conventional source of energy it is accounted for separate from other new renewable sources of energy. Energy consumption is higher than energy production due to electricity imports.

U.S. Energy Production by Energy Source (%) 2000-2007

	Coal	Natural Gas	Crude Oil	Natural Gas Plant Liquids	Nuclear	Hydropower	Non-Hydro Renewables	Total Production (Quadrillion Btu)
2000	31.8%	27.5%	17.3%	3.7%	11.0%	3.9%	4.8%	71.5
2001	32.8%	28.0%	17.1%	3.5%	11.2%	3.1%	4.3%	71.9
2002	32.0%	27.4%	17.1%	3.6%	11.5%	3.8%	4.5%	70.9
2003	31.4%	28.0%	17.1%	3.3%	11.3%	4.0%	4.7%	70.3
2004	32.5%	27.1%	16.3%	3.5%	11.7%	3.8%	5.1%	70.4
2005	33.3%	26.7%	15.7%	3.4%	11.7%	3.9%	5.3%	69.6
2006	33.5%	26.8%	15.3%	3.3%	11.6%	4.1%	5.5%	71.0
2007	32.7%	27.6%	15.1%	3.3%	11.7%	3.4%	6.0%	71.7

Source: EIA

Note: Annual totals may not equal 100% due to rounding

U.S. Energy Consumption by Energy Source (%) 2000-2007

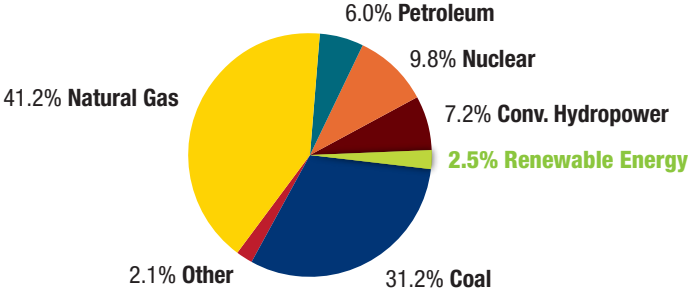
	Coal	Natural Gas	Petroleum	Nuclear	Hydropower	Non-Hydro Renewables	Total Consumption (Quadrillion Btu)
2000	22.8%	24.1%	38.7%	7.9%	2.8%	3.5%	99.0
2001	22.8%	23.6%	39.6%	8.3%	2.3%	3.2%	96.3
2002	22.4%	24.1%	39.1%	8.3%	2.7%	3.3%	97.9
2003	22.7%	23.3%	39.5%	8.1%	2.9%	3.4%	98.2
2004	22.4%	22.9%	40.2%	8.2%	2.7%	3.6%	100.4
2005	22.6%	22.7%	40.1%	8.1%	2.7%	3.7%	100.5
2006	22.5%	22.5%	39.8%	8.2%	2.9%	4.1%	99.9
2007	22.4%	23.3%	39.2%	8.3%	2.4%	4.2%	101.6

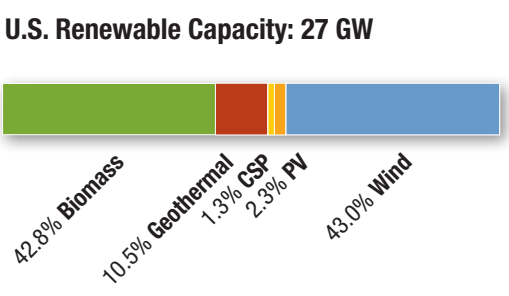
Source: EIA

U.S. Nameplate Capacity & Generation

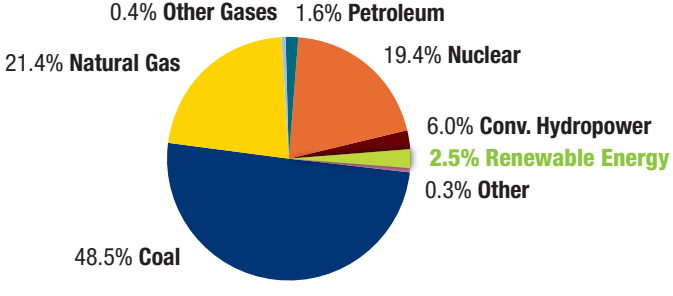
I

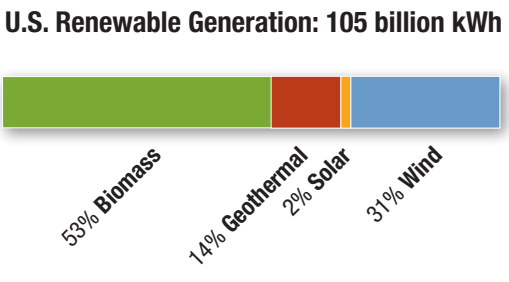
U.S. Electric Nameplate Capacity (2006): 1,076 GW





U.S. Electric Net Generation (2007): 4,161 billion kWh





Other includes: pumped storage, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels and miscellaneous technologies

U.S. Electric Generating Capacity by Source (%) 2000-2007

I

	Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Hydro	Renew-ables	Hydro Pumped Storage	Other	Total Capacity (GW)
2000	38.8%	7.9%	28.0%	0.3%	12.1%	8.9%	1.9%	2.2%	0.1%	867
2001	36.8%	8.0%	30.9%	0.2%	11.5%	8.4%	2.0%	2.1%	0.1%	914
2002	34.5%	6.8%	35.9%	0.2%	10.7%	7.9%	1.9%	2.0%	0.1%	980
2003	32.5%	6.5%	39.1%	0.2%	10.2%	7.5%	2.0%	1.9%	0.1%	1,032
2004	31.9%	6.2%	40.2%	0.2%	10.1%	7.3%	2.0%	1.9%	0.1%	1,050
2005	31.5%	6.1%	40.9%	0.2%	9.9%	7.2%	2.2%	1.8%	0.1%	1,068
2006	31.2%	6.0%	41.2%	0.2%	9.8%	7.2%	2.5%	1.8%	0.1%	1,076
2007*	30.9%	5.9%	41.4%	0.2%	9.7%	7.1%	3.0%	1.8%	0.1%	1,094

* Projected

Sources: EIA, IEA, AWEA, GEA

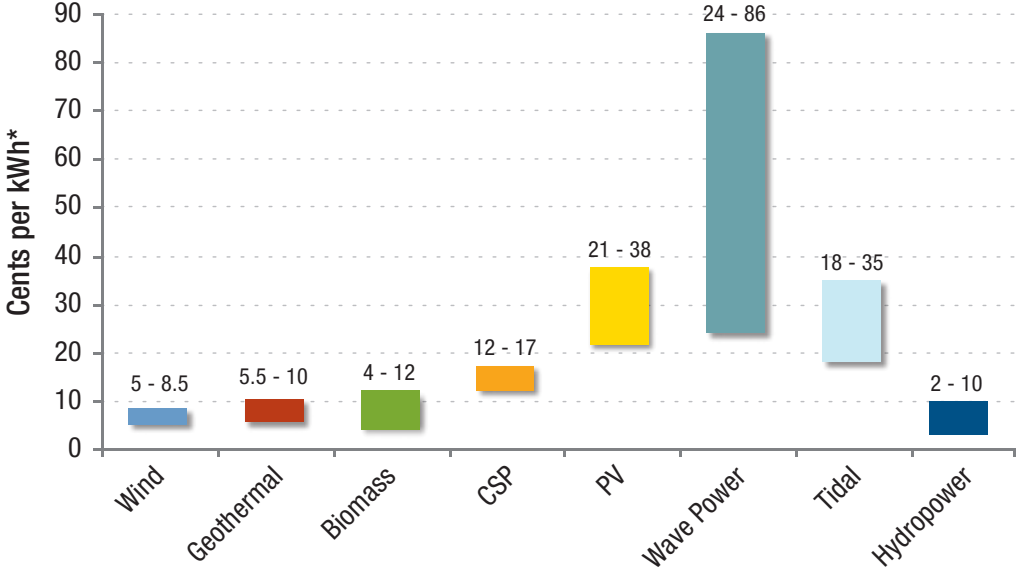
U.S. Electricity Generation by Source (%) 2000-2007

	Coal	Petroleum Liquids	Petroleum Coke	Natural Gas	Other Gases	Nuclear	Hydro	Renew-ables	Hydro Pumped Storage	Other	Total Generation (million kWh)
2000	51.7%	2.7%	0.2%	15.8%	0.4%	19.8%	7.2%	2.1%	-0.1%	0.1%	3,802,607
2001	50.9%	3.1%	0.3%	17.1%	0.2%	20.6%	5.8%	1.9%	-0.2%	0.3%	3,737,140
2002	50.1%	2.0%	0.4%	17.9%	0.3%	20.2%	6.8%	2.1%	-0.2%	0.4%	3,859,008
2003	50.8%	2.6%	0.4%	16.7%	0.4%	19.7%	7.1%	2.1%	-0.2%	0.4%	3,883,862
2004	49.8%	2.5%	0.5%	17.8%	0.4%	19.9%	6.8%	2.1%	-0.2%	0.4%	3,971,331
2005	49.6%	2.5%	0.6%	18.7%	0.4%	19.3%	6.7%	2.2%	-0.2%	0.3%	4,056,403
2006	49.0%	1.1%	0.5%	20.0%	0.4%	19.4%	7.1%	2.4%	-0.2%	0.3%	4,065,954
2007	48.7%	1.2%	0.4%	21.3%	0.4%	19.4%	6.1%	2.5%	-0.2%	0.3%	4,159,873

Sources: EIA, IEA, AWEA, GEA

Note: Electricity generation from hydro pumped storage is negative because more electricity is consumed than generated by these plants.

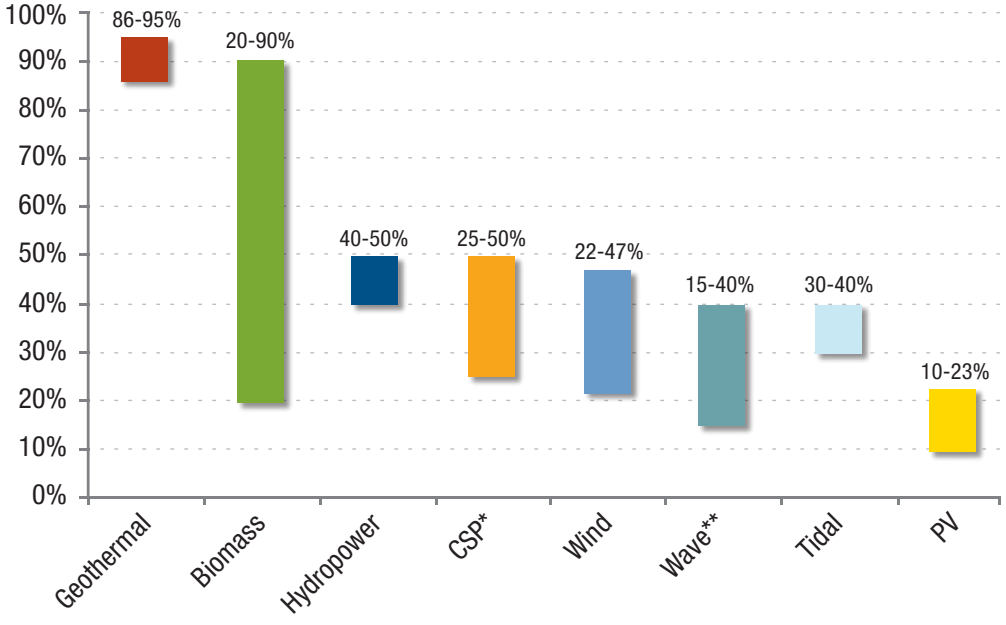
Price Range of Renewable Electricity by Technology (2007)



* Average cost will vary according to financing used and the quality of the renewable energy resource available.

Sources: Sandia National Laboratory, Idaho National Lab, Carbon Trust, Simmons Energy Monthly, U.S. DOE EERE, California Energy Commission, IEA, SolarBuzz LLC

Capacity Factor for Renewable Resources (2007)



* CSP reaches the upper part of this range when systems are combined with natural gas co-firing

** This range is derived from experimental wave installations

Sources: EERE, GEA, NREL, Idaho National Lab, EPRI, Ocean Power Delivery LTD, Simmons Energy Monthly

II. Renewable Electricity in the U.S.

- Since 2000, renewable electricity installations in the U.S. (excluding hydropower) have nearly doubled, and in 2007 represent **33 GW of installed capacity**.

- Renewable electricity (excluding hydropower) has grown at a compounded annual average of **10% per year from 2000-2007**.

- Although it is a growing part of U.S. energy supply, renewable electricity (excluding hydropower) in 2007 still represents a small percentage of overall installed electricity capacity (3%) and generation (2.5%) in the U.S.

- Wind and solar PV are the fastest growing renewable energy sectors. **In 2007, wind capacity installations grew 45% and solar PV grew 40% from the previous year.**

Renewable Electricity in the U.S.: Summary, *continued*

II

- In 2007, biomass produced just over 50% of total renewable electricity generation (excluding hydropower).

- Wind energy accounted for about 50% of total installed renewable electricity capacity in 2007 (excluding hydropower).

- Electricity generation from biomass, geothermal, and hydropower have remained relatively stable since 2000.

Capacity and Generation: All Renewables *(including hydropower)*

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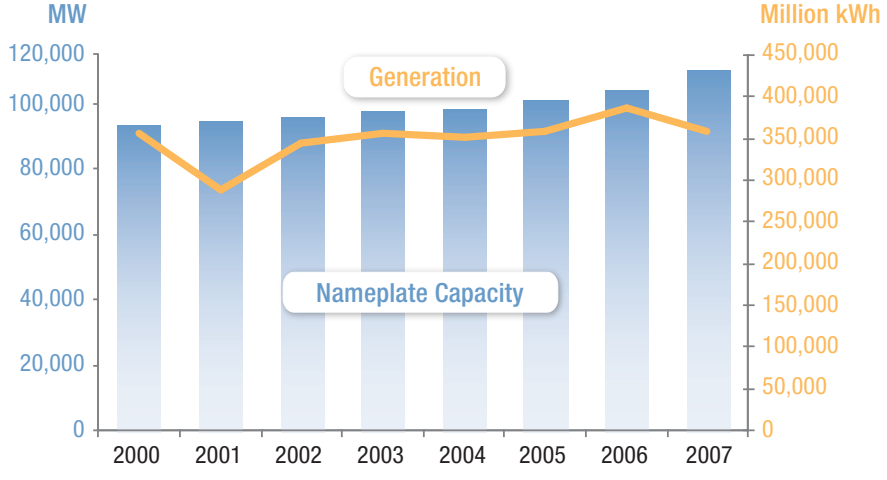

	Total Nameplate Capacity (MW)	Total Generation (Million kWh)
2000	93,486	356,980
2001	95,677	288,227
2002	95,959	343,993
2003	97,651	355,968
2004	98,412	351,797
2005	101,358	358,515
2006	104,358	386,922
2007	110,218	359,303

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

Capacity and Generation: Renewables *(excluding hydropower)*

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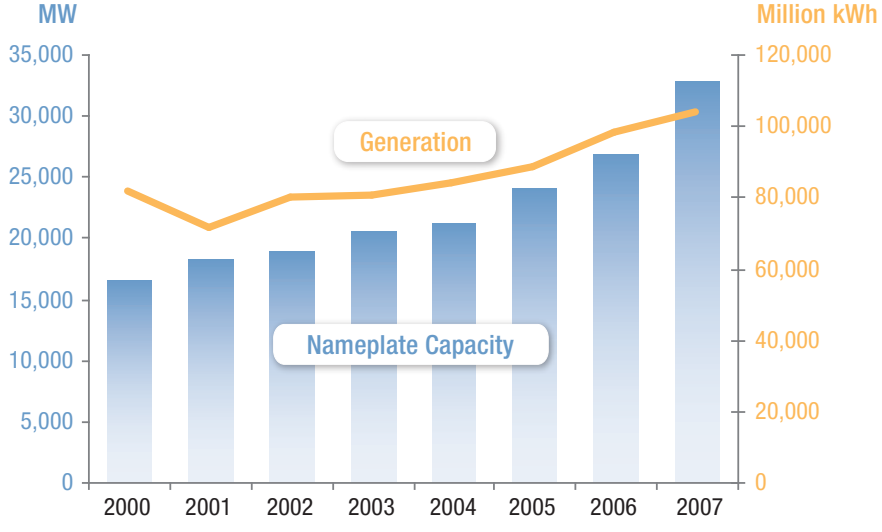
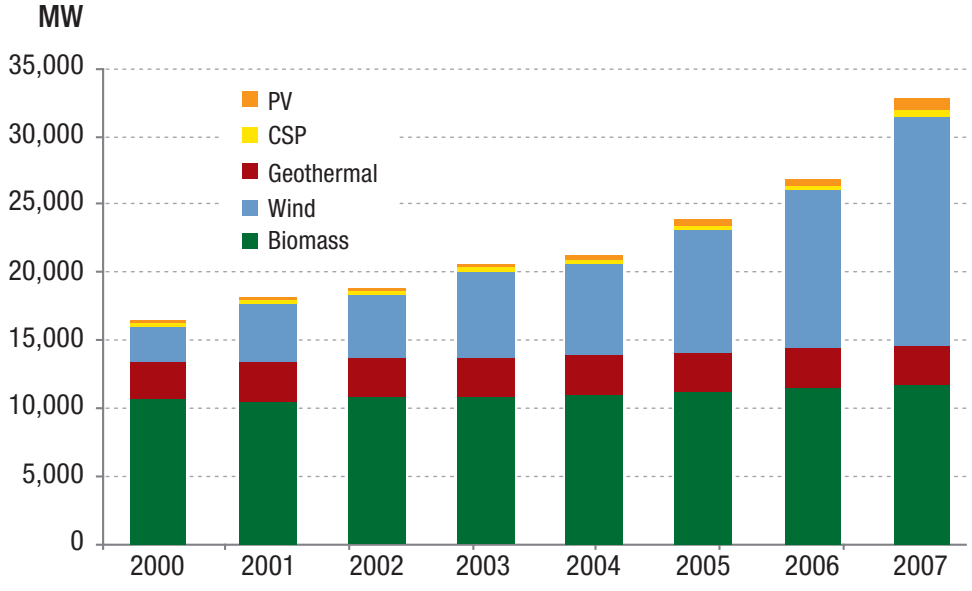


	Total Nameplate Capacity (MW)	Total Generation (Million kWh)
2000	16,545	81,407
2001	18,171	71,266
2002	18,917	79,664
2003	20,636	80,162
2004	21,276	83,380
2005	24,004	88,194
2006	26,939	97,676
2007	32,786	103,348

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

Renewable Electricity Generating Capacity by Source *(excluding hydropower)*

II



Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

Renewable Electricity Nameplate Capacity Added (MW) and Percent Annual Change from Previous Year

II

	Solar PV	CSP	Wind	Geothermal	Biomass	Advanced Water Power	Total Capacity Added (w/o Hydropower)	% Annual Change in Growth from Previous
2000	22	0	66	59	(323)	0	**(176)**	**- 128%**
2001	29	0	1,697	0	(100)	0	**1,626**	**+ 1,024%**
2002	44	0	411	0	291	0	**746**	**- 54%**
2003	63	0	1,667	0	(11)	0	**1,719**	**+ 130%**
2004	90	0	372	0	177	0	**640**	**- 63%**
2005	114	0	2,396	30	188	0	**2,761**	**+ 327%**
2006	145	1	2,454	2	332	0	**2,935**	**+ 7%**
2007	250	64	5,244	106	184	0	**5,848**	**+ 102%**

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

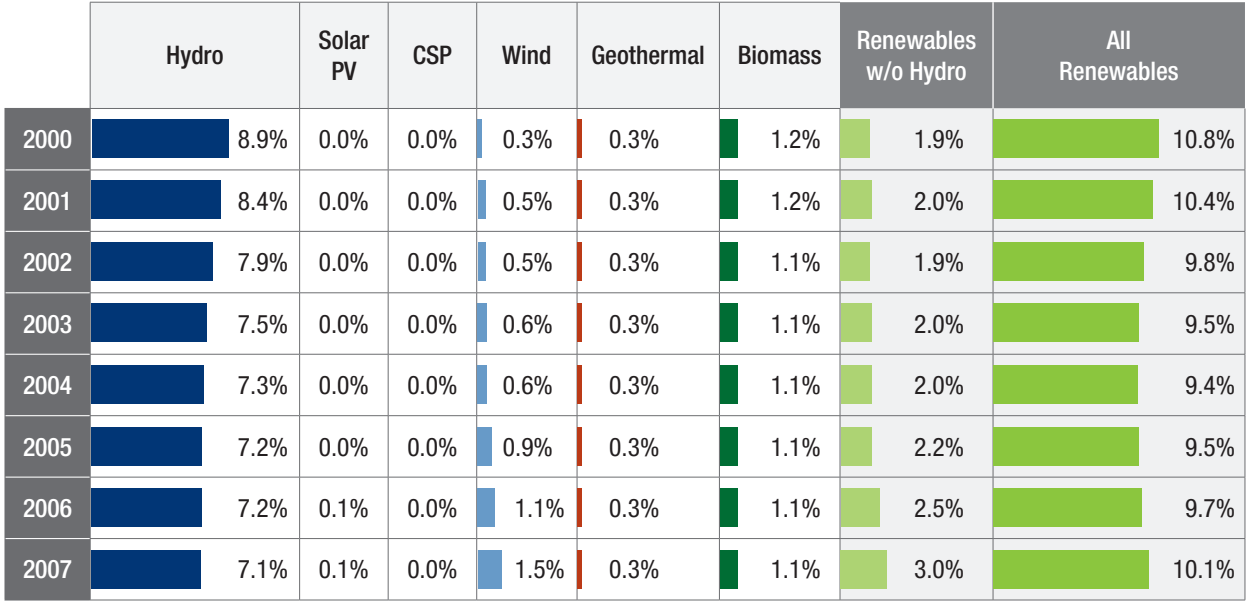
Renewable Electricity Nameplate Capacity (MW) and Percent Cumulative Increase from Previous Year

	Hydro	Solar PV	CSP	Wind	Geothermal	Biomass	Advanced Water Power	Total (without Hydropower)	Total U.S.
2000	**76,946** 0%	**139** 18.8%	**354** 0%	**2,578** 2.6%	**2,798** 2.2%	**10,676** 2.6%	**0** 0%	**16,545** -1.1%	**93,491** -0.3%
2001	**76,911** 0%	**168** 20.9%	**354** 0%	**4,275** 65.8%	**2,798** 0%	**10,576** 0.9%	**0** 0%	**18,171** 9.8%	**95,082** 1.7%
2002	**77,047** 0.2%	**212** 26.5%	**354** 0%	**4,686** 9.6%	**2,798** 0%	**10,867** 2.8%	**0** 0%	**18,917** 4.1%	**95,964** 0.9%
2003	**77,020** 0%	**275** 29.7%	**354** 0%	**6,353** 35.6%	**2,798** 0%	**10,856** 0.1%	**0** 0%	**20,636** 9.1%	**97,656** 1.8%
2004	**77,130** 0.1%	**365** 32.7%	**354** 0%	**6,725** 5.9%	**2,798** 0%	**11,034** 1.6%	**0** 0%	**21,276** 3.1%	**98,406** 0.8%
2005	**77,354** 0.3%	**479** 31.2%	**354** 0%	**9,121** 35.6%	**2,828** 1.1%	**11,222** 1.7%	**0** 0%	**24,004** 12.8%	**101,358** 3.0%
2006	**77,419** 0.1%	**624** 30.3%	**355** 0.3%	**11,575** 26.9%	**2,831** 0.1%	**11,554** 3.0%	**0** 0%	**26,939** 12.2%	**104,358** 3.0%
2007	**77,432** 0%	**874** 40.1%	**419** 18%	**16,818** 45.3%	**2,937** 3.7%	**11,738** 1.6%	**0** 0%	**32,786** 21.7%	**110,218** 5.6%

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

Renewable Electricity Nameplate Capacity as a % of Total Electricity Generating Capacity

II



	Hydro	Solar PV	CSP	Wind	Geothermal	Biomass	Renewables w/o Hydro	All Renewables
2000	8.9%	0.0%	0.0%	0.3%	0.3%	1.2%	1.9%	10.8%
2001	8.4%	0.0%	0.0%	0.5%	0.3%	1.2%	2.0%	10.4%
2002	7.9%	0.0%	0.0%	0.5%	0.3%	1.1%	1.9%	9.8%
2003	7.5%	0.0%	0.0%	0.6%	0.3%	1.1%	2.0%	9.5%
2004	7.3%	0.0%	0.0%	0.6%	0.3%	1.1%	2.0%	9.4%
2005	7.2%	0.0%	0.0%	0.9%	0.3%	1.1%	2.2%	9.5%
2006	7.2%	0.1%	0.0%	1.1%	0.3%	1.1%	2.5%	9.7%
2007	7.1%	0.1%	0.0%	1.5%	0.3%	1.1%	3.0%	10.1%

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

Annual Renewable Electric Capacity Growth *(excluding hydropower)*

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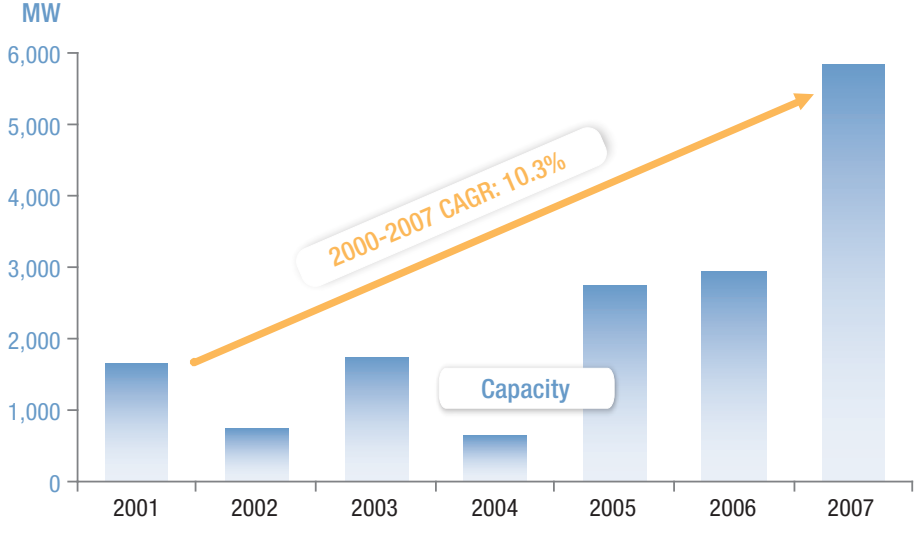
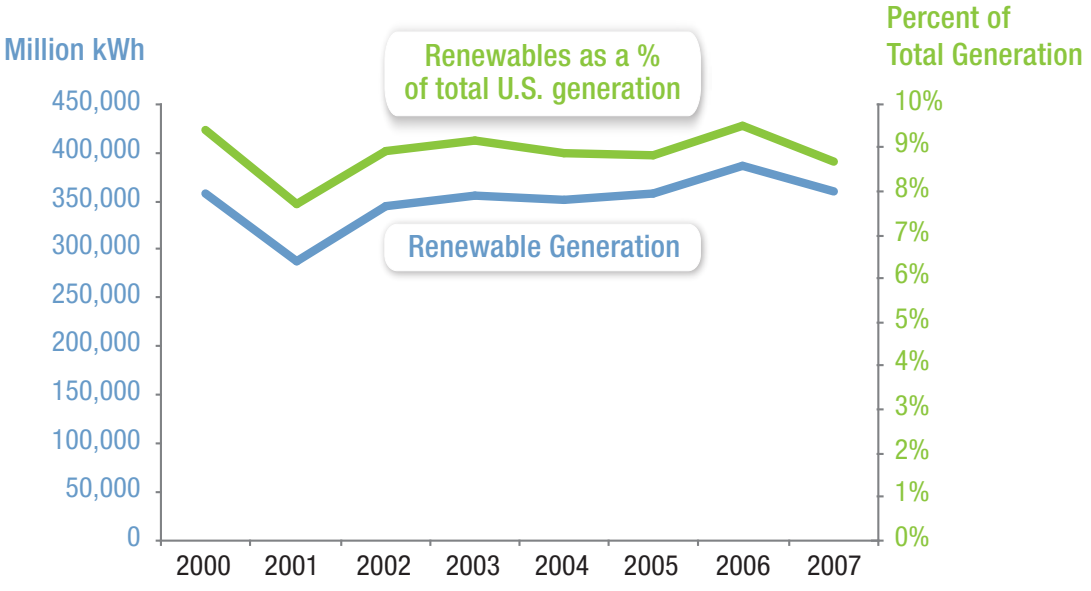


	Compounded Annual Growth Rate (CAGR) (2000-2007)
Wind	30.7%
Solar PV	29.5%
CSP	2.4%
Biomass	1.4%
Geothermal	0.7%

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

U.S. Renewable Electricity Generation *(including hydropower)*

II



Source: EIA

U.S. Renewable Electricity Generation *(excluding hydropower)*

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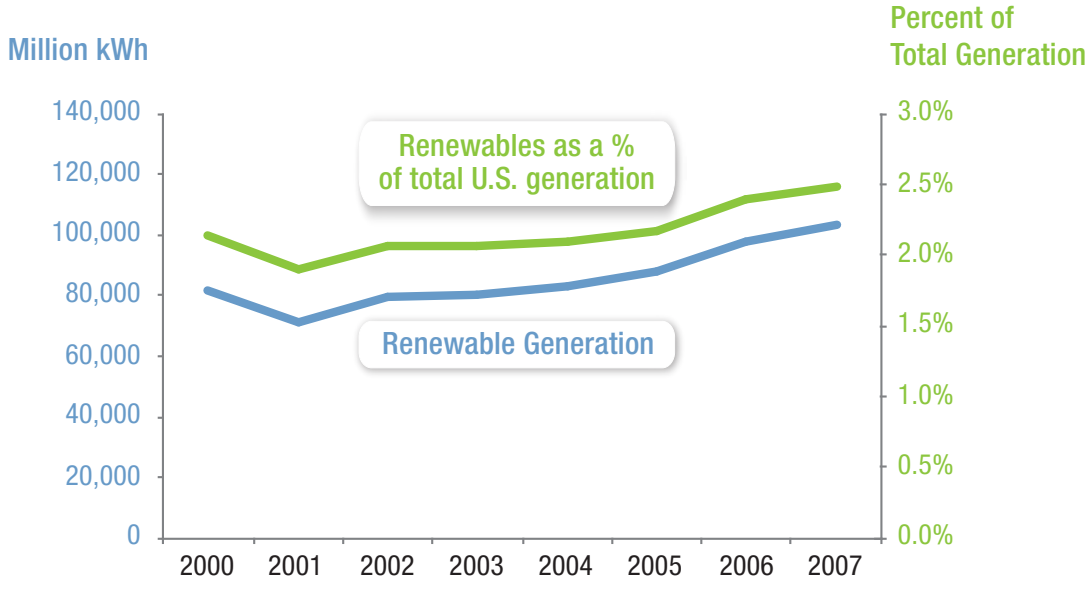

Source: EIA

Note: The generation decrease between 2000 to 2001 in part reflects an EIA classification change. Beginning with 2001 data, non-biogenic Municipal Solid Waste and tire-derived fuels were reclassified as non-renewable energy sources (previously considered waste biopower).

U.S. Renewable Generation by Technology *(excluding hydropower)*

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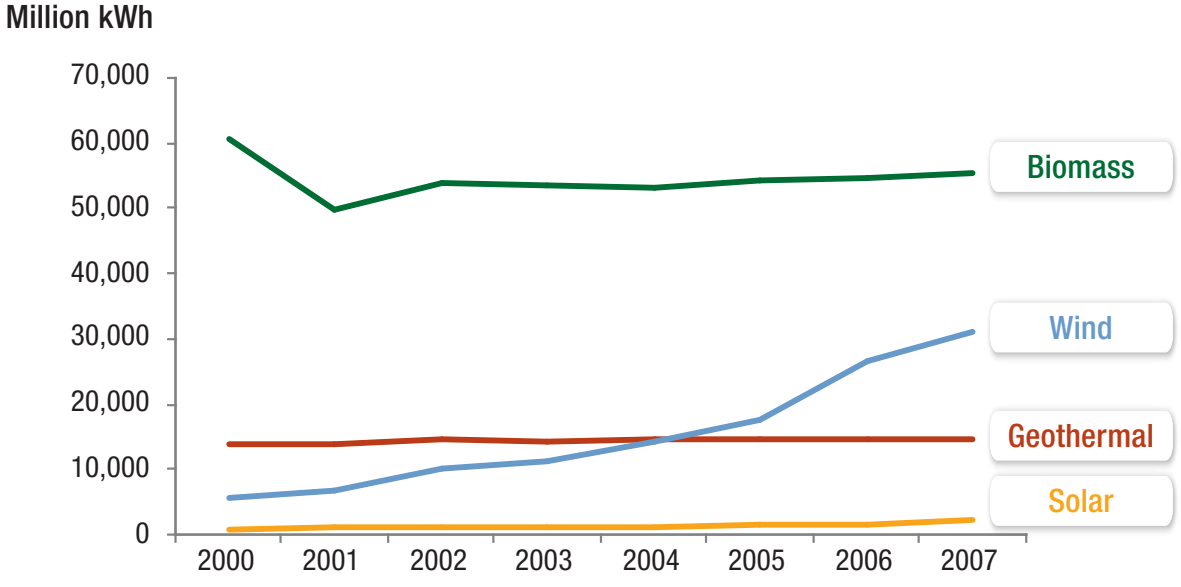
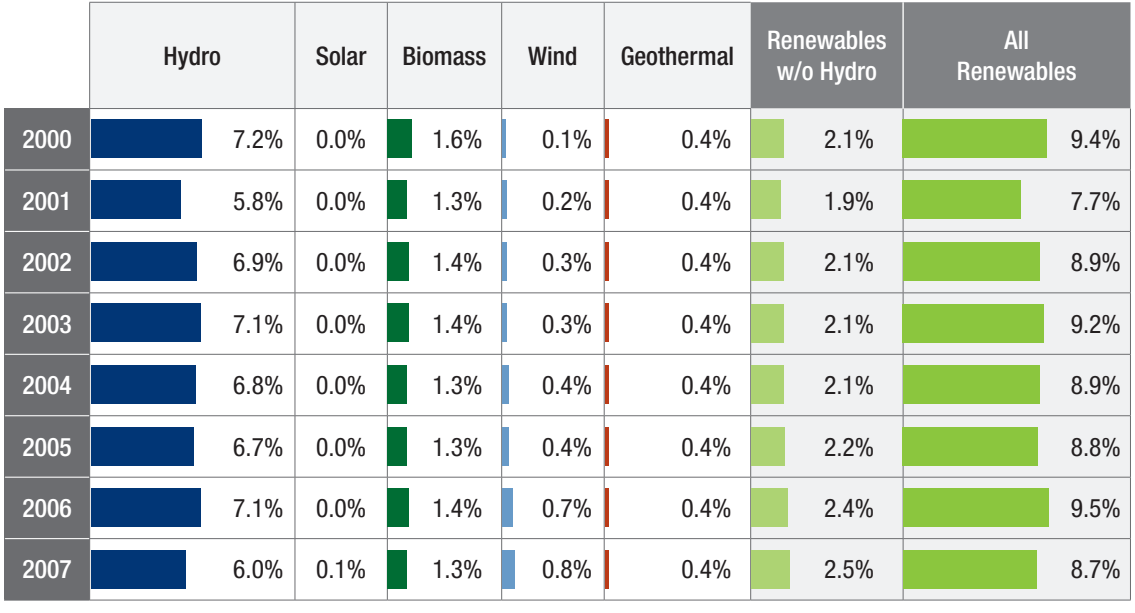


Source: EIA

Renewable Electricity as a Percent of Total Generation



	Hydro	Solar	Biomass	Wind	Geothermal	Renewables w/o Hydro	All Renewables
2000	7.2%	0.0%	1.6%	0.1%	0.4%	2.1%	9.4%
2001	5.8%	0.0%	1.3%	0.2%	0.4%	1.9%	7.7%
2002	6.9%	0.0%	1.4%	0.3%	0.4%	2.1%	8.9%
2003	7.1%	0.0%	1.4%	0.3%	0.4%	2.1%	9.2%
2004	6.8%	0.0%	1.3%	0.4%	0.4%	2.1%	8.9%
2005	6.7%	0.0%	1.3%	0.4%	0.4%	2.2%	8.8%
2006	7.1%	0.0%	1.4%	0.7%	0.4%	2.4%	9.5%
2007	6.0%	0.1%	1.3%	0.8%	0.4%	2.5%	8.7%

Source: EIA

Renewable Electricity Generation (Million kWh) and % Cumulative Increase from Previous Year

II

	Hydropower	Solar	Wind	Geothermal	Biomass	All Renewables	Renewables without Hydropower
2000	**275,570** -13.8%	**1,020** 8.3%	**5,600** 24.6%	**14,870** -5.0%	**60,730** 1.9%	**357,000** -10.6%	**81,430** 2.0%
2001	**216,960** -21.3%	**1,070** 5.2%	**6,740** 20.5%	**13,740** -2.5%	**49,750** -18.1%	**288,260** 19.3%	**71,300** -12.4%
2002	**264,330** 21.8%	**1,150** 7.2%	**10,350** 53.7%	**14,490** 5.5%	**53,710** 8.0%	**344,030** 19.3%	**79,700** 11.8%
2003	**275,810** 4.3%	**1,260** 9.6%	**11,190** 8.0%	**14,420** -0.5%	**53,340** -0.7%	**356,020** 3.5%	**80,210** 0.6%
2004	**268,420** -2.7%	**1,420** 12.6%	**14,140** 26.4%	**14,810** 2.7%	**53,070** -0.5%	**351,860** -1.2%	**83,440** 4.0%
2005	**270,320** 0.7%	**1,610** 14.1%	**17,810** 25.9%	**14,690** -0.8%	**54,160** 2.0%	**358,600** 1.9%	**88,280** 5.8%
2006	**289,250** 7.0%	**1,870** 15.9%	**26,590** 49.3%	**14,570** -0.8%	**54,760** 1.1%	**387,030** 7.9%	**97,780** 10.8%
2007	**260,720** -9.9%	**2,450** 30.9%	**32,140** 20.1%	**14,840** 1.8%	**55,400** 1.1%	**364,220** -5.9%	**104,830** 7.2%

Sources: EIA, AWEA, IEA PVPS, Navigant, SEIA, GEA

State Renewable Energy Information: Summary

- California has the most diverse mix of renewable energy of any state in the U.S., and the most renewable electricity (excluding hydropower) of any U.S. state.

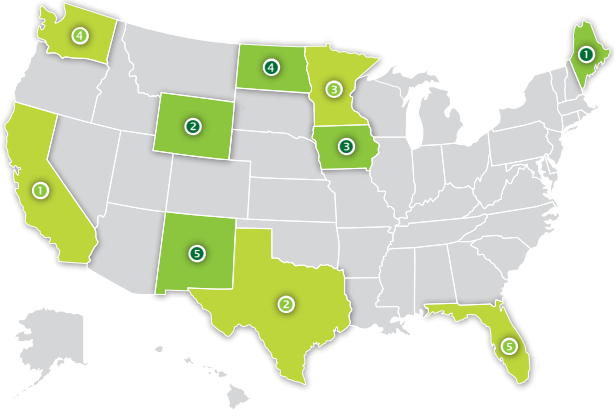
- Washington is the leader in installed renewable energy capacity when including hydropower.

- Texas has become the national leader in wind power development, and in 2006 had over four times as much wind installed as the rest of the Southern states combined.

- A combination of state incentives and renewable portfolio standards for renewable energy and renewable resource development has driven renewable growth in some states.

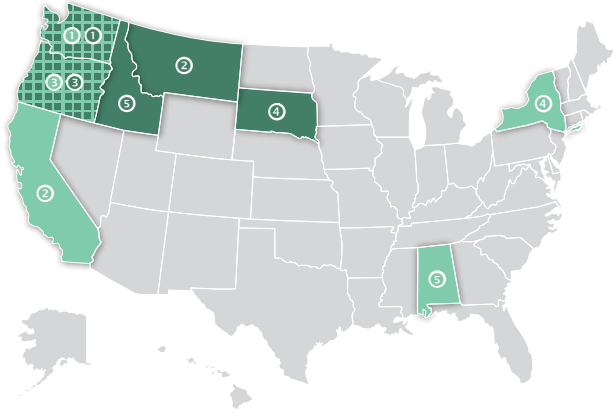
Top States Renewable Electricity Installed Nameplate Capacity (2006)

II



Total Renewables *(excluding hydropower)*
1 California
2 Texas
3 Minnesota
4 Washington
5 Florida

Per Capita Renewables *(excluding hydropower)*
1 Maine
2 Wyoming
3 Iowa
4 North Dakota
5 New Mexico

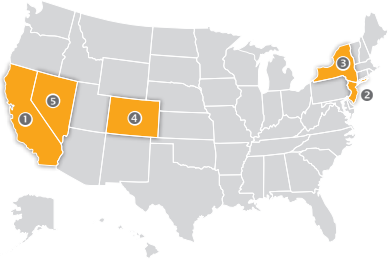


Total Renewables *(including hydropower)*
1 Washington
2 California
3 Oregon
4 New York
5 Alabama

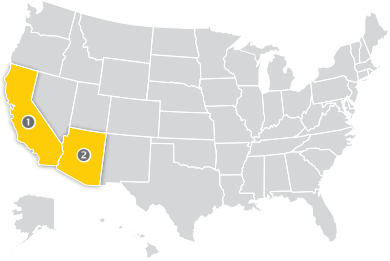
Per Capita Renewables *(including hydropower)*
1 Washington
2 Montana
3 Oregon
4 South Dakota
5 Idaho

Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

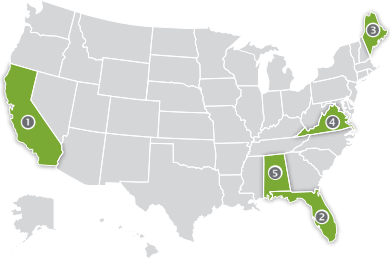
Top States Renewable Electricity Installed Nameplate Capacity (2006)



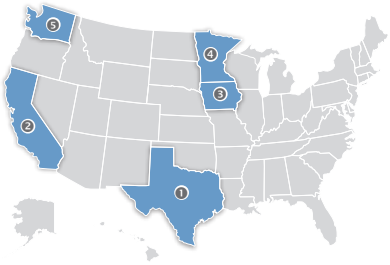
Solar PV
1 California
2 New Jersey
3 New York
4 Colorado
5 Nevada



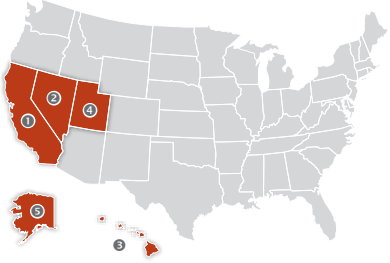
CSP
1 California
2 Arizona



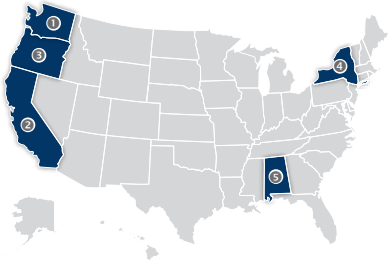
Biomass
1 California
2 Florida
3 Maine
4 Virginia
5 Alabama



Wind
1 Texas
2 California
3 Iowa
4 Minnesota
5 Washington



Geothermal
1 California
2 Nevada
3 Hawaii
4 Utah
5 Alaska



Hydropower
1 Washington
2 California
3 Oregon
4 New York
5 Alabama

II

Renewables 2006 Installed Nameplate Capacity (MW)
NORTHEAST

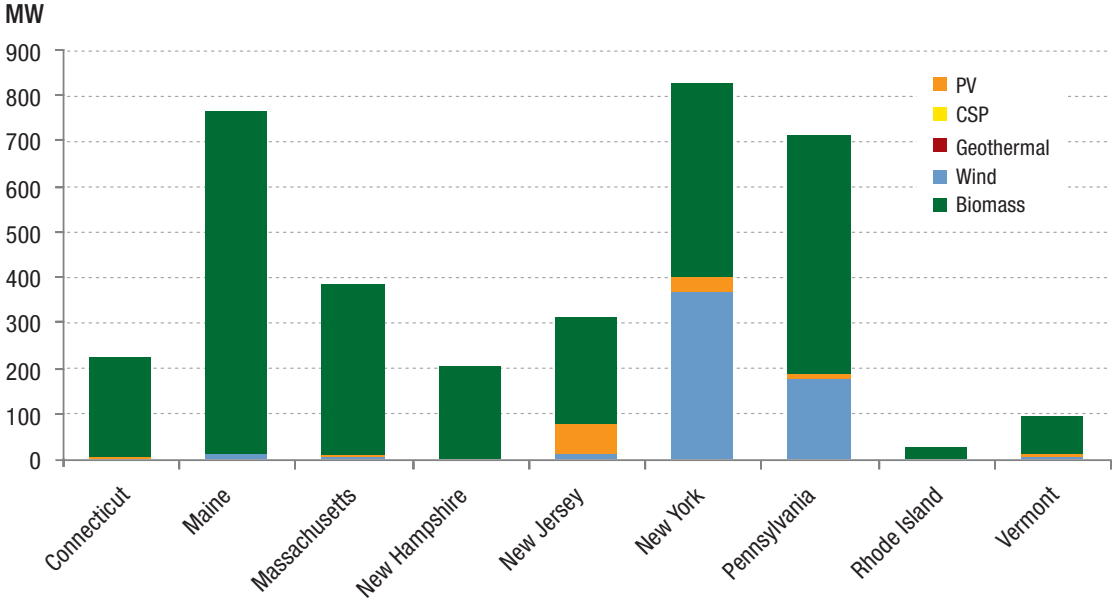
II

	Wind	PV*	CSP	Geothermal	Biomass	Hydropower	Total Renewables	Per capita RE (excl hydro) watts/person
New York	370	32	0	0	423	4,648	5,473	43
Pennsylvania	179	9	0	0	525	775	1,488	57
Maine	9	2	0	0	755	719	1,485	579
Massachusetts	4	7	0	0	372	268	651	59
New Hampshire	1	1	0	0	203	445	651	156
Vermont	6	2	0	0	85	299	392	149
Connecticut	0	3	0	0	222	143	367	64
New Jersey	8	69	0	0	235	13	325	36
Rhode Island	1	1	0	0	26	4	32	26

Sources: EIA, Navigant, AWEA, GEA, NREL, EERE
*2007 Nameplate Capacity

Renewables 2006 Installed Nameplate Capacity *(excluding hydropower)* **NORTHEAST**

II



Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

Renewables 2006 Installed Nameplate Capacity (MW)
MIDWEST

II

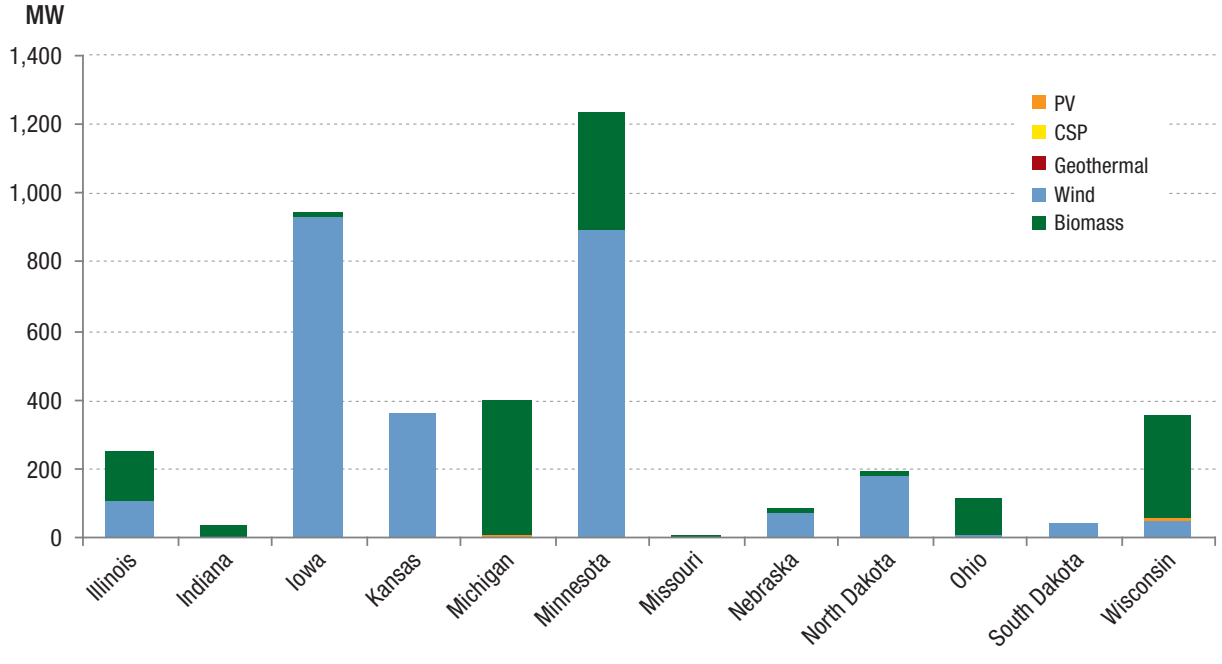
	Wind	PV*	CSP	Geothermal	Biomass	Hydropower	Total Renewables	Per capita RE (excl hydro) watts/person
South Dakota	44	1	0	0	0	1,598	**1,643**	**57**
Minnesota	895	1	0	0	343	186	**1,425**	**240**
Iowa	931	1	0	0	15	131	**1,078**	**317**
Wisconsin	53	6	0	0	293	506	**858**	**63**
North Dakota	178	1	0	0	10	614	**803**	**297**
Michigan	3	1	0	0	392	383	**779**	**39**
Missouri	0	1	0	0	3	499	**503**	**1**
Nebraska	73	1	0	0	10	327	**411**	**48**
Kansas	364	1	0	0	0	3	**368**	**132**
Illinois	107	1	0	0	143	38	**289**	**20**
Ohio	7	2	0	0	102	128	**240**	**10**
Indiana	0	1	0	0	34	92	**127**	**6**

Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

*2007 Nameplate Capacity

Renewables 2006 Installed Nameplate Capacity *(excluding hydropower)* **MIDWEST**

II



Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

Renewables 2006 Installed Nameplate Capacity (MW)
SOUTH

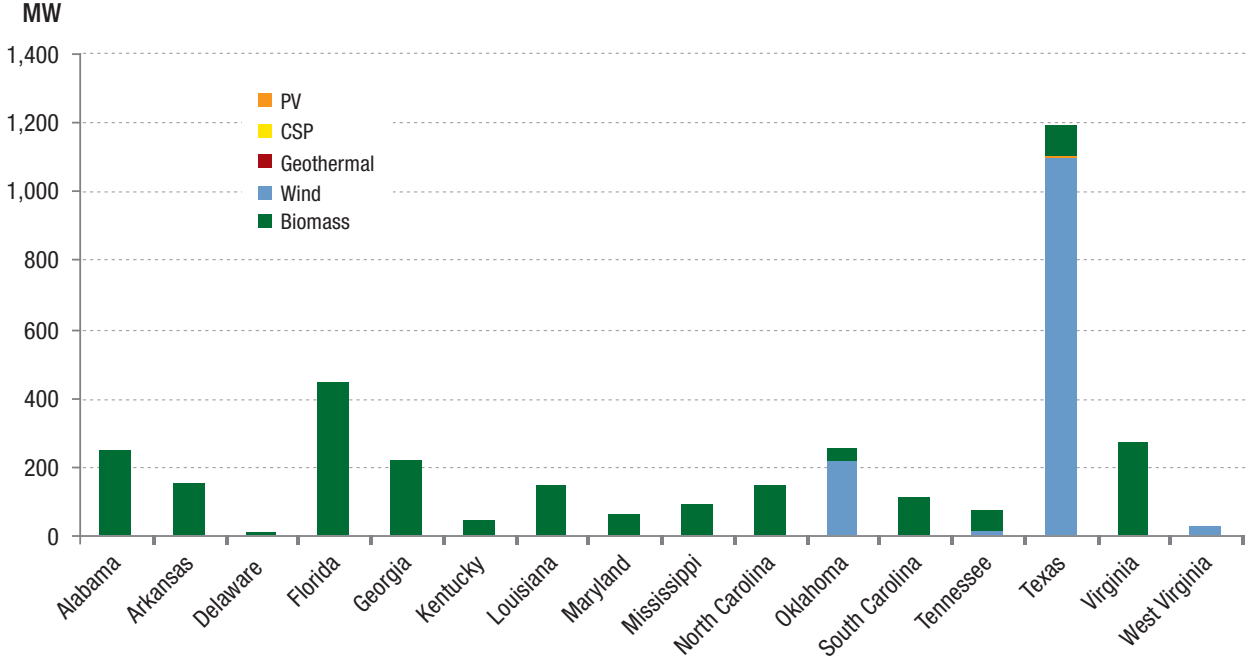
II

	Wind	PV*	CSP	Geothermal	Biomass	Hydropower	Total Renewables	Per capita RE (excl hydro) watts/person
Alabama	0	1	0	0	607	3,280	3,888	132
Texas	2,739	6	0	0	233	673	3,652	127
Tennessee	29	1	0	0	156	2,418	2,604	31
Georgia	0	1	0	0	540	1,932	2,473	58
North Carolina	0	3	0	0	363	1,828	2,194	41
Arkansas	0	1	0	0	375	1,309	1,685	134
South Carolina	0	2	0	0	267	1,353	1,622	62
Virginia	0	1	0	0	679	740	1,419	89
Oklahoma	535	1	0	0	90	778	1,403	175
Florida	0	1	0	0	1,100	56	1,157	61
Kentucky	0	1	0	0	105	777	883	25
Maryland	0	2	0	0	147	494	643	26
Louisiana	0	1	0	0	359	192	552	84
Mississippi	0	1	0	0	223	0	224	77
West Virginia	66	1	0	0	0	325	392	37
Delaware	0	1	0	0	7	0	8	9

Sources: EIA, Navigant, AWEA, GEA, NREL, EERE / *2007 Nameplate Capacity

Renewables 2006 Installed Nameplate Capacity *(excluding hydropower)* **SOUTH**

II



Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

Renewables 2006 Installed Nameplate Capacity (MW)
WEST

II

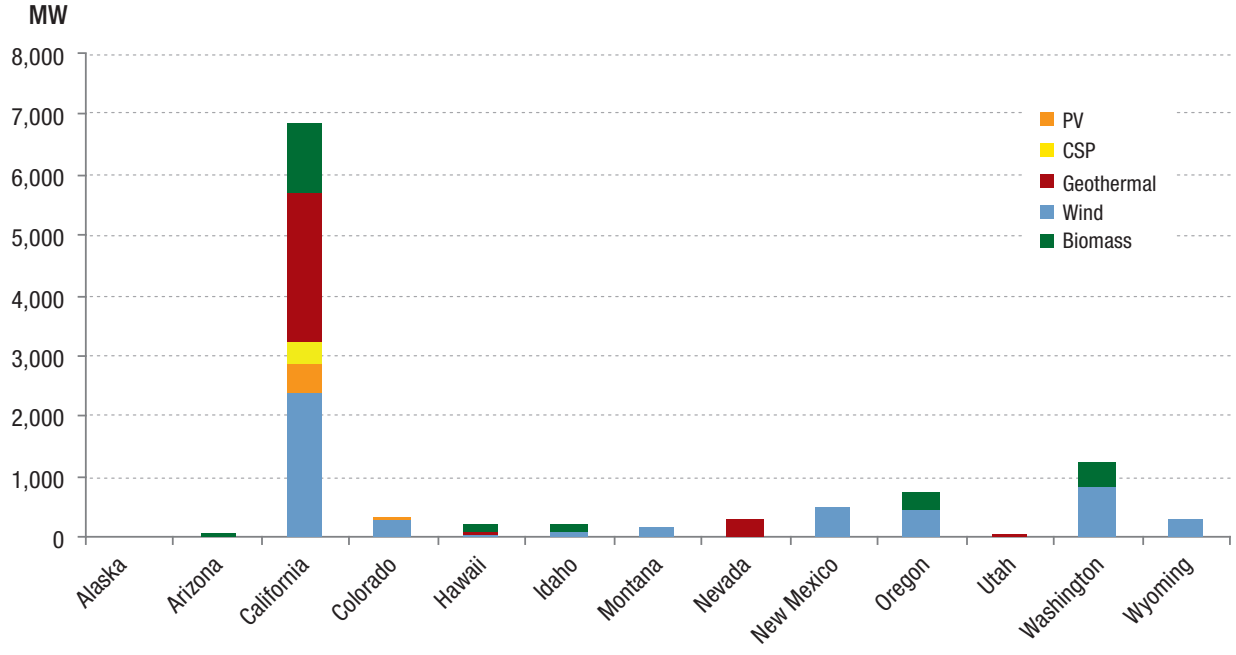
	Wind	PV*	CSP	Geothermal	Biomass	Hydropower	Total Renewables	Per capita RE (excl hydro) watts/person
Washington	818	6	0	0	388	20,677	**21,890**	**190**
California	2,376	499	354	2,492	1,150	9,987	**16,858**	**188**
Oregon	438	2	0	0	284	8,261	**8,985**	**196**
Arizona	0	14	1	0	8	2,718	**2,741**	**4**
Idaho	75	1	0	0	126	2,523	**2,726**	**138**
Montana	146	1	0	0	17	2,529	**2,693**	**174**
Nevada	0	15	0	276	0	1,047	**1,323**	**111**
Colorado	291	20	0	0	15	640	**966**	**69**
New Mexico	496	9	0	0	7	79	**590**	**262**
Wyoming	288	1	0	0	0	299	**588**	**562**
Alaska	2	1	0	0	0	397	**400**	**5**
Utah	1	1	0	26	5	262	**294**	**13**
Hawaii	42	6	0	35	114	25	**222**	**153**

Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

*2007 Nameplate Capacity

Renewables 2006 Installed Nameplate Capacity

II



Sources: EIA, Navigant, AWEA, GEA, NREL, EERE

III. Global Renewable Energy Development

Global Renewable Energy Development: Summary

- Global renewable electricity installations (excluding hydropower) have **more than doubled** from 2000-2006.

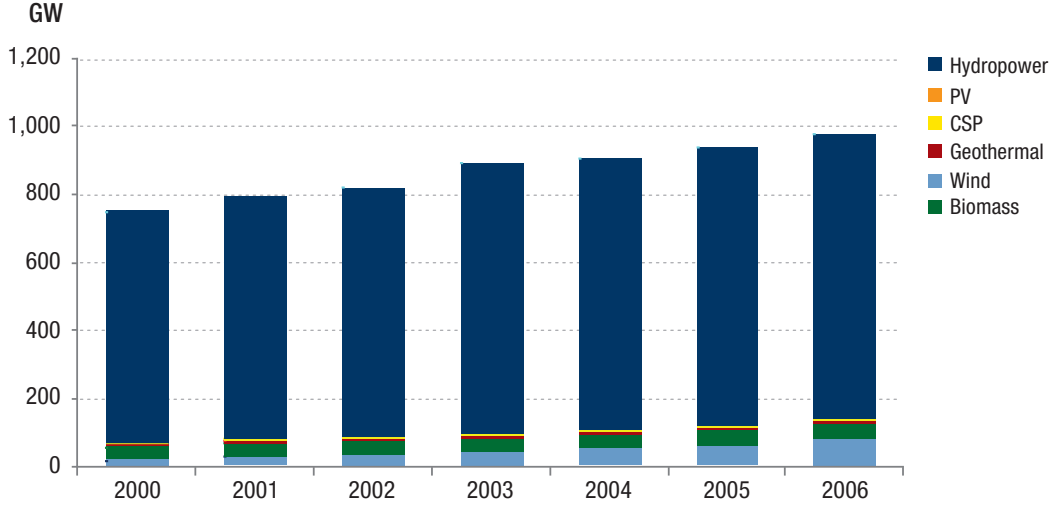
- Including hydropower, renewable energy accounts for **18%** of all global electricity generation; without hydropower renewable energy accounts for **2.5%** of global generation.

- Wind energy is the fastest growing renewable energy technology worldwide, and its generation **quadrupled** between 2000 and 2006.

- In 2006, Germany led the world in cumulative wind and solar PV installed capacity. The U.S. leads the world in geothermal, biomass and CSP installed capacity.

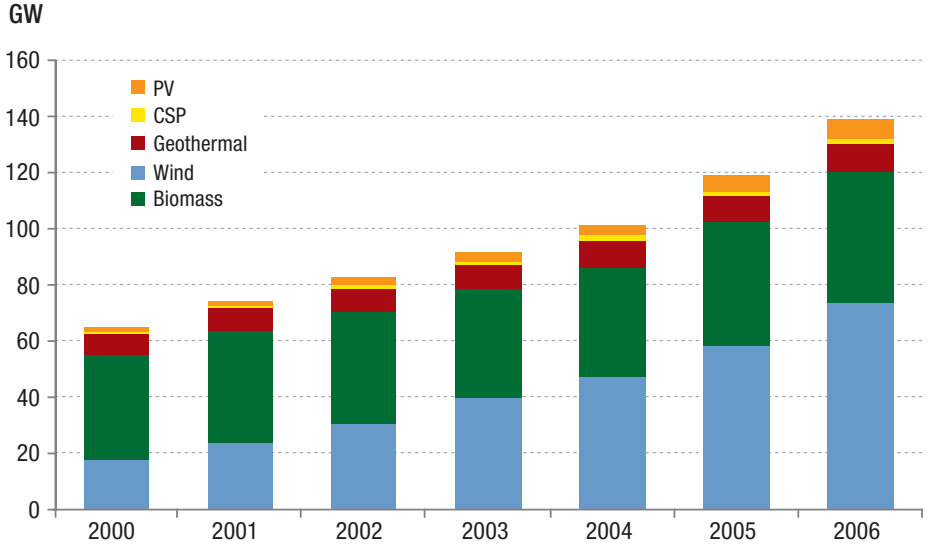
Renewable Electricity Capacity Worldwide
(including hydropower)

III



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt

Renewable Electricity Generating Capacity Worldwide *(excluding hydropower)*



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt

World Renewable Electricity Capacity
% Increase from the Previous Year

III

	Hydro	Solar PV	CSP	Wind	Geothermal	Biomass	Renewables without Hydro	All Renewables
2000	0%	22%	0%	31%	0%	6%	11%	1%
2001	5%	29%	0%	33%	0%	8%	15%	6%
2002	2%	33%	0%	29%	2%	0%	11%	3%
2003	9%	25%	0%	29%	9%	-3%	11%	9%
2004	1%	33%	0%	20%	0%	0%	10%	1%
2005	2%	28%	0%	23%	4%	13%	18%	4%
2006	2%	32%	0%	25%	3%	7%	17%	4%

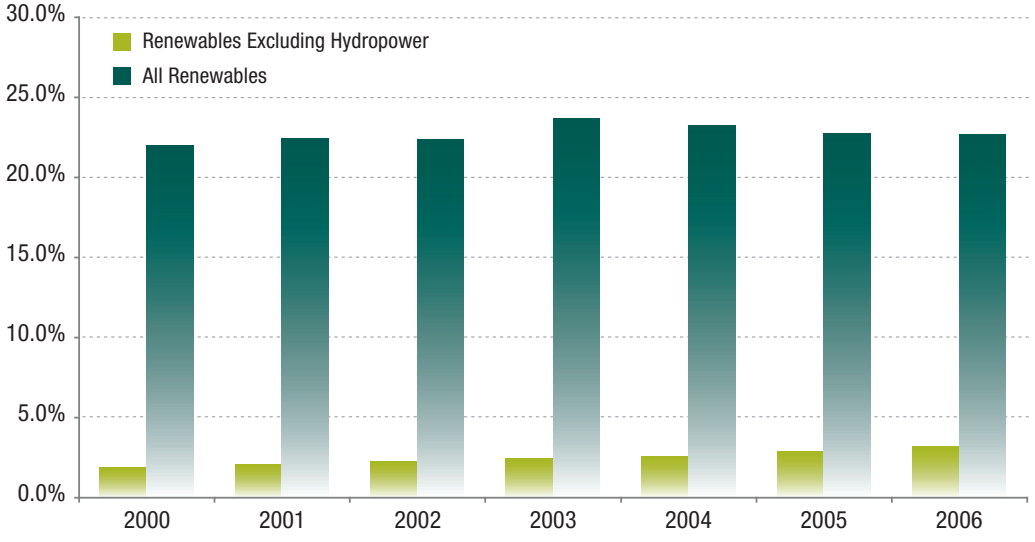
Renewables as a % of Total Installed Nameplate Capacity Worldwide

	Hydro	Solar PV	CSP	Wind	Geothermal	Biomass	All Renewables	Renewables without Hydropower	Renewable Capacity without Hydropower (GW)
2000	20.14%	0.04%	0.01%	0.53%	0.24%	1.09%	22.03%	1.89%	**65**
2001	20.36%	0.05%	0.01%	0.68%	0.23%	1.14%	22.44%	2.08%	**74**
2002	20.12%	0.07%	0.01%	0.85%	0.23%	1.10%	22.37%	2.25%	**82**
2003	21.26%	0.08%	0.01%	1.07%	0.24%	1.04%	23.70%	2.44%	**91**
2004	20.69%	0.10%	0.01%	1.24%	0.23%	1.01%	23.28%	2.59%	**100**
2005	19.90%	0.13%	0.01%	1.44%	0.23%	1.07%	22.79%	2.88%	**118**
2006	19.44%	0.17%	0.01%	1.72%	0.22%	1.09%	22.66%	3.21%	**138**

Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt

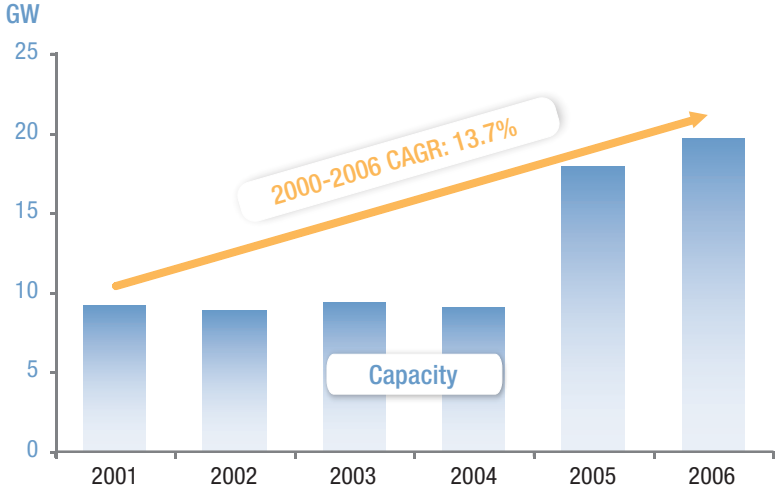
Renewables Share of Total Electricity Capacity Worldwide

III



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt

Annual Renewable Electricity Growth Worldwide *(excluding hydropower)*

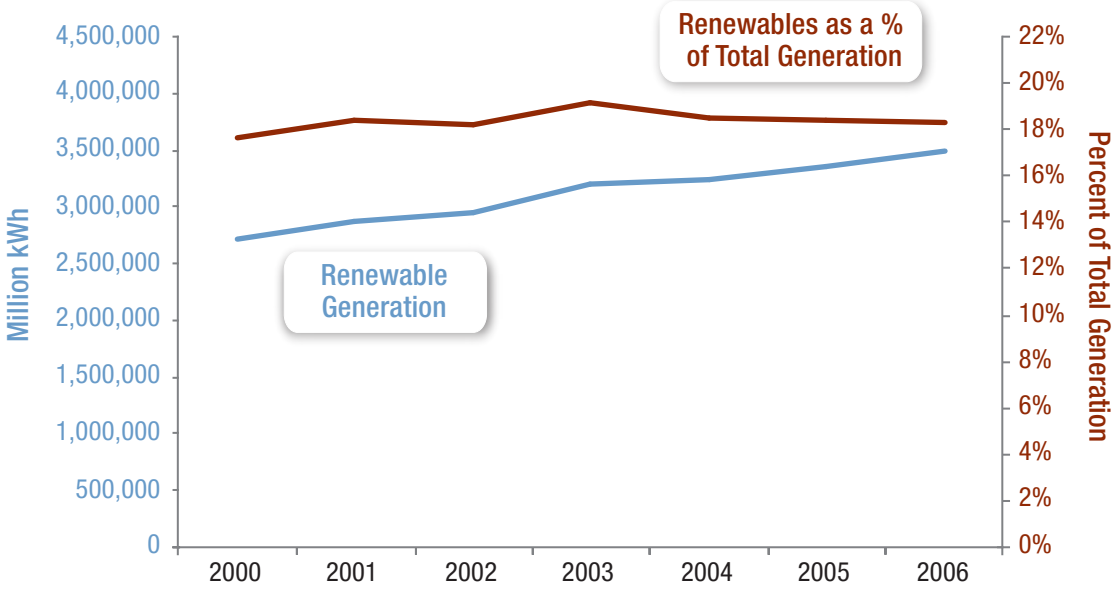


	Compounded Annual Growth Rate (CAGR) (2000-2006)
Wind	26.6%
Solar PV	31.5%
CSP	0%
Geothermal	3.1%
Biomass	4.1%

Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt

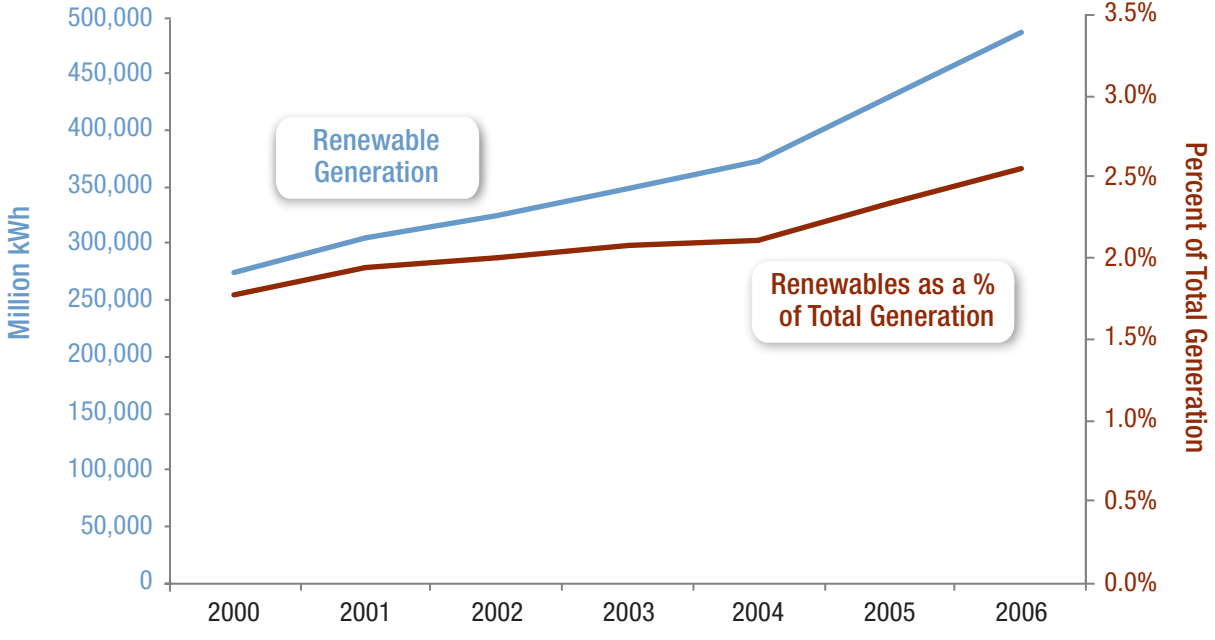
Worldwide Renewable Electricity Generation
(including hydropower)

III



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt, BP

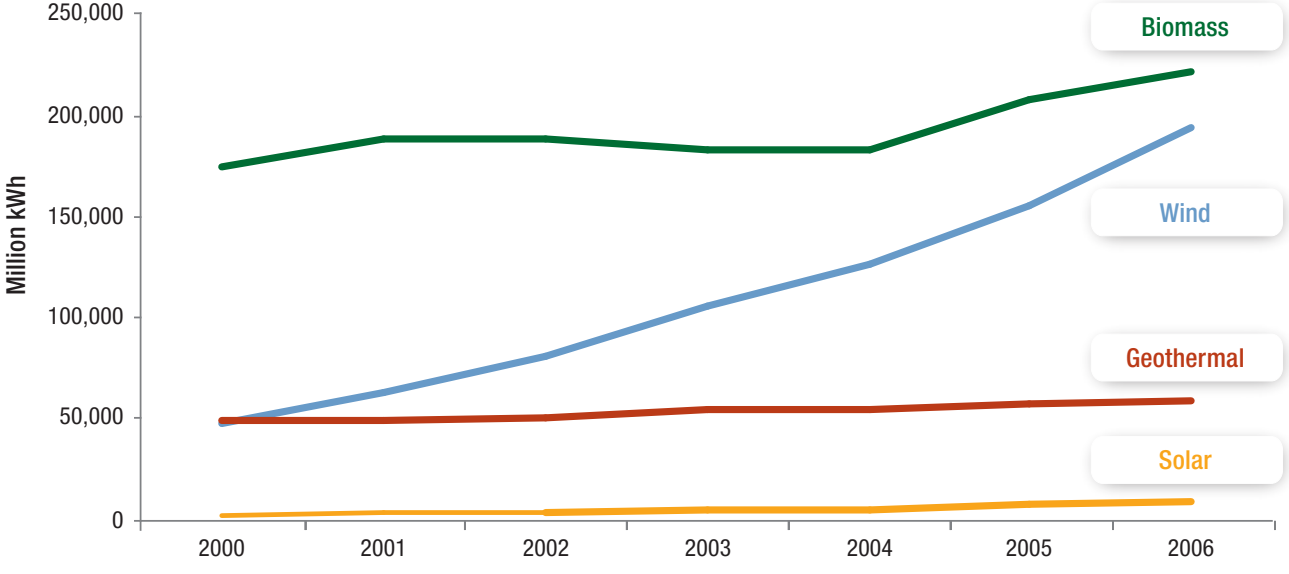
Renewable Electricity Generation Worldwide
(excluding hydropower)



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt, BP

Renewable Electricity Generation Worldwide by Technology (2000-2006)

III



Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt, BP

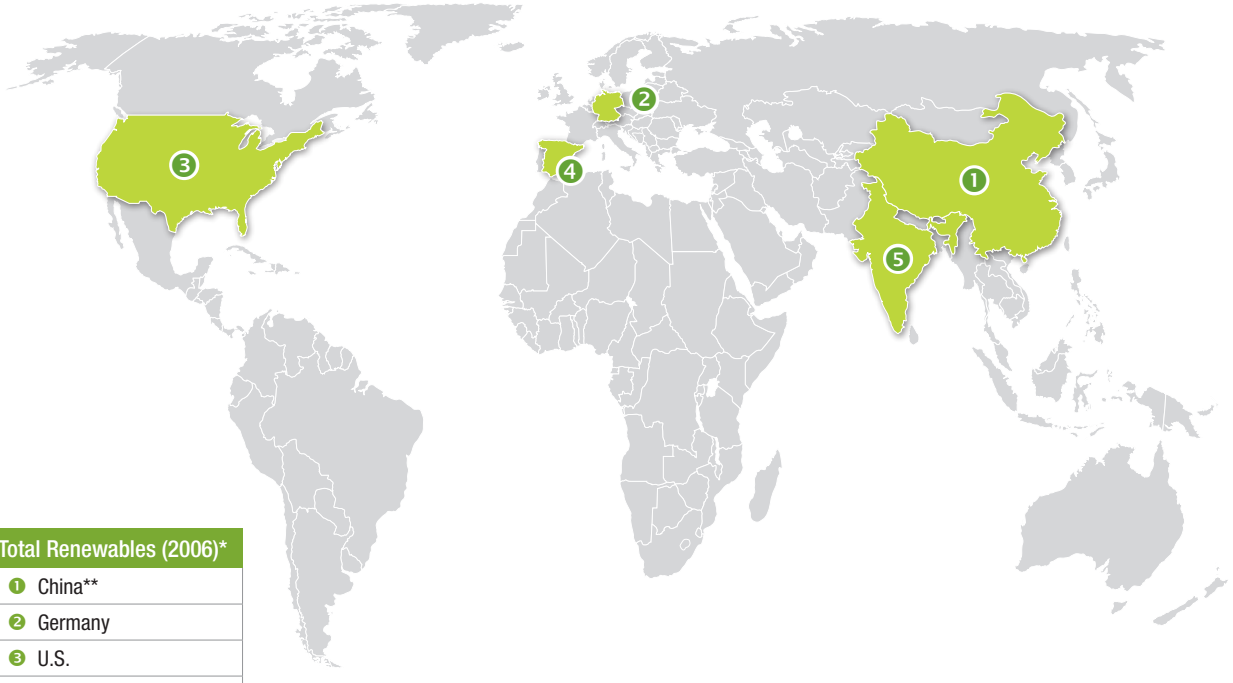
Note: World capacity data used, with generation derived through using capacity factors of 14% for solar power, 30% for wind, 70% for geothermal, 54% for biomass.

Worldwide Renewable Electricity Generation as a % of Total Generation

	Hydro	Solar PV	Biomass	Wind	Geothermal	All Renewables	Renewables without Hydropower	Renewable Generation without Hydropower (million kWh)
2000	15.9%	0.0%	1.1%	0.3%	0.3%	17.7%	1.8%	**273,000**
2001	16.5%	0.0%	1.2%	0.4%	0.3%	18.4%	1.9%	**303,400**
2002	16.2%	0.0%	1.2%	0.5%	0.3%	18.2%	2.0%	**323,800**
2003	17.1%	0.0%	1.1%	0.6%	0.3%	19.1%	2.1%	**347,800**
2004	16.4%	0.0%	1.0%	0.7%	0.3%	18.5%	2.1%	**370,000**
2005	16.0%	0.0%	1.1%	0.8%	0.3%	18.4%	2.3%	**426,700**
2006	15.8%	0.1%	1.2%	1.0%	0.3%	18.3%	2.5%	**484,200**

Sources: IEA, REN21, NREL, UNDP, Martino, WWEAt, BP

Top Countries with Installed Renewable Electricity



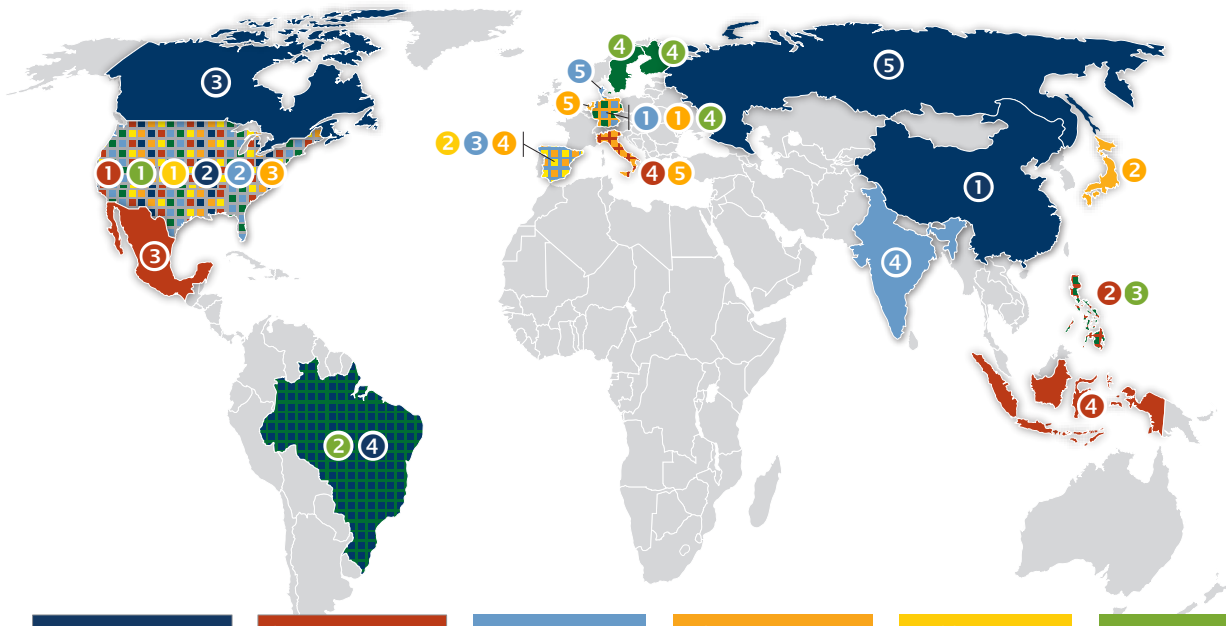
Total Renewables (2006)*
❶ China**
❷ Germany
❸ U.S.
❹ Spain
❺ India

* Including small hydro, geothermal, solar, wind, and biomass. Does not include large hydropower capacity.

** Majority of China's renewable energy is from small hydropower

Source: REN21, WEC

Top Countries with Installed Renewable Electricity by Technology



Hydropower (2005)	Geothermal (2006)	Wind (2006)	Solar PV (2006)*	CSP (2006)	Biomass (2006)
1 China	1 U.S.	1 Germany	1 Germany	1 U.S.	1 U.S.
2 U.S.	2 Philippines	2 U.S.	2 Japan	2 Spain	2 Brazil
3 Canada	3 Mexico	3 Spain	3 U.S.		3 Philippines
4 Brazil	4 Indonesia / Italy	4 India	4 Spain		4 Germany / Sweden / Finland
5 Russia		5 Denmark	5 Italy / Netherlands		

** Grid connected*

IV. Wind

- In the U.S., wind energy installed capacity **increased 6.5 times between 2000 and 2007** and it is the fastest growing renewable electricity technology.

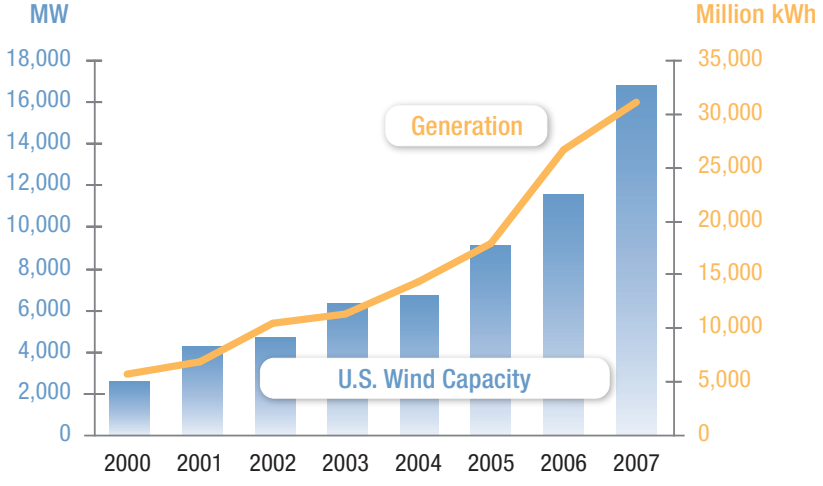
- In the U.S., wind experienced record growth in 2007 and **more wind capacity was installed in the last quarter of 2007 than in all of 2006**. Texas led the U.S. in wind installations in 2007, installing over 1,600 MW of wind capacity.

- The levelized cost of wind power, excluding the Production Tax Credit, was **6 cents per kilowatt hour in 2007**—a price that competes with fossil fuel-generated electricity.

- Germany is still the world leader in installed wind capacity, but **the U.S. has led the world for three years in a row in annual wind capacity installations**.

U.S. Total Installed Wind Energy Nameplate Capacity and Generation

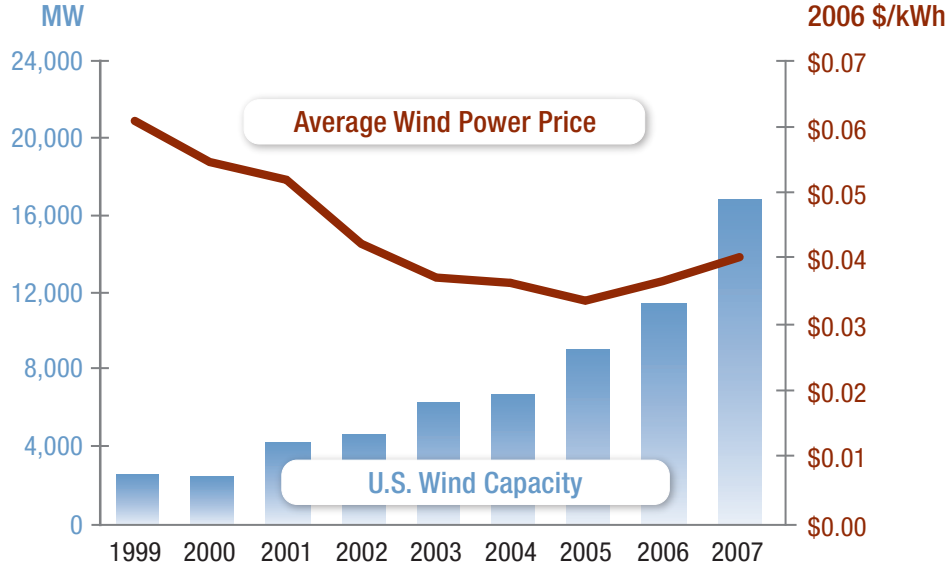
IV



	U.S. Wind Energy Generation (Million kWh)	U.S. Wind Energy Capacity and % Increase from Previous Year	
		Total (MW)	% Increase
2000	5,593	2,578	2.6%
2001	6,737	4,275	65.8%
2002	10,354	4,686	9.6%
2003	11,187	6,353	35.6%
2004	14,144	6,725	5.9%
2005	17,811	9,121	33.6%
2006	26,589	11,575	26.9%
2007	30,977	16,818	45.3%

Source: AWEA, EIA

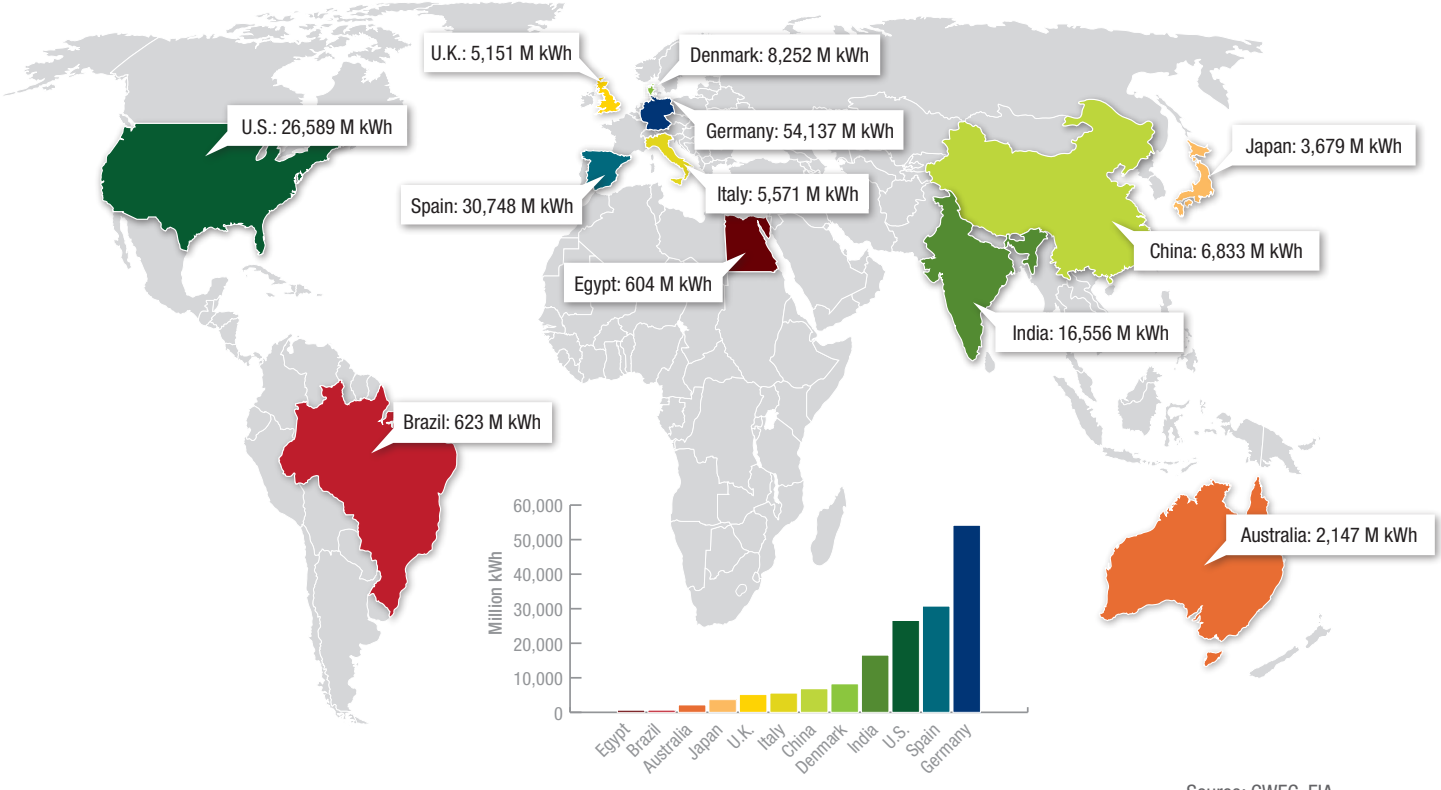
U.S. Wind Power Sales Price



Source: EERE; Based on 58% of wind plants installed since 1999

Note: Prices reflect cumulative capacity-weighted average wind power prices and include state and federal incentives in the price . The recent increase in wind power price is due to increased demand for turbines coupled with global increases in prices for steel, cement, copper, and other commodity materials.

Wind Energy Generation (2006) - Select Countries

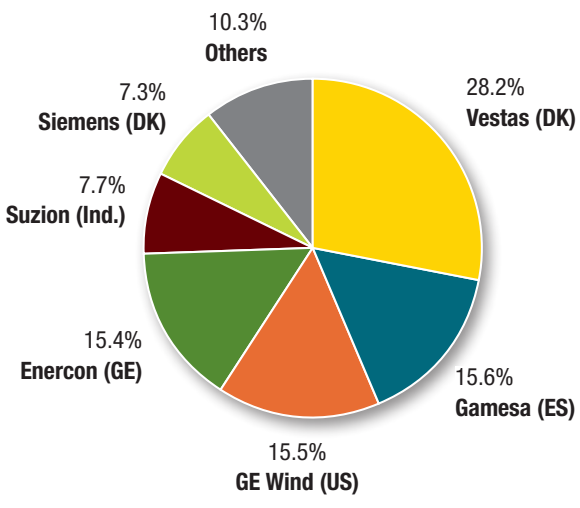


Source: GWEC, EIA

Note: Other than U.S., generation figures based on calculations that convert MW numbers to M kWh using a 30% capacity factor; U.S. numbers from EIA.

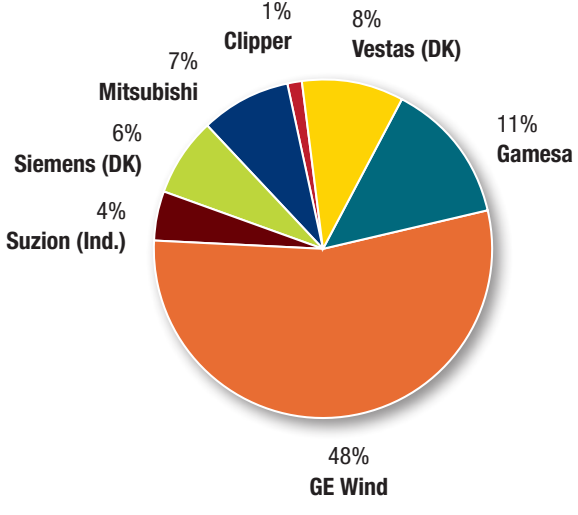
Global Wind Turbine Market Share 2006

Total Turbine Installations: 2,454 MW



U.S. Wind Turbine Market Share 2007

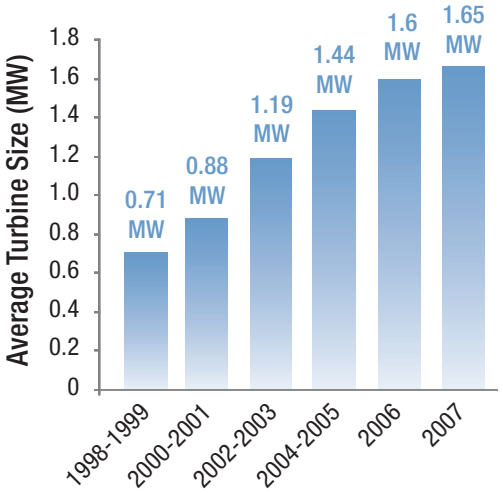
Total Turbine Installations: 5,329 MW

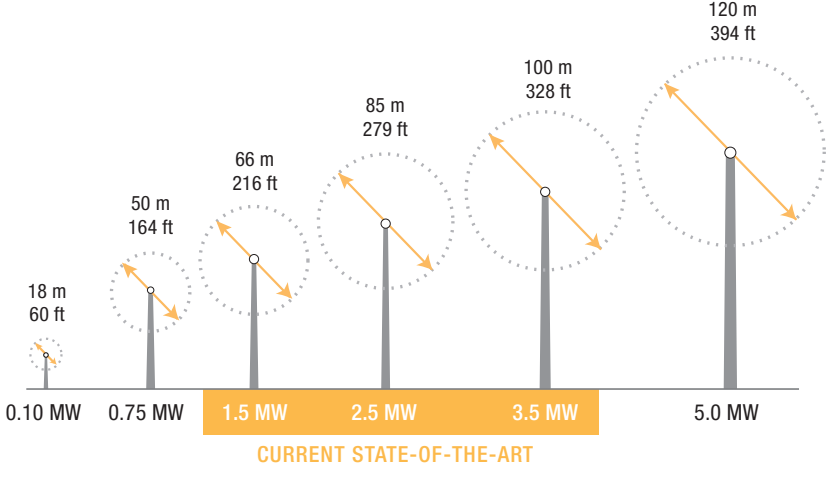


Source: BMT Consult, AWEA, EERE

Average Installed Turbine Size

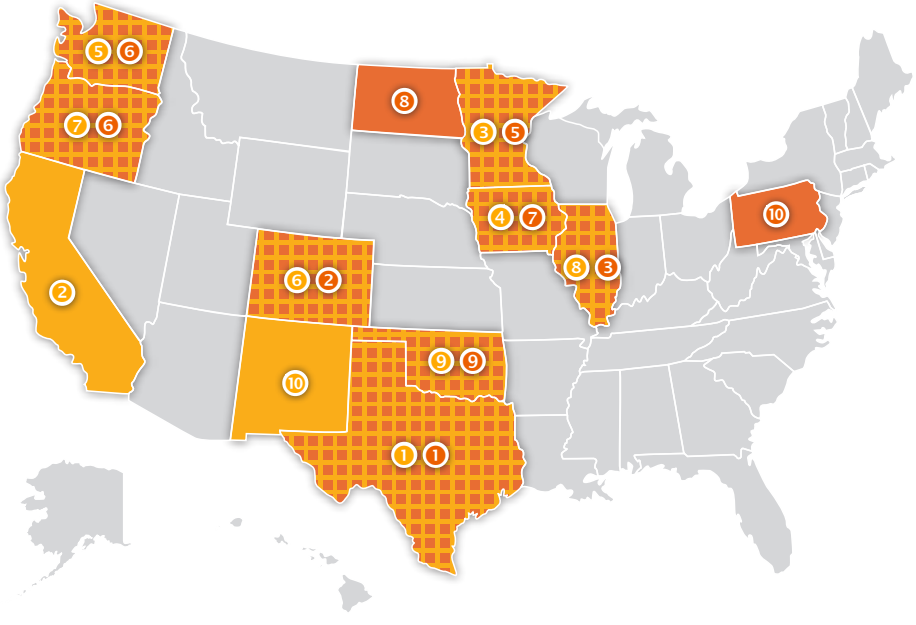
IV





Source: AWEA/GEC Project Database, Sandia, EERE

States Leading Wind Power Development



Cumulative Capacity (2007, MW)	
1 Texas	4,356
2 California	2,439
3 Minnesota	1,299
4 Iowa	1,273
5 Washington	1,163
6 Colorado	1,067
7 Oregon	885
8 Illinois	699
9 Oklahoma	689
10 New Mexico	496

Annual Capacity (2007, MW)	
1 Texas	1,618
2 Colorado	776
3 Illinois	592
4 Oregon	447
5 Minnesota	405
6 Washington	345
7 Iowa	342
8 North Dakota	167
9 Oklahoma	154
10 Pennsylvania	115

Source: AWEA

V. Solar

Solar: Summary

- Solar energy capacity has **more than doubled between 2000 and 2007**, but still represents a very small part of overall U.S. electricity generation.

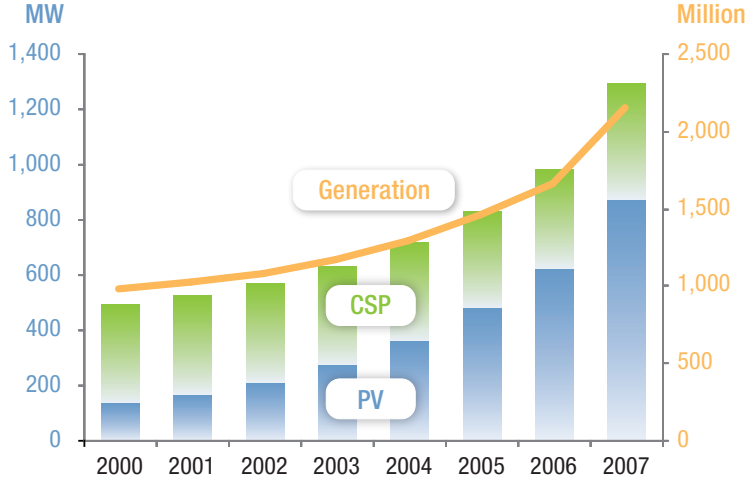
- Countries with aggressive solar policies, such as Germany and Japan, lead the world in solar PV deployment. Similarly, **U.S. states with aggressive solar incentives lead the U.S. in installations** (California, New Jersey, and New York).

- U.S. manufacturers currently have a **small share of the world PV market**. China raised its share of global PV manufacturing from 20% in 2006 to 35% in 2007.

- In 2006, a 1 MW CSP facility came online in Arizona, followed by a **64 MW concentrating solar power (CSP) plant in Nevada**, ending a 17 year lapse in domestic CSP deployment.

U.S. Total Installed Solar Energy Nameplate Capacity & Generation

V

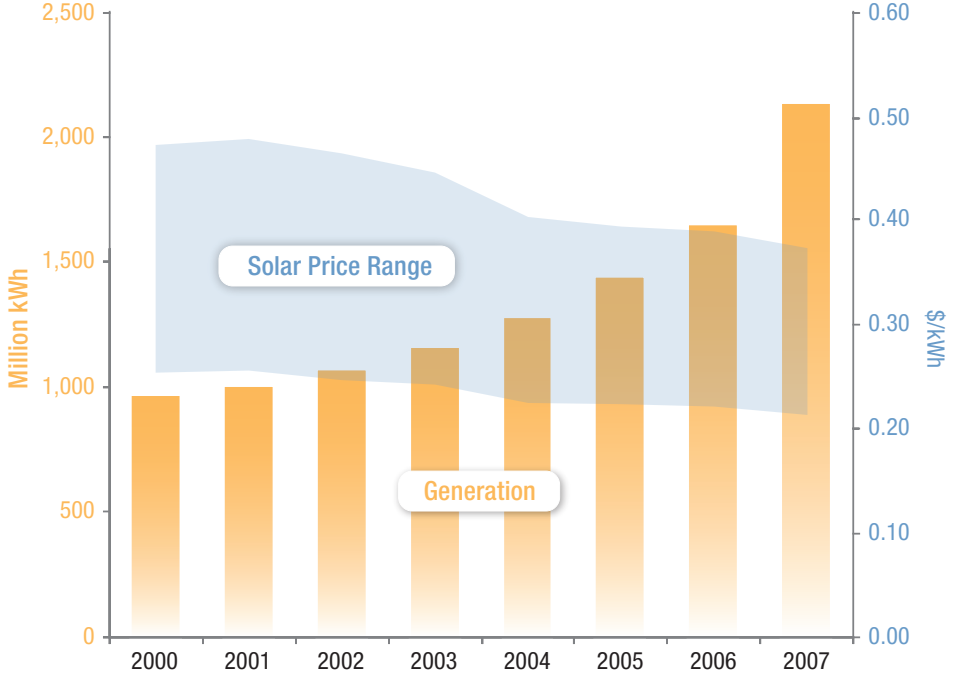


	U.S. Solar Energy Generation (Million kWh)	U.S. Solar Energy Capacity (MW) and % Increase from Previous Year			
		PV	CSP	Total	Increase
2000	970	139	354	493	18.8%
2001	1,011	168	354	522	20.9%
2002	1,072	212	354	629	29.7%
2003	1,161	275	354	629	29.7%
2004	1,287	365	354	629	29.7%
2005	1,447	479	354	833	31.2%
2006	1,652	624	355	979	30.3%
2007	2,143	874	419	1293	40.1%

Source: IEA PVPS, Navigant

Note: Generation numbers calculated from installed capacity using a 16% capacity factor for PV and 25% capacity factor for CSP

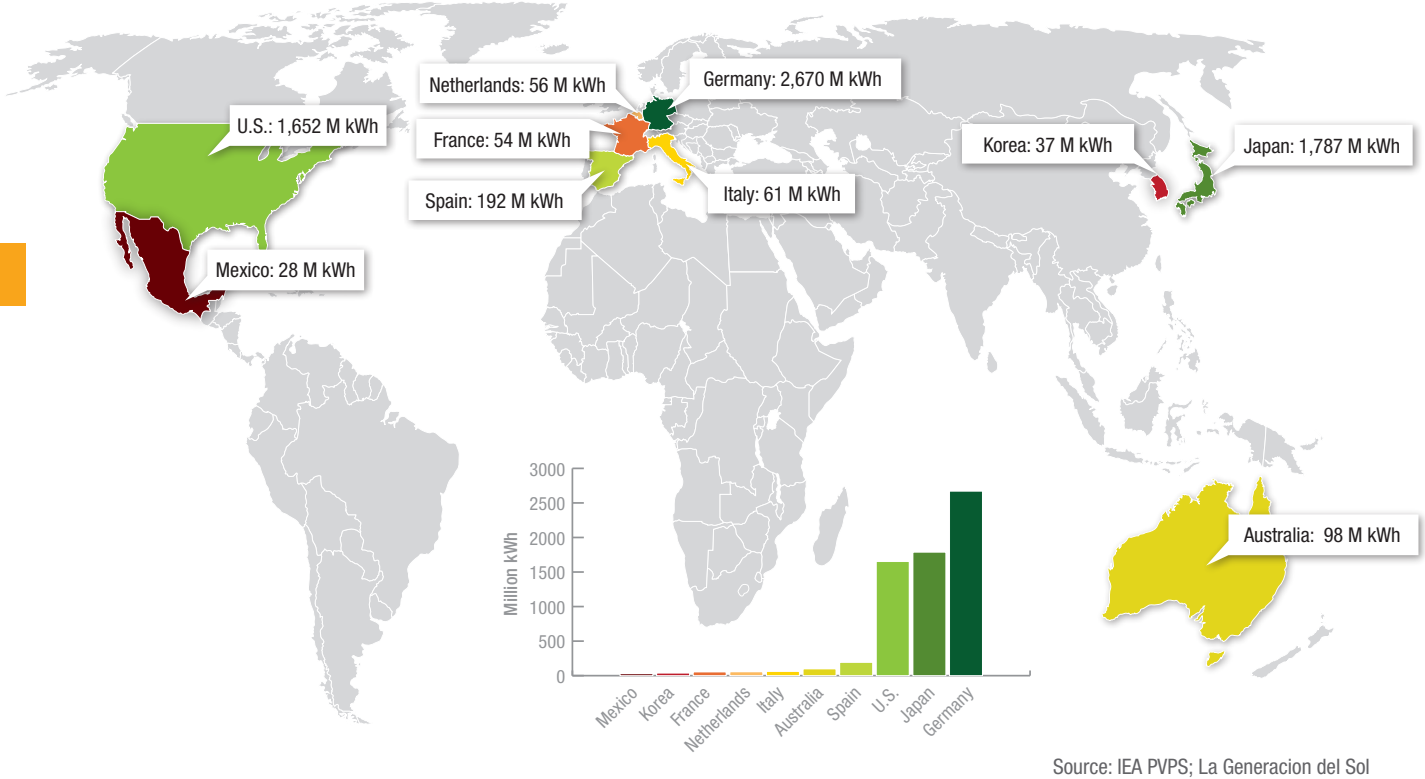
U.S. PV Power Sales Price



Source: Solarbuzz LLC

Note: Data from Solarbuzz are corrected for inflation.

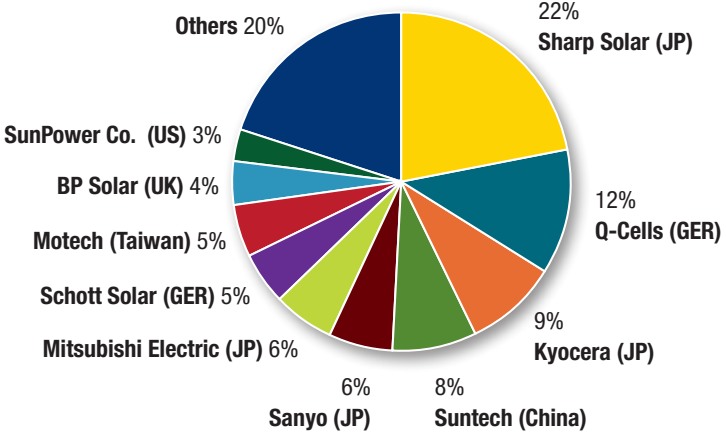
Solar Energy Generation (2006) - Select Countries



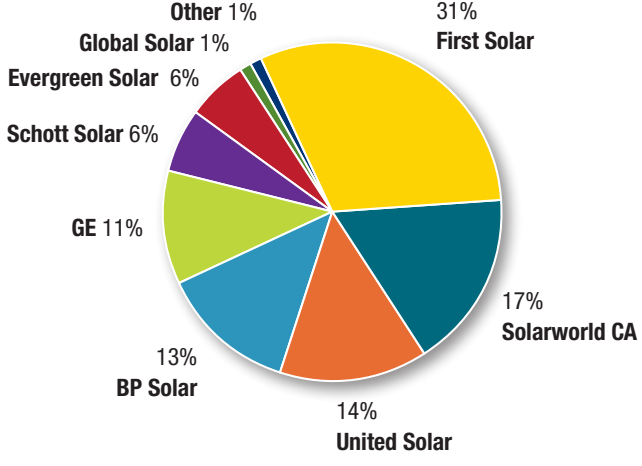
Source: IEA PVPS; La Generacion del Sol

Note: Numbers calculated using capacity factors of 16% for U.S., Australia, and Mexico PV; 14% for Spain, Italy, and France PV; 12% for Germany, Japan, Korea, and the Netherlands PV; and 25% for CSP (in U.S. and Spain only)

Global Solar PV Market Share 2006:
2,500 MW nameplate capacity



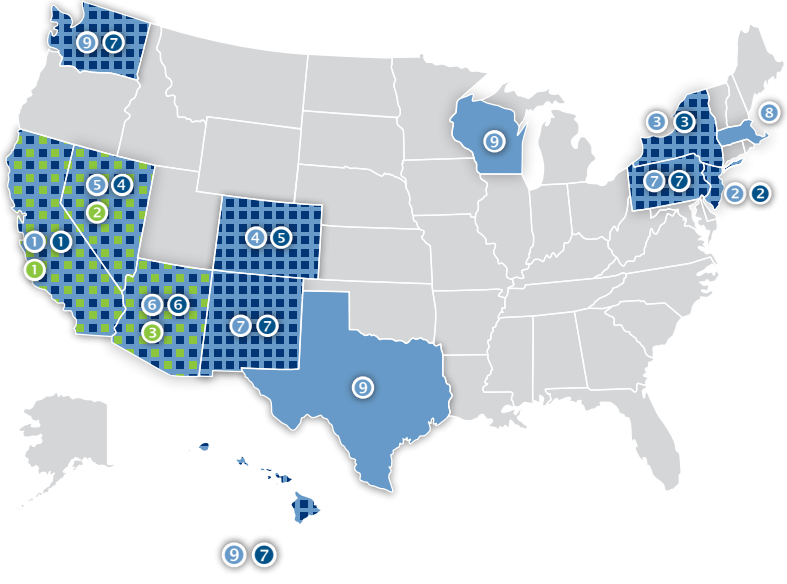
U.S. Cell Production 2006:
200 MW nameplate capacity



Source: Navigant; Prometheus Institute

States Leading Solar Energy Development

V



PV Cumulative Capacity (2007, MW)	
1 California	499
2 New Jersey	69
3 New York	32
4 Colorado	20
5 Nevada	15
6 Arizona	14
7 New Mexico	9
7 Pennsylvania	9
8 Massachusetts	7
9 Hawaii	6
9 Texas	6
9 Washington	6
9 Wisconsin	6

PV Annual Capacity (2007, MW)	
1 California	166
2 New Jersey	29
3 New York	10
4 Nevada	7
5 Colorado	6
6 Arizona	5
7 Pennsylvania	3
7 New Mexico	3
7 Hawaii	3
7 Washington	3

CSP Cumulative Capacity (2007, MW)	
1 California	354
2 Nevada	64
3 Arizona	1

Source: Navigant

Note: All installments equal 1% or less of electricity generation in states

VI. Geothermal

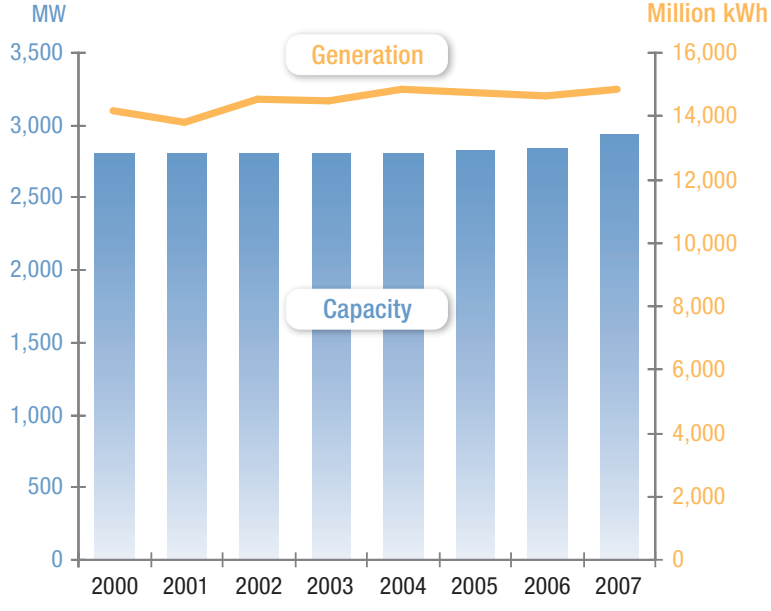
- U.S. geothermal energy generation has remained relatively stable from 2000 to 2007, with the **past two years seeing the first measurable growth in a decade.**

- Geothermal energy generates power for **between 5.5 and 10 cents /kilowatt-hour**

- **The U.S. leads the world in terms of installed geothermal electricity capacity and generation**, with most of that power installed in California.

- As a base load source of energy, geothermal is distinct from other renewables such as wind and solar, since **it can provide electricity 24 hours a day 365 days a year**.

U.S. Geothermal Electricity Nameplate Capacity and Generation

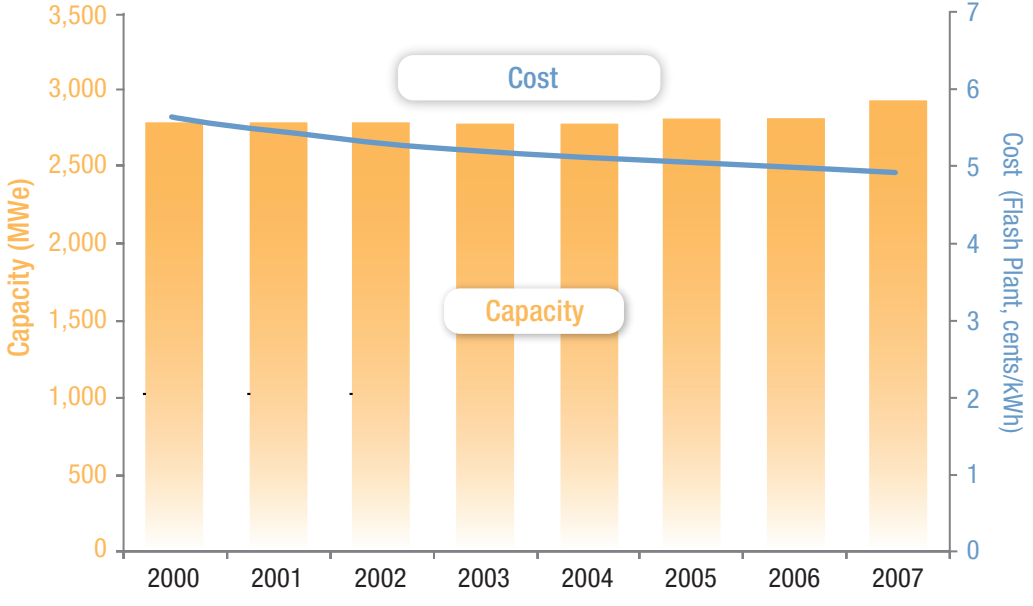


	U.S. Geothermal Electricity Generation (Million kWh)	U.S. Geothermal Electricity Capacity and % Increase from Previous Year	
		Total (MW)	% Increase
2000	14,093	2,798	2.2%
2001	13,741	2,798	0%
2002	14,491	2,798	0%
2003	14,424	2,798	0%
2004	14,811	2,798	0%
2005	14,692	2,828	1.1%
2006	14,568	2,831	0.1%
2007	14,822	2,937	3.7%

Source: GEA, EIA

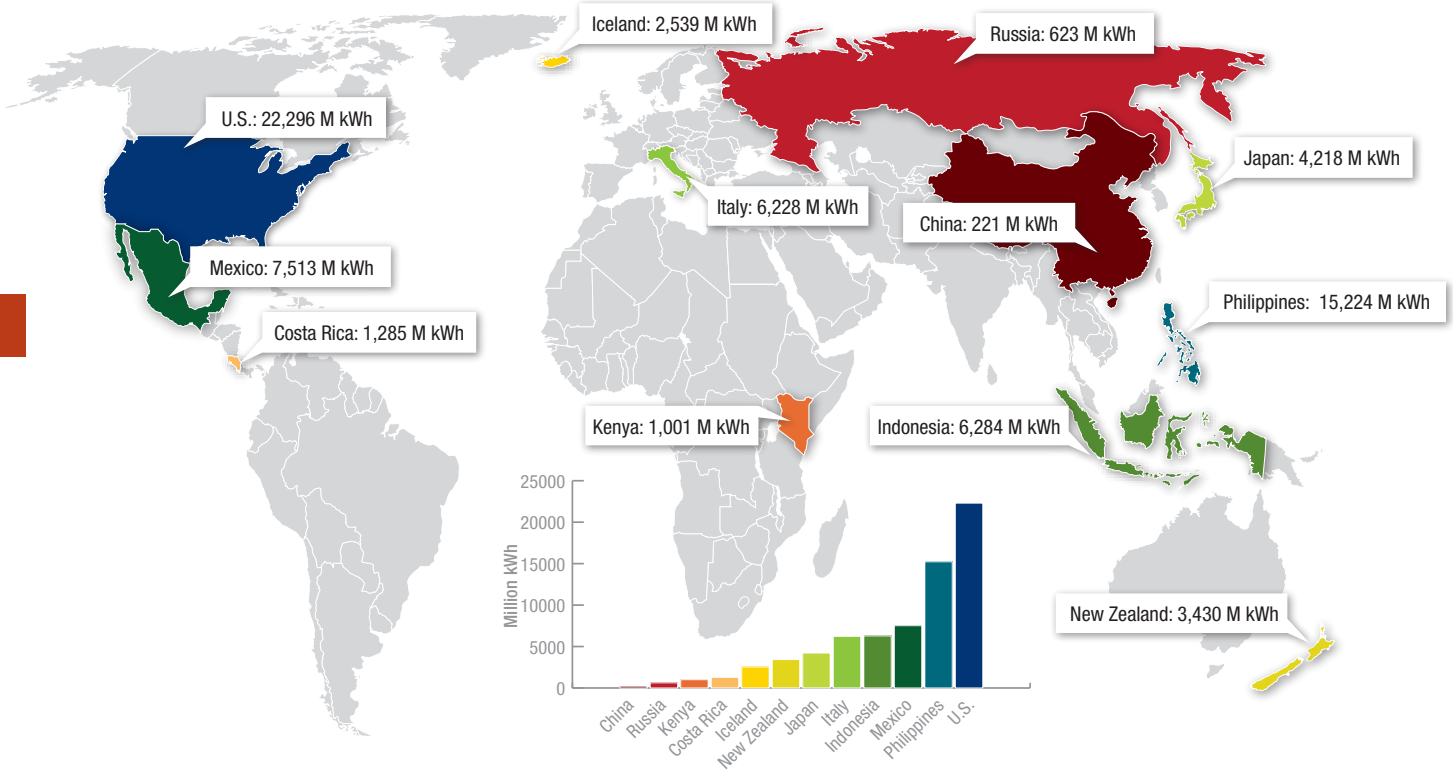
Note: Total U.S. generation from direct use of geothermal energy in 2005 was 8,700 Million kWh

U.S. Geothermal Capacity and Cost Trends



Source: EERE

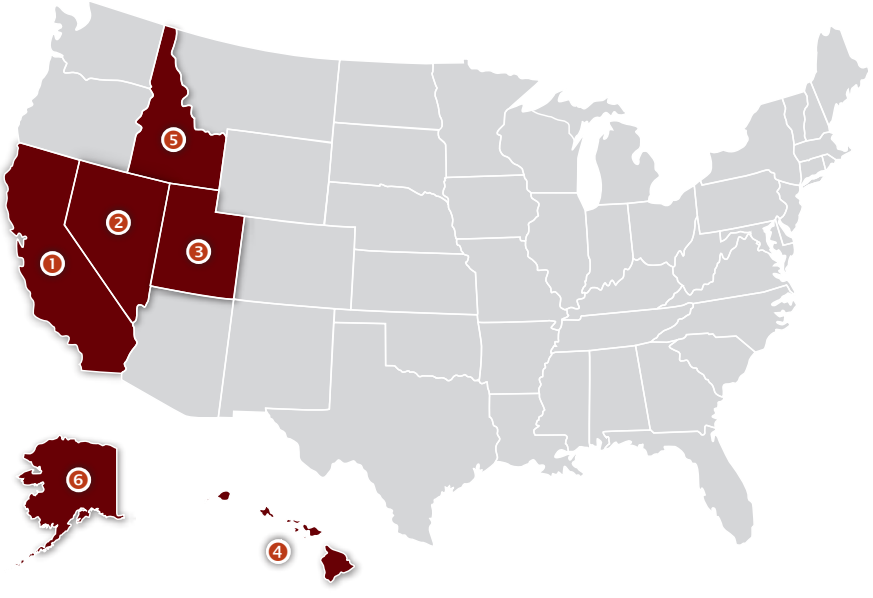
Global Geothermal Electricity Generation (2005) - Select Countries



VI

Source: IGA

State Geothermal Energy Development (2007)



Total Installed Capacity (2007, MW)	
1 California	2,541
2 Nevada	310
3 Utah	37
4 Hawaii	35
5 Idaho	13
6 Alaska	0.4

VI

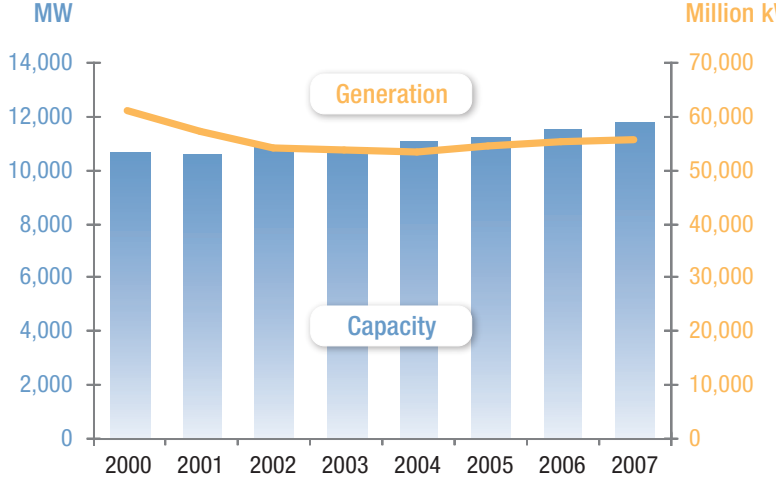
Source: GEA

VII. Biopower

- Biopower generation has remained steady over the past 7 years, and currently accounts for **56% of all renewable energy generated in the U.S.** (excluding hydropower).

- Biomass electricity primarily comes from wood and agricultural residues that are burned as a fuel for cogeneration in the industrial sector (such as in the pulp and paper industry).

U.S. Biopower Nameplate Capacity and Generation

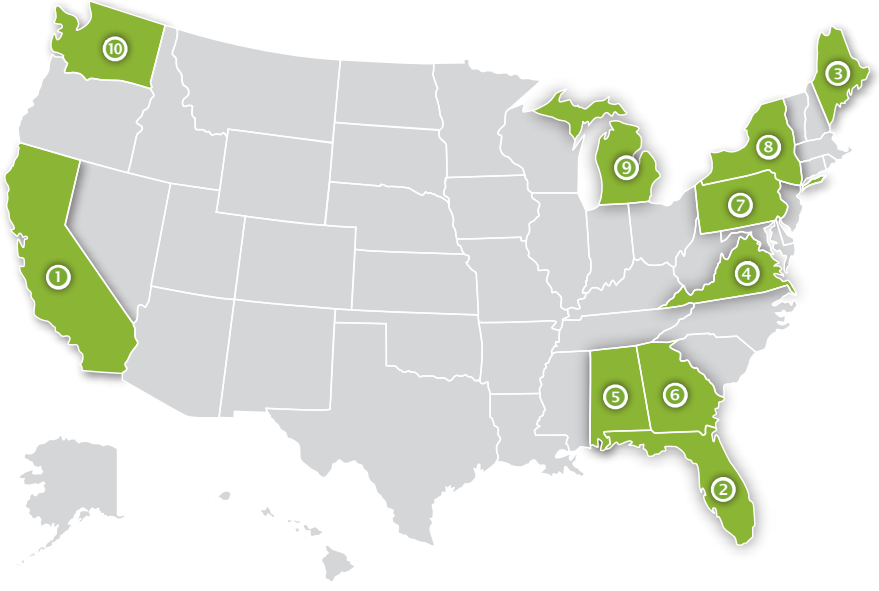


	U.S. Biopower Generation (Million kWh)	U.S. Biopower Capacity and % Increase from Previous Year	
		Total (MW)	% Change
2000	60,727	10,676	- 2.9%
2001	56,964	10,576	- 0.9%
2002	53,709	10,867	2.8%
2003	53,342	10,856	- 0.1%
2004	53,074	11,033	1.6%
2005	54,160	11,222	1.7%
2006	54,758	11,553	3.0%
2007	55,253	11,738	1.6%

Source: EIA

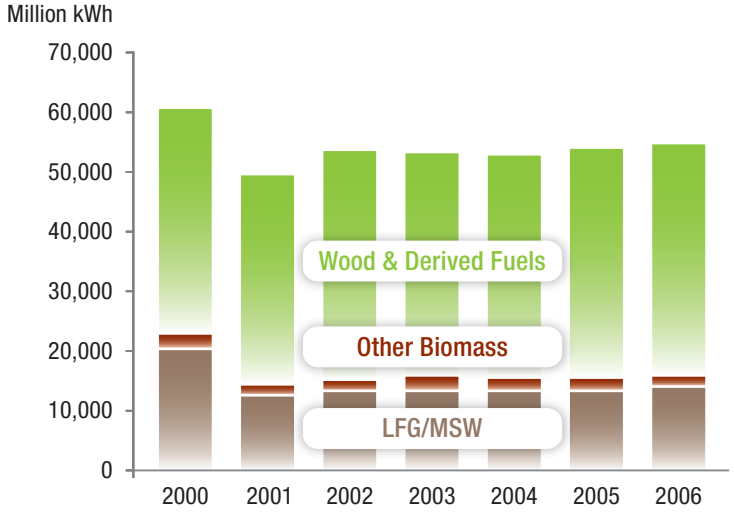
Note: The generation decrease between 2000 to 2001 reflects an EIA classification change. Beginning with 2001 data, non-biogenic Municipal Solid Waste and Tire-derived fuels were reclassified as non-renewable energy sources (previously considered waste biopower).

States Leading Biopower Energy Development (2006)



Total Installed Capacity (2006, MW)	
❶ California	1,150
❷ Florida	1,100
❸ Maine	750
❹ Virginia	680
❺ Alabama	610
❻ Georgia	540
❼ Pennsylvania	530
❽ New York	420
❾ Michigan	390
❿ Washington	390

U.S. Biopower Generation Sources (2000-2006)



	LFG/MSW	Other Biomass	Wood & Derived Fuel	TOTAL
2000	20,305	2,826	37,595	60,726
2001	12,714	1,834	35,200	49,748
2002	13,398	1,646	38,665	53,709
2003	13,383	2,428	37,529	53,342
2004	13,281	2,216	37,576	53,074
2005	13,470	2,009	38,681	54,160
2006	14,106	2,004	38,649	54,758

Source: EIA

Note: LFG stands for Landfill Gas and MSW stands for Municipal Solid Waste

Note: The generation decrease between 2000 to 2001 reflects an EIA classification change. Beginning with 2001 data, non-biogenic Municipal Solid Waste and tire-derived fuels were reclassified as non-renewable energy sources (previously considered waste biopower).

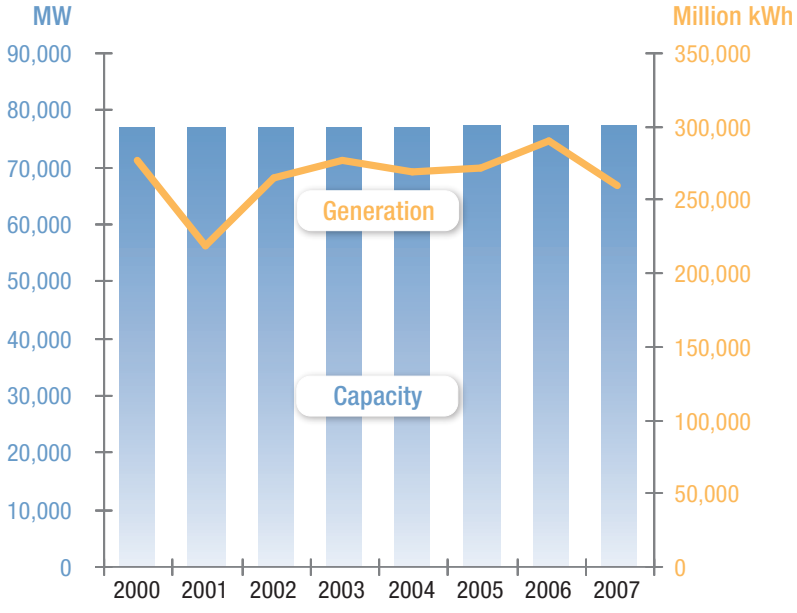
VIII. Hydropower

Hydropower: Summary

- Hydropower **capacity has remained constant between 2000-2007**, with generation fluctuation depending on water supply.

- Hydropower remains the largest source of renewable energy generation, and an important component of the energy mix; primarily large-scale hydropower **accounts for 7% of U.S. electricity generation**.

U.S. Hydropower* Nameplate Capacity and Generation

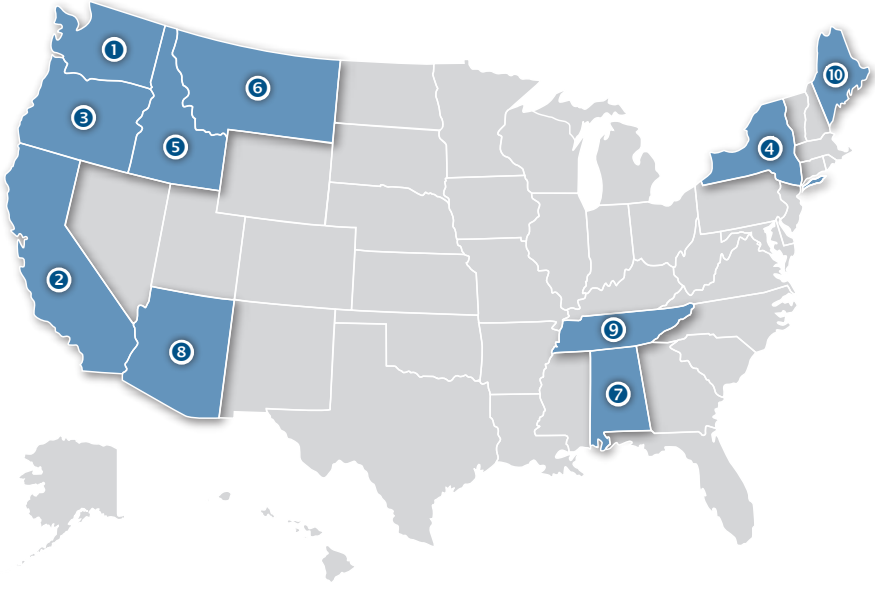


	U.S. Hydropower Generation (Million kWh)	U.S. Hydropower Capacity and % Increase from Previous Year	
		Total (MW)	% Increase
2000	275,573	76,946	0.0%
2001	216,961	76,911	0.0%
2002	264,329	77,047	0.2%
2003	275,806	77,020	0.0%
2004	268,417	77,130	0.1%
2005	270,321	77,354	0.3%
2006	289,246	77,419	0.1%
2007	258,184	77,432	0.0%

Source: EIA

*Note: Excludes pumped storage.

States Leading Hydropower Generation (2006)



Generation (2006, Million kWh)	
1 Washington	61,321
2 California	38,091
3 Oregon	28,119
4 New York	18,583
5 Idaho	8,993
6 Montana	7,584
7 Alabama	4,953
8 Arizona	4,904
9 Tennessee	4,734
10 Maine	3,038

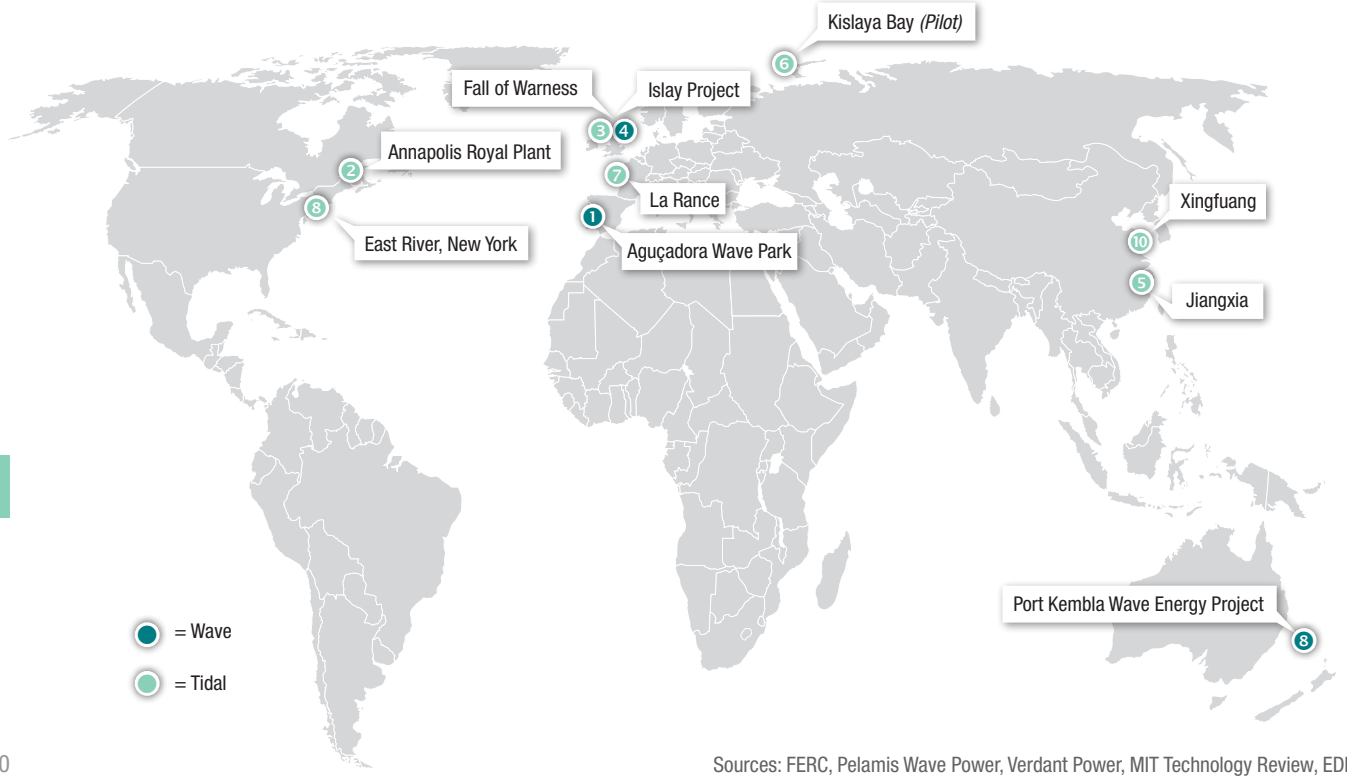
Source: EIA

IX. Advanced Water Power

- U.S. interest in advanced water power such as **tidal**, **river** and **ocean current**, and **ocean wave** energy is just beginning to grow, with many prototype projects in testing stages and permits being filed at the Federal Energy Regulatory Commission (FERC).

- In Fiscal Year 2008, the U.S. Government appropriated **about $10 Million for water power research and development**.

Worldwide Advanced Water Power Commercial and Pilot Plants in Operation



Sources: FERC, Pelamis Wave Power, Verdant Power, MIT Technology Review, EDF

Worldwide Advanced Water Power Commercial and Pilot Plants in Operation

PROJECT NAME	Type	Location	Technology	Size	Year of Oper.
1 Aguçadora Wave Park	WAVE	Póvoa de Varzim, Portugal	Pelamis Wave Energy Converter	2.25 MW	2007
2 Annapolis Royal Plant	TIDAL	Bay of Fundy, Nova Scotia	Tidal barrage; Straflo Turbine-Generator	20 MW	1984
3 Fall of Warness	TIDAL	United Kingdom	Open Hydro Open Centre Turbine	250 kW	2008
4 Islay Project	WAVE	United Kingdom	Wavegen Limpet Device	500 kW	2000
5 Jiangxia	TIDAL	China	n/a	3.2 MW	~1980
6 Kislaya Bay	TIDAL	Barents Sea, Russia	Orthogonal rotor	200 kW	1968 (updated in 2005)
7 La Rance	TIDAL	Bretagne, France	Tidal barrage, Bulb Turbines	240 MW	1966
8 Port Kembla Wave Energy Project	WAVE	Australia	Oceanlinx Wave Energy System	500 kW	2006
9 RITE Project	TIDAL	East River, New York	Verdant Free Flow Turbines	120 kW	2007
10 Xingfuyang	TIDAL	China	n/a	1.3 MW	~1980

= Commercial Plants

FERC Permitted and Licensed Projects in the U.S. (as of March 2008)	Permitted	Pending Permit	Licensed	Pending licenses
	49	26	1	0

Sources: FERC, Pelamis Wave Power, Verdant Power, MIT Technology Review, EDF, Bellona


reliable
green-friendly
colorless
clean
ZERO EMISSION
HYDROGEN FUEL CELL - HYBRID-ELECTRIC DRIVE
FC2

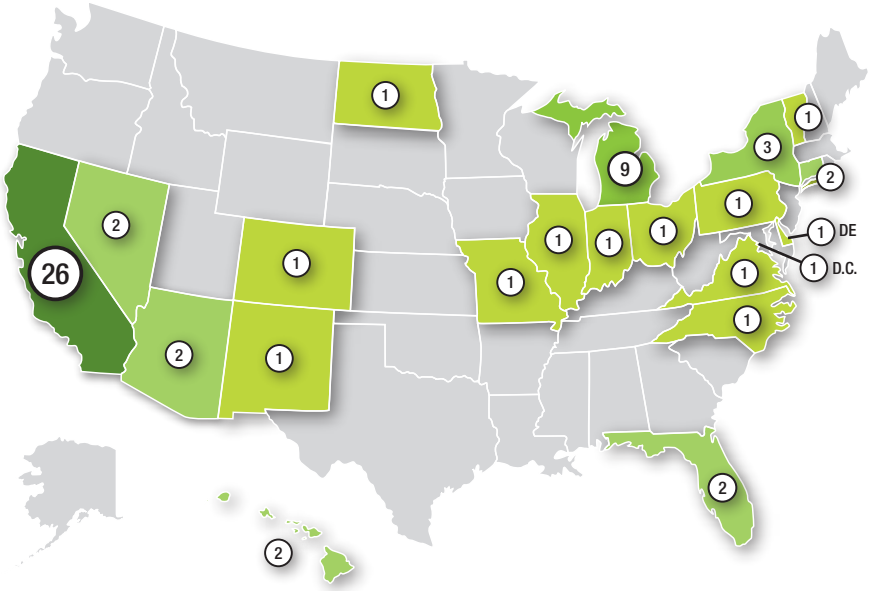
x. Hydrogen

- More than **100 hydrogen fueling stations** are operational worldwide, approximately half within the U.S.
- Approximately **34,000 fuel cell units have been delivered globally**; 12,000 units were shipped in 2007 for stationary, portable, and transport applications.
- Hydrogen fuel cell vehicles offer **more than twice the efficiency of conventional gasoline vehicles**. More than 200 vehicles have been demonstrated in the U.S. to date, with major automakers starting to lease vehicles.
- Global public R&D investment for hydrogen is **~$1 billion worldwide**, with more than $400 million in the U.S.

Hydrogen - Transportation

Number of Operational U.S. Hydrogen Fueling Stations

(January 2008 - **Total of 61**)



Number of recorded fuel cell vehicles in the U.S. = 219 *(27 in California)*

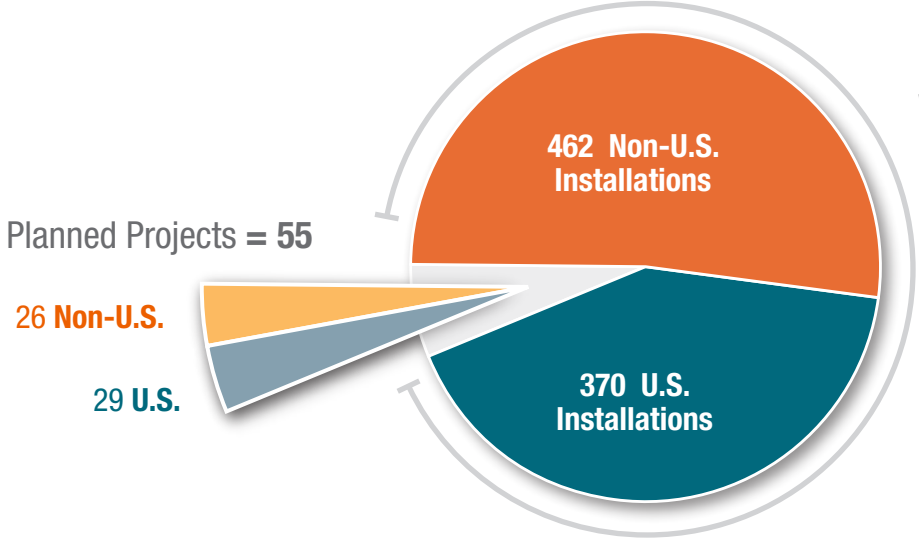
Sources: NHA, NREL, DOE, Gale Group

Hydrogen Production

50 million tons of hydrogen are produced each year worldwide, with **9 million tons** being consumed in the U.S.

Approximately **60%** is used for making ammonia for fertilizer, **23%** used to make gasoline cleaner by removing sulfur, **9%** used to make methanol, and the remainder is for chemical processing, metal production, electronics and for space exploration.

Stationary Fuel Cell Installations



Worldwide Installations = **832**

Number of stationary fuel cells >1 MW = 7

Located in the U.S. (4), Italy (1), Japan (2)

X

Sources: FuelCells2000

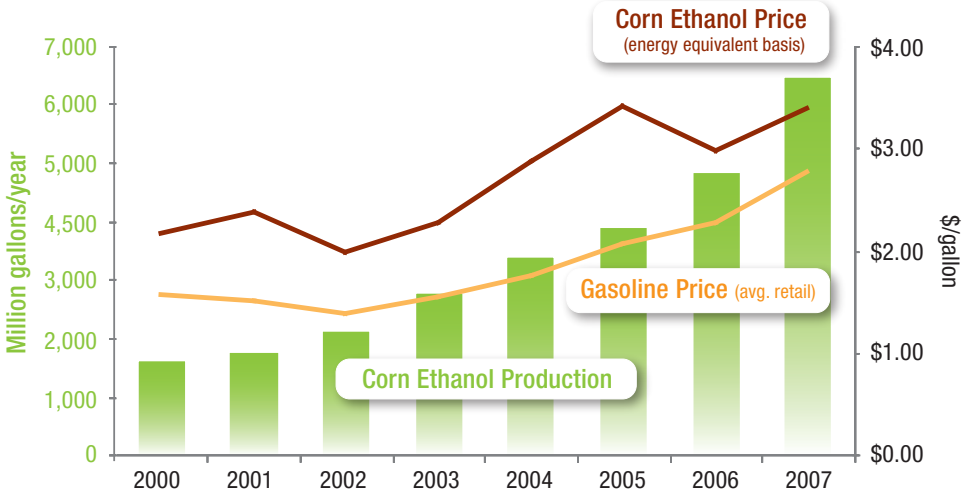
XI. Renewable Fuels

- Corn ethanol production continues to expand rapidly in the U.S., and **between 2000 and 2007 production nearly quadrupled**.
- Ethanol production **grew over 30% in 2007** to reach **6,500 million gallons** per year.
- Ethanol has steadily increased its percentage of the overall gasoline pool, and in 2007 was estimated to be **4.6%**.
- In 2006, the U.S. became the world's largest ethanol producer.*

* Currently all U.S. ethanol is produced from corn (in contrast to Brazil's ethanol coming from sugar cane), but efforts are underway by the U.S. Department of Energy and others to commercialize cellulosic ethanol, which is produced from non-food crops.

Note: Ethanol is blended with gasoline and generally comprises up to 10% of the fuel with gasoline as the other 90% (E10). Additionally, flex fuel vehicles use a blend of 85% ethanol and 15% gasoline (E85).

U.S. Corn Ethanol Production and Price Trends



XI

Sources: RFA, EIA, EERE

U.S. Ethanol Production and Growth in Gasoline Pool by Volume

	Gasoline Pool* (Million gallons/yr)	Ethanol Production (Million gallons/yr)	Annual Growth (%)	% of gasoline pool
2000	128,662	1,630	11%	1.3%
2001	129,312	1,770	9%	1.4%
2002	132,782	2,130	20%	1.6%
2003	134,089	2,800	31%	2.1%
2004	137,022	3,400	21%	2.5%
2005	136,949	3,904	15%	2.9%
2006	138,378[3]	4,855[4]	24%	3.5%
2007**	142,287	6,500	32%	4.6%

U.S. Ethanol Distribution & Utilization

1,499 E85 stations (6/28/08)

E85 average retail price (April 2008): **$4.06/gallon** (energy equivalent basis), gasoline price: $3.43/gallon

Approximately 7 million flex-fuel vehicles (FFV) are on the road, with 970,000 of those built in 2007

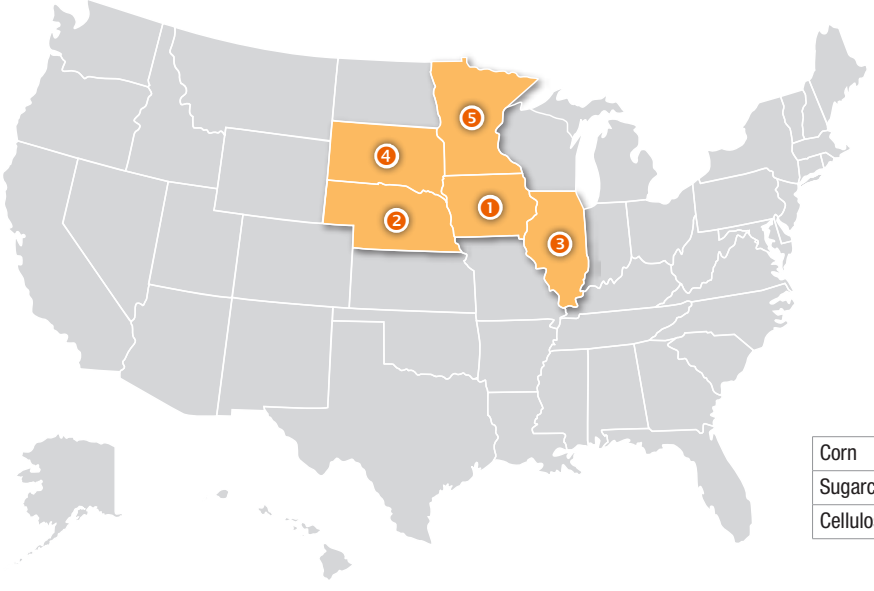
XI

* Includes Ethanol

** Projection

Sources: EIA, Renewable Fuels Association

U.S. Ethanol Production Capacity and Ethanol Yields and Emissions



Top 5 States 2007 U.S. Ethanol Production Capacity (millions of gallons)	
❶ Iowa	2,059
❷ Nebraska	1,144
❸ Illinois	887
❹ South Dakota	683
❺ Minnesota	620

	Yields (gallons/acre)	GHG Emissions[1] (% less than gasoline)
Corn	330	22%
Sugarcane	600-800	56%
Cellulosic	>1,000	91%

[1] In terms of lbs/gallon produced for production and use of fuel

Note: no sugarcane ethanol is currently produced in the United States

Sources: RFA, EIA, National Geographic, Cornell University

XI

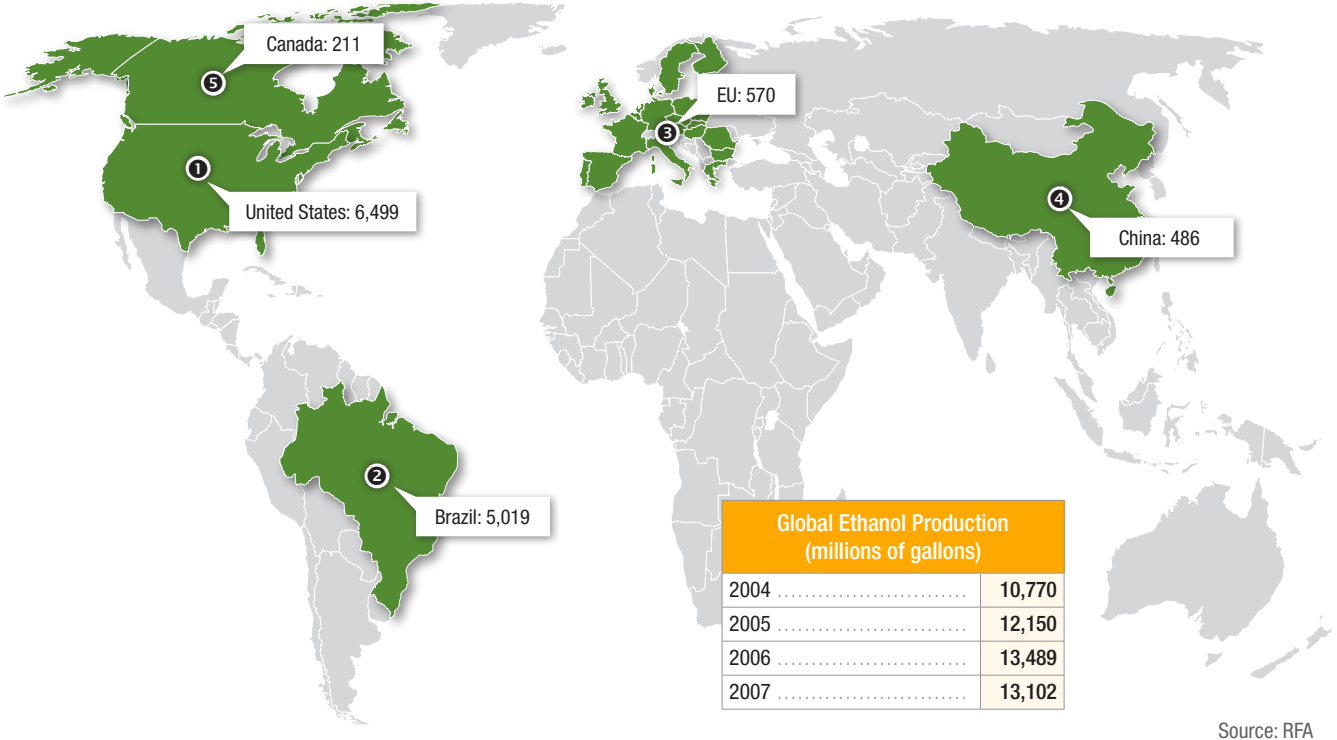
Total U.S. Ethanol Production Capacity (2007): 7,888 million gallons/year (mmgy)

Top 5 Ethanol Companies - Production Capacity 2007 (millions of gallons/year)	
❶ Poet	1,208
❷ Archer Daniels Midland Co.	1,070
❸ VeraSun Energy	560
❹ US BioEnergy Corp.	310
❺ Hawkeye Renewables, LLC	220

Source: RFA

Global Ethanol Production

Top 5 Countries (2007) Ethanol Production (millions of gallons)



Global Ethanol Production (millions of gallons)	
2004	10,770
2005	12,150
2006	13,489
2007	13,102

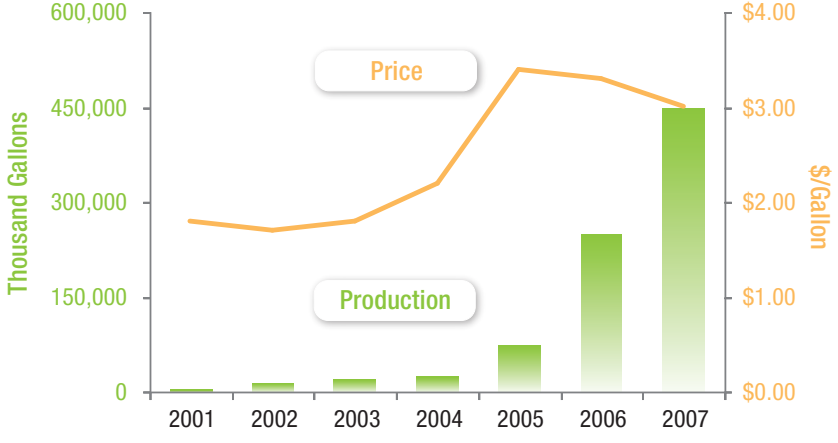
Source: RFA

Renewable Fuels - Biodiesel: Summary

- Biodiesel has expanded from a relatively small production base in 2000, to a total U.S. production of **500 million gallons** in 2007.
- Biodiesel production in 2007 is **250 times** what it was in the year 2000.
- Europe leads the world in biodiesel production, with most production and consumption in Germany.

XI

U.S. Biodiesel Demand and Price (2000-2007)



	Annual growth	Total Production (thousand gallons)
2000	300%	2,000
2001	150%	5,000
2002	200%	15,000
2003	33%	20,000
2004	25%	25,000
2005	200%	75,000
2006	233%	250,000
2007	80%	450,000

GHG Emissions: 68% less than diesel gasoline

(in terms of lbs/gallon produced for production and use of fuel)

XI

Sources: National Biodiesel Board, National Geographic, EERE

Total U.S. Biodiesel Production Capacity (2006): 1,850 million gallons/year (mmgy)

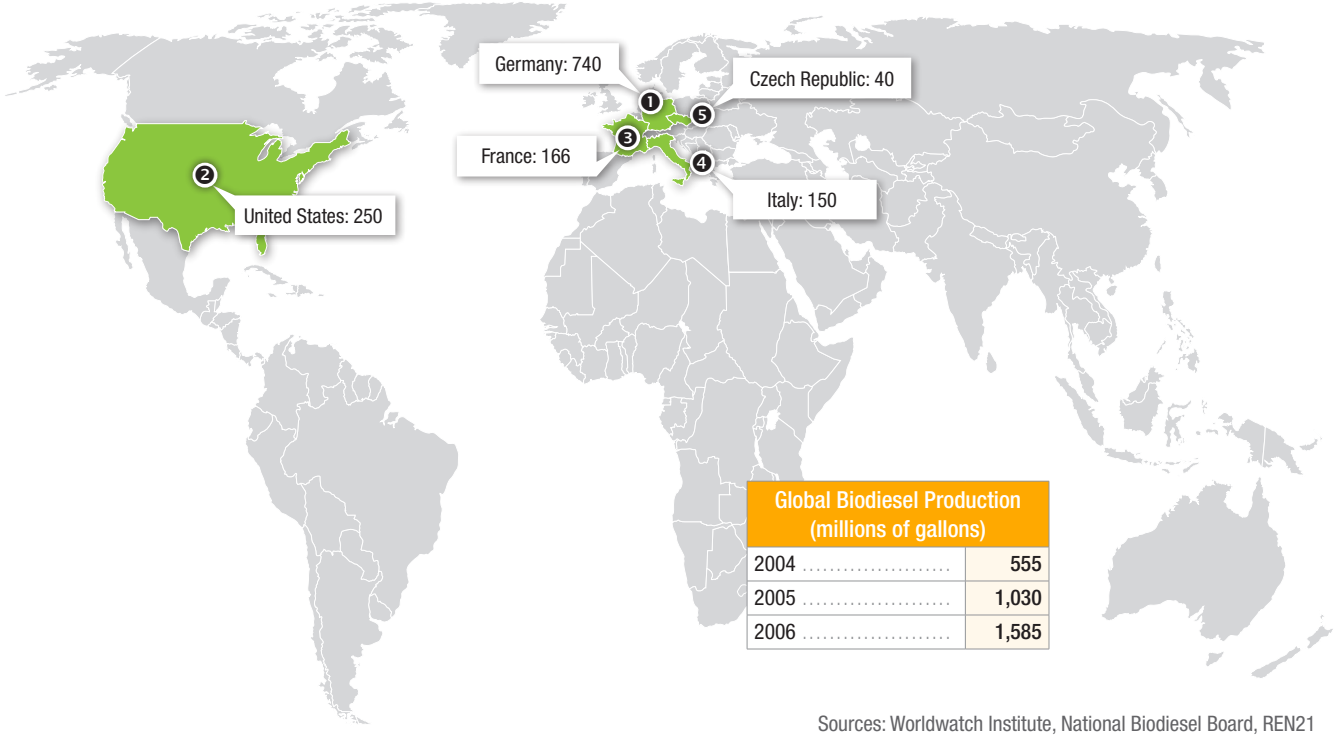
Top 6 Biodiesel Companies - Production Capacity 2007 (millions of gallons/year)	
❶ Imperium Grays Harbor	100
❷ Green Earth Fuels of Houston, LLC	86
❸ ADM	85
❹ Delta Biofuels, Inc	80
❺ Fuel Bio One, LLC	50
❺ Memphis Biofuels, LLC	50

XI

Source: National Biodiesel Board

Global Biodiesel Production

Top 5 Countries (2006) Biodiesel Production (millions of gallons)



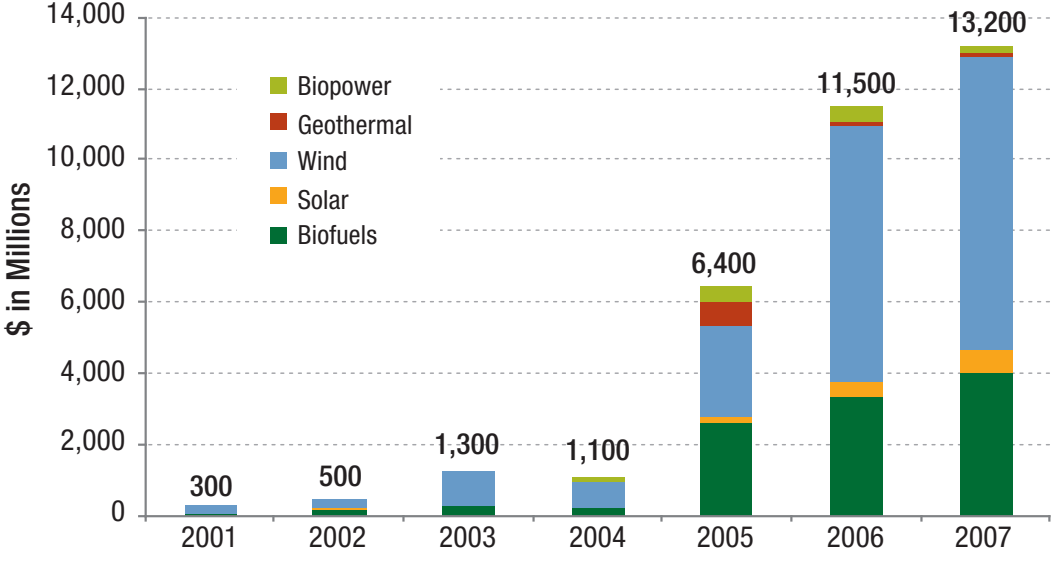
Global Biodiesel Production (millions of gallons)	
2004	555
2005	1,030
2006	1,585

Sources: Worldwatch Institute, National Biodiesel Board, REN21

XII. Clean Energy Investments

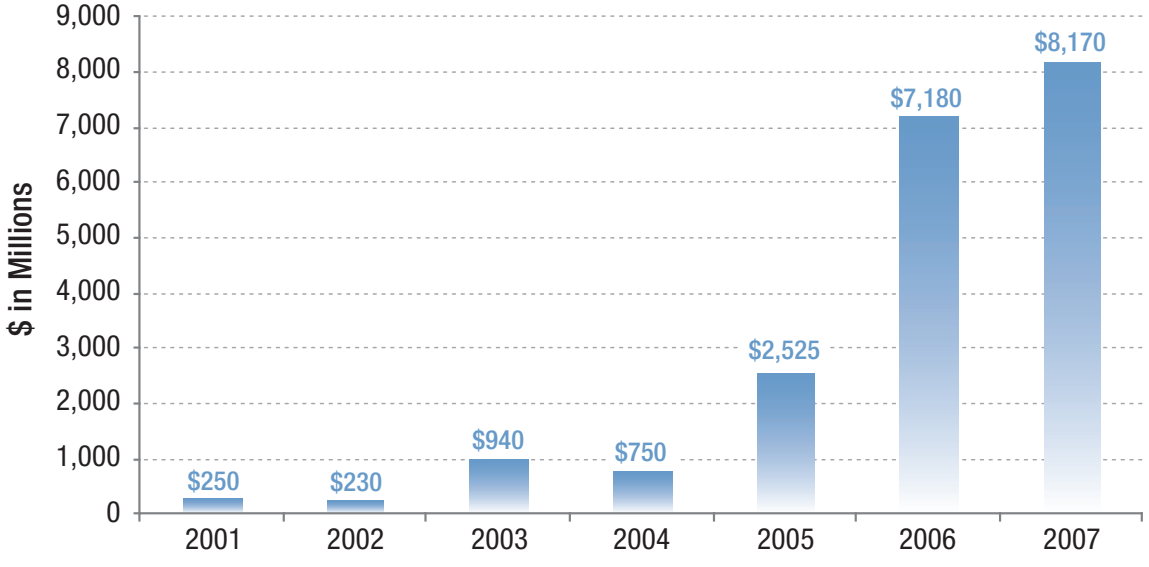
- U.S. investment in renewable energy projects has grown dramatically in the past decade, and in 2007 investment reached over **$13 billion.**
- U.S. investment in wind energy projects grew from $250 million in 2001 to **over $8 billion in 2007**.
- In 2007, U.S. venture capital investment in renewable energy technology companies was **$2.5 billion** – up from $30 million in 2001.
- U.S. venture capital investment in solar technology companies has increased from $5 million in 2001 to over **$1 billion** in 2007.

U.S. Investment in Renewable Energy Projects 2001-2007



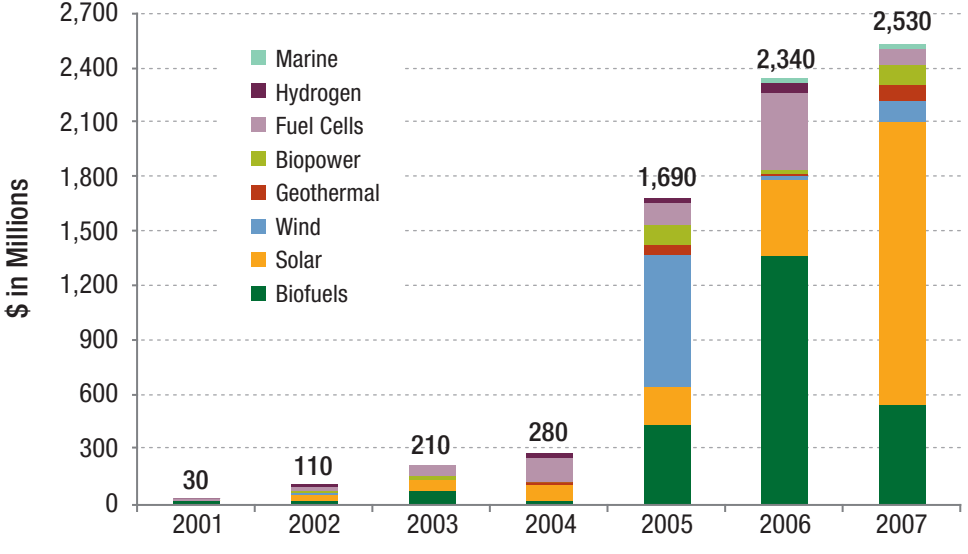
Note: "Investment" figures include project investment.
Figures represent Disclosed Deals derived from New Energy Finance's Desktop database.

U.S. Investment in Wind Energy Projects 2001-2007



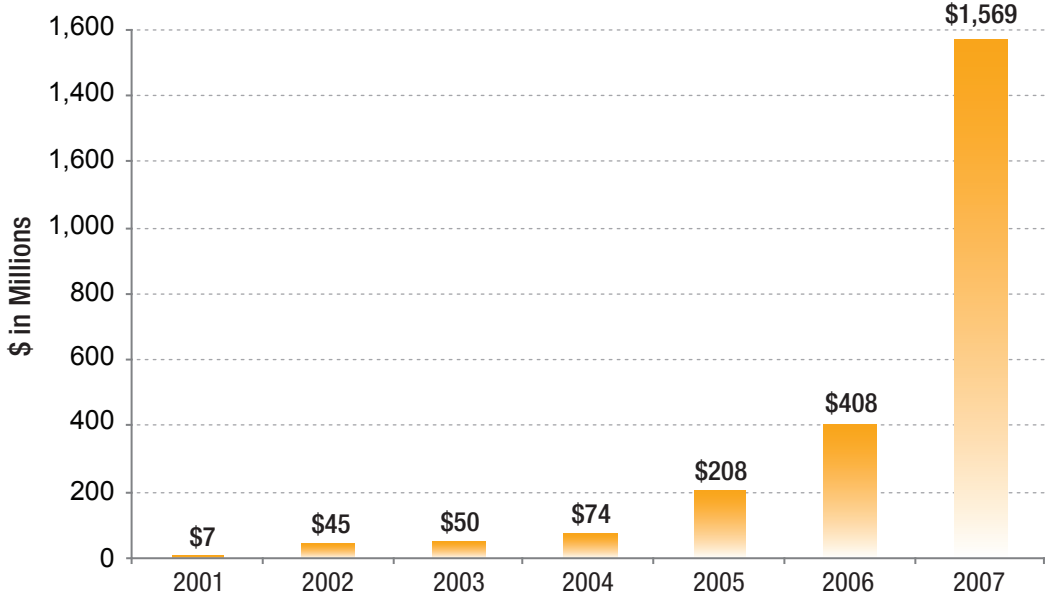
Figures represent Disclosed Deals derived from New Energy Finance's Desktop database

U.S. Venture Capital Investment in Renewable Energy Technology Companies, 2001-2007



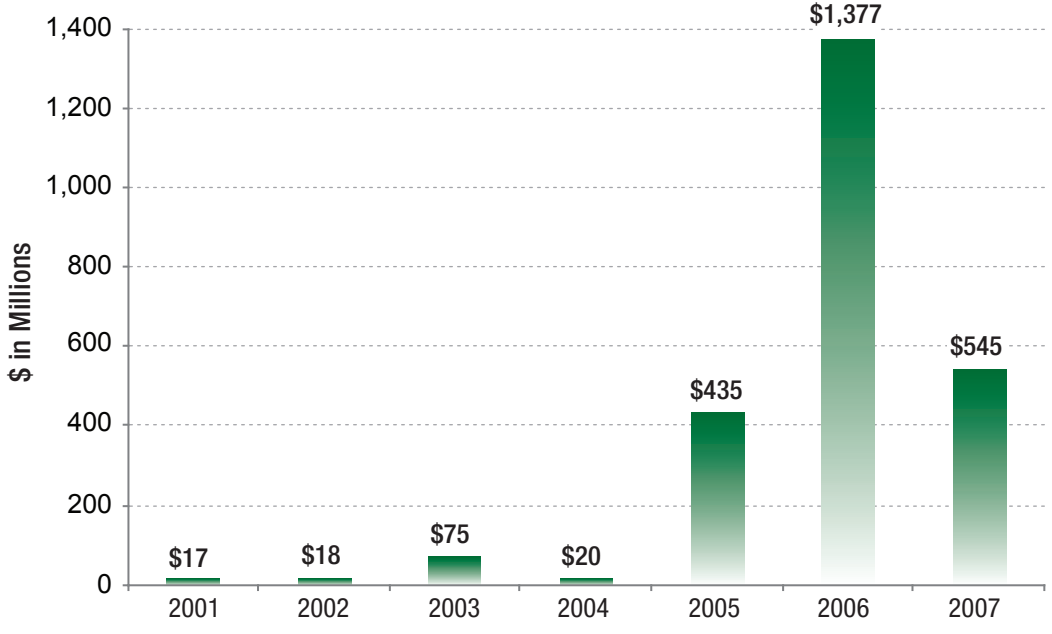
Figures represent Disclosed Deals derived from New Energy Finance's Desktop database

U.S. Venture Capital Investment in Solar Energy Technology Companies, 2001-2007



Figures represent Disclosed Deals derived from New Energy Finance's Desktop database

U.S. Venture Capital Investment in Biofuels Technology Companies, 2001-2007



Figures represent Disclosed Deals derived from New Energy Finance's Desktop database

Base load capacity

The generating equipment normally operated to serve loads on an around-the-clock basis.

Biodiesel

Any liquid biofuel suitable as a diesel fuel substitute or diesel fuel additive or extender. Biodiesel fuels are typically made from oils such as soybeans, rapeseed, or sunflowers, or from animal tallow. Biodiesel can also be made from hydrocarbons derived from agricultural products such as rice hulls.

Biofuels

Liquid fuels and blending components produced from biomass (plant) feedstocks, used primarily for transportation.

Biomass

Organic non-fossil material of biological origin constituting a renewable energy source.

British Thermal Unit (Btu)

The quantity of heat required to raise the temperature of 1 pound of liquid water by 1 degree Fahrenheit at the temperature at which water has its greatest density (approximately 39 degrees Fahrenheit).

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.

Compound Annual Growth Rate

The year over year growth rate applied over a multiple-year period. The formula for calculating CAGR is (Current Value/Base Value)^(1/# of years) - 1.

Concentrating Solar Power (CSP)

A solar energy conversion system characterized by the optical concentration of solar rays through an arrangement of mirrors to heat working fluid to a high temperature. Concentrating solar power (but not solar thermal power) may also refer to a system that focuses solar rays on a photovoltaic cell to increase conversion efficiency.

Cost

The amount paid to produce a good or service. Cost represents the sum of the value of the inputs in production

Direct Use

Use of electricity that 1) is self-generated, 2) is produced by either the same entity that consumes the power or an affiliate, and 3) is used in direct support of a service or industrial process located within the same facility or group of facilities that house the generating equipment. Direct use is exclusive of station use.

E85

A fuel containing a mixture of 85 percent ethanol and 15 percent gasoline.

Glossary

Ethanol

A clear, colorless, flammable oxygenated hydrocarbon. 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. It is used in the United States as a gasoline octane enhancer and oxygenate (blended up to 10 percent concentration). Ethanol can also be used in high concentrations (E85) in vehicles designed for its use.

Federal Energy Regulatory Commission (FERC)

The Federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within the Department of Energy and is the successor to the Federal Power Commission.

Flexible-Fuel Vehicles

Vehicles that can operate on (1) alternative fuels (such as E85); (2) 100-percent petroleum-based fuels; (3) any mixture of an alternative fuel (or fuels) and a petroleum-based fuel. Flexible fuel vehicles have a single fuel system to handle alternative and petroleum-based fuels.

Fuel Cell

A device capable of generating an electrical current by converting the chemical energy of a fuel (e.g., hydrogen) 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. It does not contain an intermediate heat cycle, as do most other electrical generation techniques.

Gasoline Pool

All gasoline produced by volume, including any additions such as ethanol or MTBE.

Generation

The total amount of electric energy produced by generating units and measured at the generating terminal in kilowatt-hours (kWh) or megawatt-hours (MWh).

Geothermal Energy

The heat that is extracted from hot water or steam that is mined from geothermal reservoirs in the earth's crust. Water or steam can be used as a working fluid for geothermal heat pumps, water heating, or electricity generation, and then is reinjected back into the earth.

Geothermal Heat Pump

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.

Gigawatt (GW)

One billion watts or one thousand megawatts.

Gigawatt-hour (GWh)

One billion watthours.

Incremental Capacity

Capacity added on an annual basis.

Insolation

The amount of radiation from the sun received at the surface of the earth in a particular geographic location or region.

Kilowatt (kW)

One thousand watts.

Kilowatt-hour (kWh)

A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,412 Btu.

Landfill Gas

Gas that is generated by decomposition of organic material at landfill disposal sites. The average composition of landfill gas is approximately 50 percent methane and 50 percent carbon dioxide and water vapor by volume. The methane in landfill gas may be vented, flared, combusted to generate electricity or useful thermal energy on-site, or injected into a pipeline for combustion off-site.

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).

Megawatt (MW)

One million watts of electricity.

Megawatt-hour (MWh)

One thousand kilowatt-hours or 1 million watt-hours.

Municipal Solid Waste

Residential solid waste and some nonhazardous commercial, institutional, and industrial wastes.

Nameplate Capacity

The maximum rated output of a generator under specific conditions designated by the manufacturer. Nameplate capacity is usually indicated in units of kilovolt-amperes (kVA) and in kilowatts (kW) on a nameplate physically attached to the generator.

Ocean Energy

Energy conversion technologies that harness the energy in tides, waves, and thermal gradients in the oceans.

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).

Price

The amount paid to acquire a good or service.

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.

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.

Solar Thermal Collector

A device designed to receive solar radiation and convert it to thermal energy. Normally, a solar thermal collector includes a frame, glazing, and an absorber, together with appropriate insulation. The heat collected by the solar collector may be used immediately or stored for later use. Solar collectors are used for space heating; domestic hot water heating; and heating swimming pools, hot tubs, or spas.

Thermoelectric Power Plant

A term used to identify a type of electric generating station, capacity, capability, or output in which the source of energy for the prime mover is heat.

Wind Energy

Kinetic energy present in wind motion that can be converted to mechanical energy for driving pumps, mills, and electric power generators.

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