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

2014 Renewable Energy Data Book

Acknowledgments

This report was produced by Philipp Beiter, edited by Karin Haas, and designed by Stacy Buchanan of the U.S. Department of Energy's National Renewable Energy Laboratory (NREL). We greatly appreciate the input, review, and support of Ookie Ma, Steve Capanna, Fred Joseck, Jay Nathwani, Tien Nguyen, Christopher Richard, Paul Spitsen, Lauren Boyd, and Cara Marcy of the U.S. Department of Energy (DOE), as well as Chad Augustine, Jerry Davis, Sean Esterly, David Feldman, Ran Fu, Caley Johnson, Eric Lantz, Al LiVecchi, Jeff Logan, David Mooney, Robin Newmark, Gian Porro, Paul Schwabe, Aaron Smith, Tian Tian, Tom Williams, and Keith Wipke of NREL.

Capacity data are reported in watts of alternating current (AC) unless indicated otherwise.

The primary data represented and synthesized in the *2014 Renewable Energy Data Book* come from the publicly available data sources identified on page 121.

Front page inset photos (left to right): iStock/754519, iStock/4393369, iStock/354309, iStock/2101722, iStock/2574180, iStock/5080552, Leslie Eudy, NREL 17854, iStock/11265066

Page 2: iStock/721000, page 6: iStock/5751076, page 17: photo from Invenergy LLC, NREL 14369, page 41: iStock/750178, page 52: iStock/ 754519, page 61: iStock/4393369, page 69: iStock/354309, page 75: iStock/2101722, page 80: iStock/2574180, page 84: iStock/5080552, Page 89: photo by Leslie Eudy, NREL 17854, page 97: iStock/11265066, page 107: iStock/330791, page 116 : iStock/3459287

Key Findings

- **The United States' overall energy consumption** grew to 98.3 quadrillion British thermal units (Btu) in 2014, a **1% increase** from 2013. Energy consumption from renewables (+3.1%), natural gas (+2.6%), nuclear (+1%), and petroleum (+0.5%) increased compared to 2013, while consumption from coal declined by 0.8%.

- The United States' **electric power sector energy consumption** grew to 38.6 quadrillion Btu in 2014, a **0.5% increase** from 2013.[1]

- **In 2014, U.S. renewable electricity[2] grew to 15.5% of total installed capacity and 13.5% of total electricity generation**. Installed renewable electricity capacity exceeded 179 gigawatts (GW) in 2014, generating 554 terawatt-hours (TWh).

- In 2014, **U.S. hydropower produced nearly half of total renewable electricity generation, wind produced 33%, biomass produced 12%**, solar photovoltaics (PV) and concentrating solar power (CSP) **produced 6%, and geothermal produced 3%.**

- In 2014, renewable electricity accounted for **more than 50% of U.S. electricity capacity additions.**

[1] Source: Energy Information Administration (EIA); full references are provided beginning on page 122.
[2] Unless noted, renewable electricity includes hydropower and biopower.

Key Findings (continued)

- In 2014, **solar electricity installed capacity increased by more than 54%** (5.5 GW), accounting for more than **48% of U.S. renewable electricity capacity installed in 2014.**
- U.S. **wind electricity generation increased by 8.3% in 2014.** Wind electricity capacity grew by 7.8% (4.8 GW).
- U.S. electricity capacities of **biomass, geothermal, and hydropower have remained relatively stable** from 2000 to 2014.
- **Installed global renewable electricity capacity continued to increase and represents 28.5% of total electricity capacity globally in 2014.**[1]
- **Worldwide, solar PV and CSP** are among the **fastest growing renewable electricity technologies**—in 2014 alone, combined capacity increased by more than 28% globally.
- In 2014, **the United States led the world in biodiesel production**, followed by Germany, Brazil, Argentina, France, and Indonesia.
- **Globally, new investments in renewables in 2014 grew by 16% from 2013 to $310 billion.**

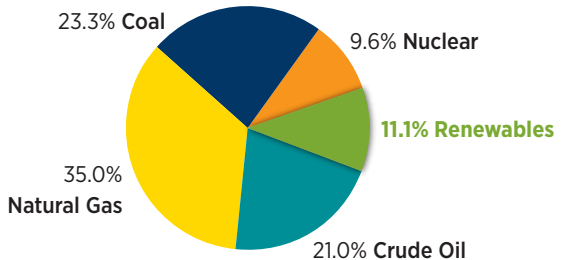
[1] Source: EIA

Table of Contents

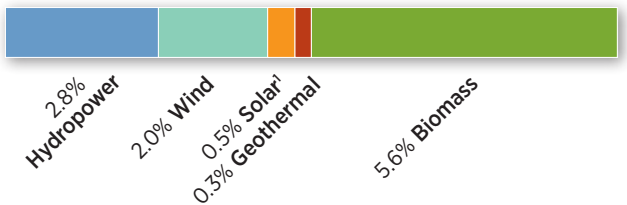
I. U.S. Energy Background Information

U.S. Energy Production and Consumption (2014)

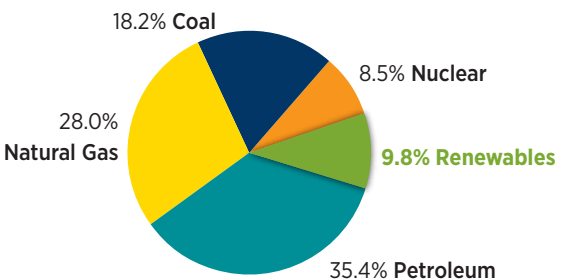
U.S. Energy Production (2014): 87.0 Quadrillion Btu



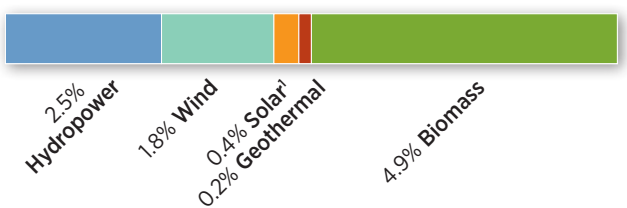
U.S. Renewable Energy Production: 9.7 Quadrillion Btu



U.S. Energy Consumption (2014): 98.3 Quadrillion Btu



U.S. Renewable Energy Consumption: 9.6 Quadrillion Btu



Source: EIA

The difference in the amount of energy consumed and produced is made up by net imports and changes in stockpiles of energy.

All data are reported as primary energy.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

[1] Solar PV data include only on-grid systems of 1 MW or higher in capacity. Grid-connected distributed capacity and associated generation of 1 MW or less, a rapidly growing market segment, is included in subsequent figures in later sections.

U.S. Energy Production by Energy Source

	Coal	Natural Gas[1]	Crude Oil	Nuclear	Renewables	Total Production (Quadrillion Btu)
2004	32.5%	30.7%	16.4%	11.7%	8.6%	70.2
2005	33.4%	30.1%	15.8%	11.8%	9.0%	69.4
2006	33.6%	30.2%	15.2%	11.6%	9.3%	70.7
2007	32.9%	31.1%	15.0%	11.8%	9.1%	71.4
2008	32.6%	31.6%	14.5%	11.5%	9.9%	73.2
2009	29.8%	32.6%	15.6%	11.5%	10.5%	72.7
2010	29.5%	32.9%	15.5%	11.3%	10.9%	74.8
2011	28.5%	33.8%	15.3%	10.6%	11.8%	78.0
2012	26.1%	35.2%	17.4%	10.2%	11.1%	79.2
2013	24.4%	34.8%	19.2%	10.1%	11.4%	82.0
2014	23.3%	35.0%	21.0%	9.6%	11.1%	87.0

Source: EIA

Annual totals may not equal 100% due to rounding.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

[1] Includes natural gas liquids.

U.S. Energy Consumption by Energy Source

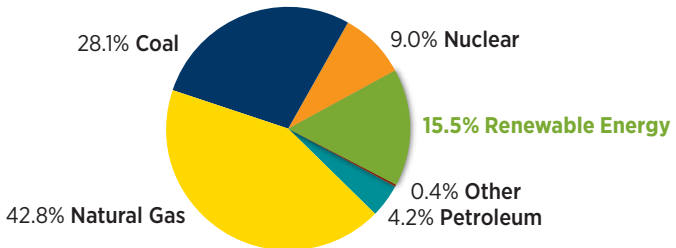
	Coal	Natural Gas	Petroleum	Nuclear	Renewables	Total Consumption (Quadrillion Btu)
2004	22.5%	22.9%	40.2%	8.2%	6.1%	100.0
2005	22.8%	22.5%	40.2%	8.1%	6.2%	100.2
2006	22.6%	22.4%	40.1%	8.3%	6.7%	99.4
2007	22.5%	23.4%	39.1%	8.4%	6.5%	101.0
2008	22.6%	24.1%	37.3%	8.5%	7.3%	99.0
2009	20.9%	24.9%	37.1%	8.9%	8.1%	94.1
2010	21.4%	25.2%	36.4%	8.7%	8.3%	97.5
2011	20.3%	25.7%	35.9%	8.5%	9.4%	97.0
2012	18.4%	27.6%	36.0%	8.5%	9.3%	94.5
2013	18.6%	27.6%	35.6%	8.5%	9.6%	97.2
2014	18.2%	28.0%	35.4%	8.5%	9.8%	98.3

Source: EIA

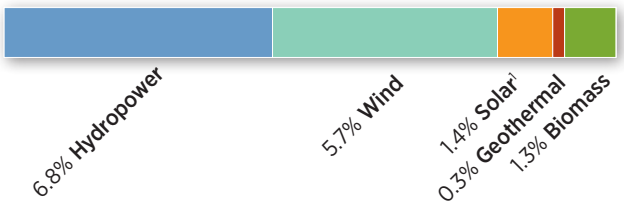
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

U.S. Electricity Nameplate Capacity and Generation (2014)

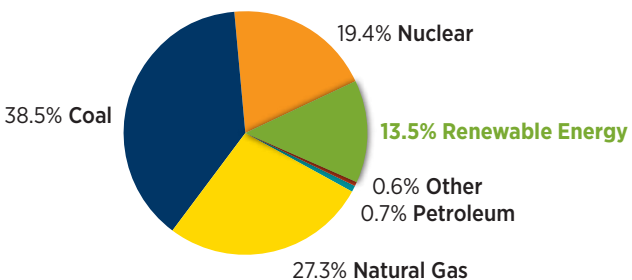
U.S. Electric Nameplate Capacity (2014): 1,158 GW



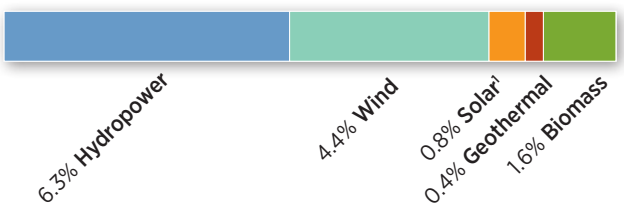
U.S. Renewable Capacity: 180 GW



U.S. Electric Net Generation (2014): 4,113 TWh



U.S. Renewable Generation: 554 TWh



Sources: EIA, Solar Energy Industries Association (SEIA)/GTM Research (GTM)

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

Totals and percentages may not correspond due to rounding.

[1] Grid-connected only. Solar generation assumes a 25% capacity factor for CSP and an 18% capacity factor for PV. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

U.S. Electricity Generating Capacity by Source

	Coal	Petroleum	Natural Gas	Other Gases	Nuclear	Renewables[1]	Other	Total Capacity (MW)
2004	32.5%	6.3%	41.0%	0.2%	10.2%	9.6%	0.1%	1,030,025
2005	32.1%	6.2%	41.7%	0.2%	10.1%	9.7%	0.1%	1,047,655
2006	31.8%	6.1%	41.9%	0.2%	10.0%	9.9%	0.1%	1,056,216
2007	31.5%	5.8%	42.1%	0.2%	9.9%	10.3%	0.1%	1,066,842
2008	30.5%	5.6%	41.4%	0.2%	9.6%	11.1%	0.1%	1,082,975
2009	30.7%	5.7%	41.7%	0.2%	9.7%	11.9%	0.1%	1,101,987
2010	30.6%	5.6%	41.7%	0.3%	9.5%	12.2%	0.1%	1,119,603
2011	30.3%	5.1%	42.1%	0.2%	9.4%	12.8%	0.1%	1,134,997
2012	29.2%	4.7%	42.3%	0.2%	9.4%	14.1%	0.1%	1,150,110
2013	28.8%	4.5%	42.6%	0.3%	9.0%	14.6%	0.1%	1,152,303
2014	28.1%	4.2%	42.8%	0.3%	9.0%	15.5%	0.1%	1,158,416

Sources: EIA, SEIA/GTM

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

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected PV only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

U.S. Electricity Generation by Source

	Coal	Petroleum Liquids	Petroleum Coke	Natural Gas	Other Gases	Nuclear	Renewables[1]	Other	Total Generation (GWh)
2004	49.7%	2.5%	0.5%	17.8%	0.4%	19.8%	8.8%	0.4%	3,979,032
2005	49.5%	2.5%	0.6%	18.7%	0.3%	19.2%	8.8%	0.3%	4,062,583
2006	48.9%	1.1%	0.5%	20.0%	0.3%	19.3%	9.5%	0.3%	4,072,073
2007	48.4%	1.2%	0.4%	21.5%	0.3%	19.4%	8.5%	0.3%	4,164,743
2008	48.1%	0.8%	0.3%	21.4%	0.3%	19.5%	9.3%	0.3%	4,126,995
2009	44.4%	0.7%	0.3%	23.3%	0.3%	20.2%	10.6%	0.3%	3,956,877
2010	44.7%	0.6%	0.3%	23.9%	0.3%	19.5%	10.4%	0.3%	4,133,671
2011	42.2%	0.4%	0.3%	24.7%	0.3%	19.2%	12.6%	0.3%	4,112,099
2012	37.3%	0.3%	0.2%	30.2%	0.3%	18.9%	12.4%	0.3%	4,061,056
2013	38.7%	0.3%	0.3%	27.6%	0.3%	19.3%	13.1%	0.3%	4,082,706
2014	38.5%	0.5%	0.3%	27.3%	0.3%	19.4%	13.5%	0.3%	4,113,375

Sources: EIA, SEIA/GTM

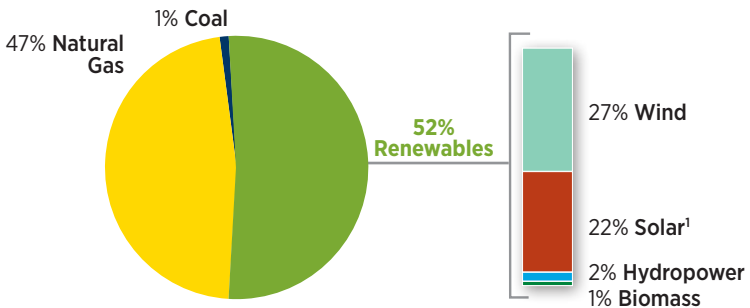
Other includes pumped storage, batteries, chemicals, hydrogen, pitch, purchased steam, sulfur, tire-derived fuels, and miscellaneous technologies.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

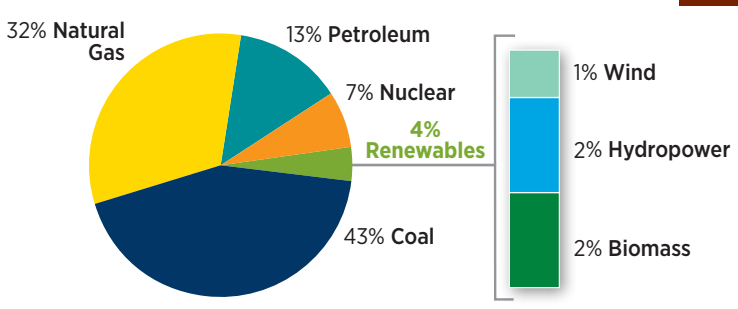
[1] Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

U.S. Electricity Generating Capacity Additions and Retirements (2014)

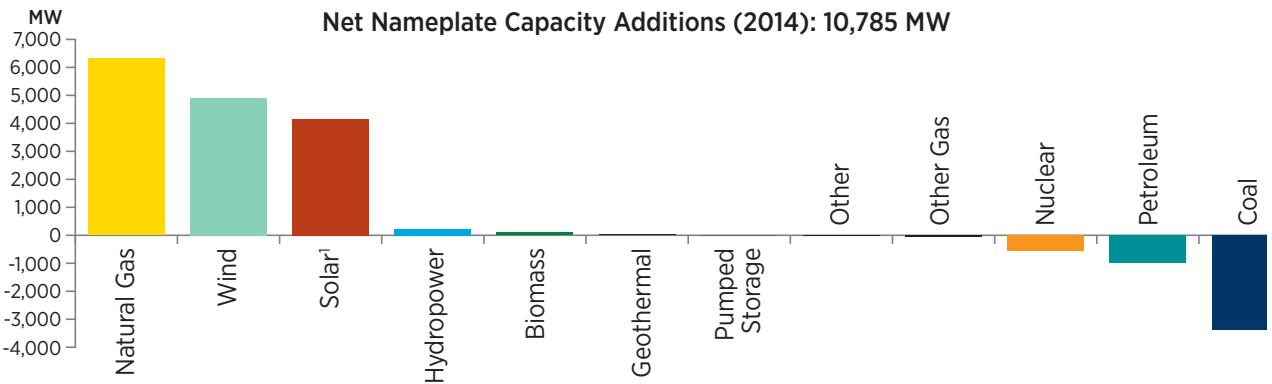
Capacity Additions (2014): 18,791 MW



Capacity Retirements (2014): 8,006 MW



Net Nameplate Capacity Additions (2014): 10,785 MW



Source: EIA

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

Capacity additions and retirements below 1% of total are not displayed.

Reported values for capacity additions may differ from those reported in other sections of the Data Book due to use of different data sources.

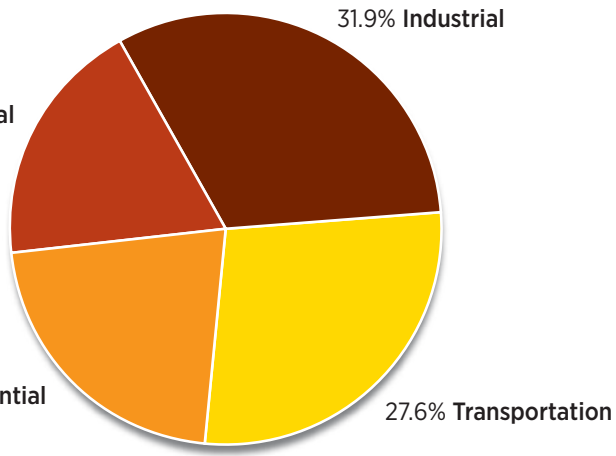
Totals may not equal 100% due to rounding.

[1] Includes only on-grid systems of 1 MW or higher in capacity.

U.S. Energy Consumption by Sector (2014)

U.S. Energy Consumption, 2014: 98.3 Quadrillion Btu

U.S. buildings represent 40.6% of total energy use.

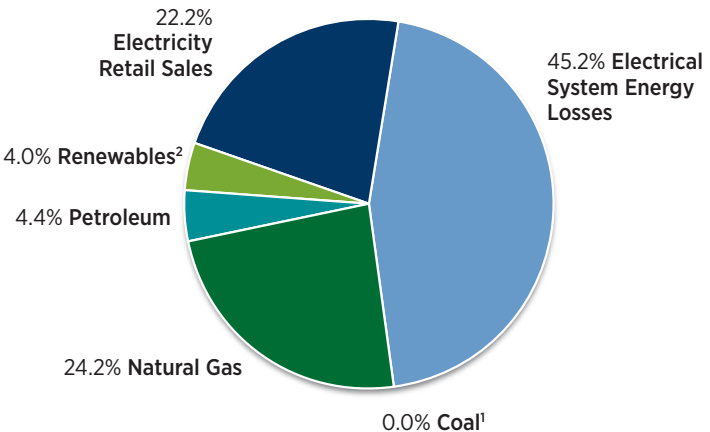


Source: EIA
Totals may not equal 100% due to rounding.

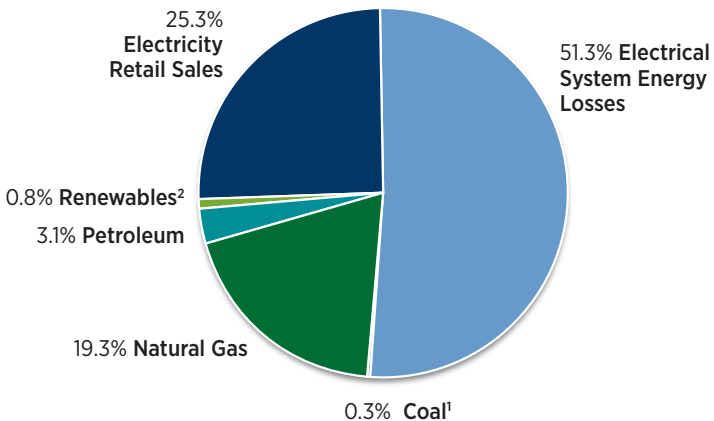
U.S. Energy Consumption – Residential and Commercial (2014)

I

2014 Residential Energy Consumption
21.5 Quadrillion Btu



2014 Commercial Energy Consumption
18.3 Quadrillion Btu



Source: EIA

[1] While coal is a small direct contributor to residential and commercial energy consumption, coal is a major fuel for electricity generation and therefore contributes to electricity retail sales and electrical system energy losses.

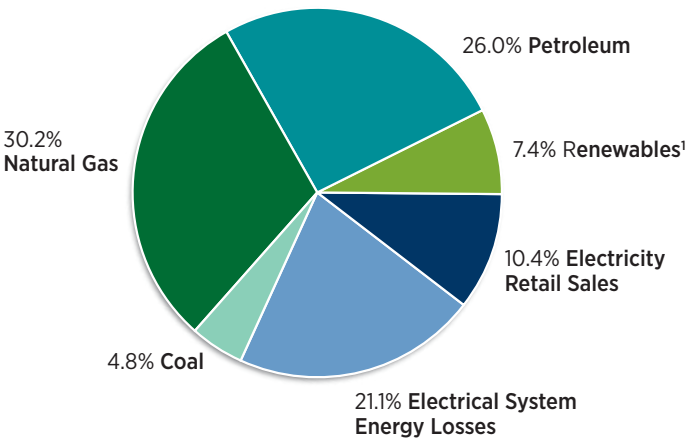
[2] The direct renewables contribution consists primarily of wood and wood-derived fuels, municipal solid waste, solar thermal direct-use energy and PV electricity net generation, and geothermal heat pump and direct-use energy.

U.S. Energy Consumption – Industry and Transportation (2014)

I

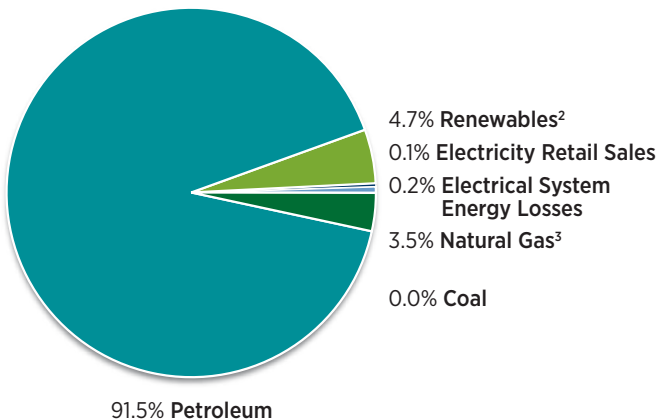
2014 Industrial Energy Consumption

31.4 Quadrillion Btu



2014 Transportation Energy Consumption

27.1 Quadrillion Btu



Source: EIA

[1] For industrial consumption, the direct renewables contribution consists primarily of wood and wood-derived fuels, municipal solid waste, and conventional hydropower.

[2] For transportation consumption, the direct renewables contribution consists primarily of fuel ethanol and biodiesel.

[3] For transportation consumption, more than 95% of natural gas is used to power natural gas pipeline compressors.

II. Renewable Electricity in the United States

Renewable Electricity in the United States: Summary

II

- U.S. renewable electricity in 2014 was **15.5% of total installed electricity capacity** and **13.5% of total annual generation in the United States.**

- Since 2004, cumulative installed renewable electricity capacity has grown 83%, from 98 GW to **more than 179 GW in 2014**, a **6.2% per year** compound annual growth rate (CAGR).

- **U.S. renewable electricity capacity expanded by 6.8% in 2014,** up from a 3.7% increase in 2013.

- Overall **renewable generation increased 3.7%** in 2014; wind electricity generation increased by 8.3% while generation from hydropower dropped by 3.7%.

- The United States' **non-hydro renewable annual electricity generation** has **more than doubled** since 2004.

Unless noted, renewable electricity includes hydropower and biopower.

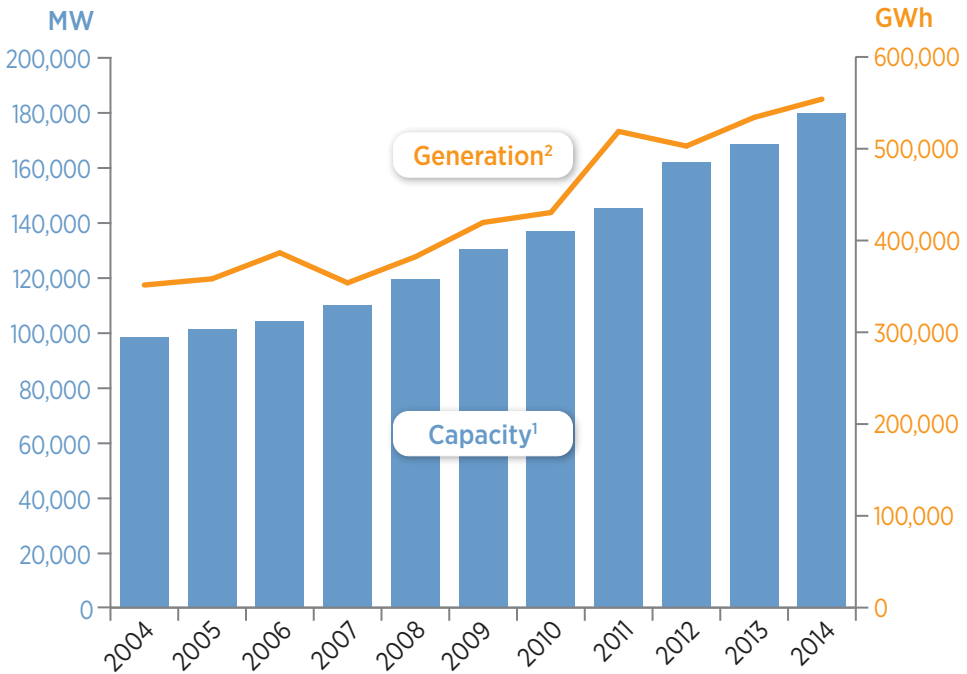
- **Wind** electricity capacity grew 4.8 GW in 2014, a 7.8% increase from 2013, to represent **5.7% of total U.S. cumulative installed electricity capacity.**

- **Solar electricity** accounted for over **48% of U.S. renewable electricity capacity installed in 2014.** Cumulative installed **PV capacity expanded by more than 51%** (6.2 GW_{dc}); **CSP capacity,** driven by a small number of large projects, increased **by nearly 84%** (0.8 GW_{ac}).

- Electricity capacities of **biomass, geothermal, and hydropower remained relatively stable** from 2000 to 2014.

- In 2014, **hydropower produced nearly half of total renewable electricity generation, wind produced 33%, biomass produced about 12%, solar** (PV and CSP) **produced 6%,** and **geothermal produced 3%.**

U.S. Capacity and Generation: All Renewables



	Total Nameplate Capacity[1] (MW)	Total Generation[2] (GWh)
2000	93,673	356,789
2001	95,243	288,017
2002	96,106	343,750
2003	97,770	355,695
2004	98,474	351,474
2005	101,379	358,254
2006	104,363	386,585
2007	110,049	353,849
2008	119,705	382,252
2009	130,664	419,643
2010	137,099	430,487
2011	145,373	518,874
2012	162,168	502,913
2013	168,268	534,134
2014	179,665	554,040

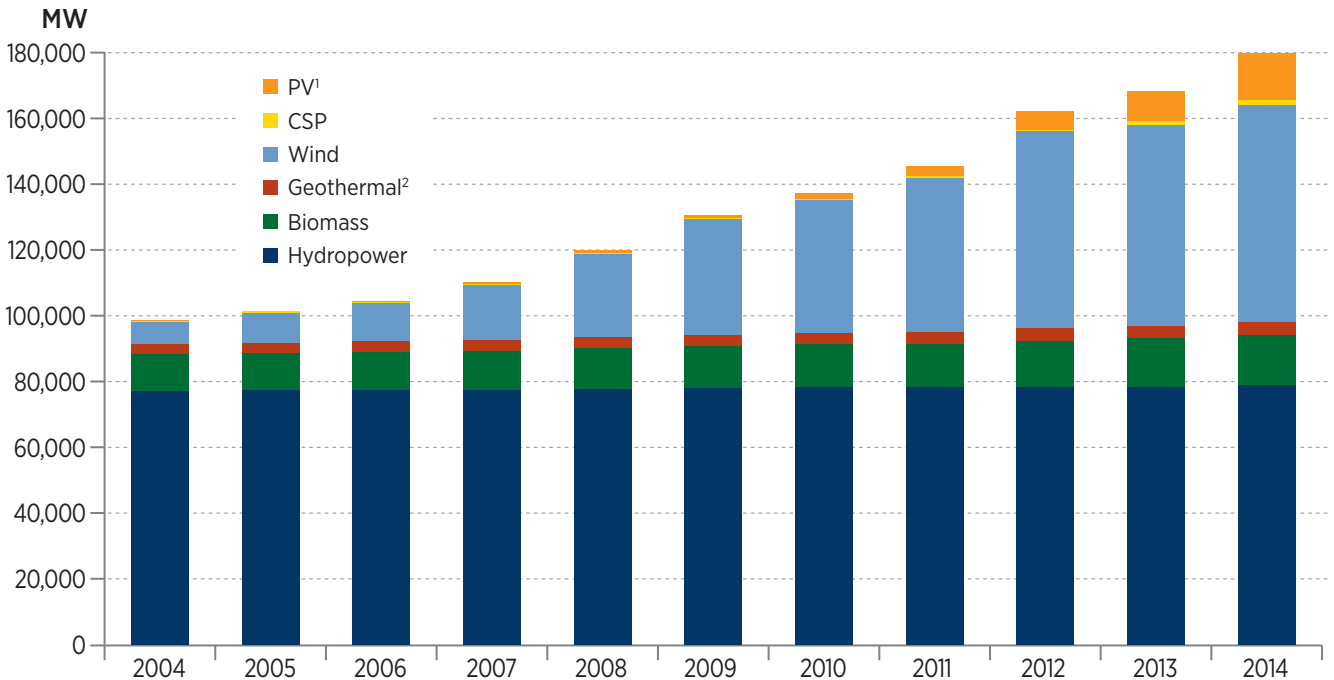
Sources: EIA, Lawrence Berkeley National Laboratory (LBNL), SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Includes grid-connected PV only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac. Reflects source change from Geothermal Energy Association (GEA) to EIA for geothermal capacity for all reported years.

[2] Solar generation assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

U.S. Renewable Electricity Nameplate Capacity by Source



Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

U.S. Renewable Electricity Nameplate Net Capacity Added (MW)

	Solar PV[1]	CSP	Wind	Geothermal[2]	Biomass	Hydropower	Total Capacity Added[3]	Capacity Added as a Percentage of Total Renewable Energy
2004	58	0	372	0	177	110	**704**	**1%**
2005	79	0	2,396	35	189	224	**2,905**	**3%**
2006	105	1	2,454	53	331	65	**2,984**	**3%**
2007	160	64	5,237	64	185	13	**5,686**	**5%**
2008	298	0	8,425	47	747	208	**9,657**	**8%**
2009	382	11	9,918	115	351	270	**10,959**	**8%**
2010	852	78	5,112	77	218	294	**6,435**	**5%**
2011	1,922	0	6,649	2	154	-10	**8,274**	**6%**
2012	3,369	0	13,089	224	840	47	**16,795**	**10%**
2013	4,776	410	1,102	37	658	216	**6,100**	**4%**
2014	6,201	767	4,772	28	703	353	**11,397**	**6%**

Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected only. Solar PV is reported in MWdc.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

Cumulative U.S. Renewable Electricity Nameplate Capacity (MW) and Annual Percent Change

	Hydropower	Solar PV[1]	CSP	Wind	Geothermal[2]	Biomass	Total Renewables[3]
2004	77,130 (0.1%)	161 (56.3%)	354 (0%)	6,725 (5.9%)	2,798 (0%)	11,033 (1.6%)	98,164 (0.7%)
2005	77,354 (0.3%)	240 (49.1%)	354 (0%)	9,121 (35.6%)	2,828 (1.1%)	11,222 (1.7%)	101,064 (3.0%)
2006	77,419 (0.1%)	345 (43.8%)	355 (0.3%)	11,575 (26.9%)	2,831 (1.7%)	11,553 (2.9%)	103,999 (2.9%)
2007	77,432 (0%)	505 (46.4%)	419 (18%)	16,812 (45.2%)	2,936 (2.0%)	11,738 (1.6%)	109,726 (5.5%)
2008	77,640 (0.3%)	803 (59%)	419 (0%)	25,237 (50.1%)	3,039 (1.4%)	12,485 (6.4%)	119,438 (8.9%)
2009	77,910 (0.3%)	1,185 (47.6%)	430 (2.6%)	35,155 (39.3%)	3,085 (3.5%)	12,836 (2.8%)	130,329 (9.1%)
2010	78,204 (0.4%)	2,037 (71.9%)	508 (18.1%)	40,267 (14.5%)	3,100 (2.3%)	13,053 (1.7%)	136,701 (4.9%)
2011	78,194 (0%)	3,959 (94.4%)	508 (0%)	46,916 (16.5%)	3,238 (0.1%)	13,207 (1.2%)	145,111 (6.2%)
2012	78,241 (0.1%)	7,328 (85.1%)	508 (0%)	60,005 (27.9%)	3,385 (6.4%)	14,047 (6.4%)	161,829 (11.5%)
2013	78,457 (0.3%)	12,140 (65.2%)	918 (80.7%)	61,107 (1.8%)	3,792 (1.0%)	14,705 (4.7%)	168,299 (4.0%)
2014	78,809 (0.4%)	18,305 (51.2%)	1,685 (83.6%)	65,879 (7.8%)	3,789 (0.7%)	15,408 (4.8%)	179,665 (6.8%)

- annual decrease annual increase +

Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected only. Solar PV is reported in MWdc

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

U.S. Renewable Electricity Capacity as a Percentage of Total Electricity Capacity

	Hydropower	Solar PV[1]	CSP	Wind	Geothermal[2]	Biomass	Total Renewables[3]
2004	7.5%	0.0%	0.0%	0.7%	0.3%	1.1%	9.5%
2005	7.4%	0.0%	0.0%	0.9%	0.3%	1.1%	9.6%
2006	7.3%	0.0%	0.0%	1.1%	0.3%	1.1%	9.8%
2007	7.3%	0.0%	0.0%	1.6%	0.3%	1.1%	10.3%
2008	7.2%	0.1%	0.0%	2.3%	0.3%	1.2%	11.0%
2009	7.1%	0.1%	0.0%	3.2%	0.3%	1.2%	11.8%
2010	7.0%	0.1%	0.0%	3.6%	0.3%	1.2%	12.2%
2011	6.9%	0.3%	0.0%	4.1%	0.3%	1.2%	12.8%
2012	6.8%	0.5%	0.0%	5.2%	0.3%	1.2%	14.1%
2013	6.8%	1.0%	0.1%	5.3%	0.3%	1.3%	14.6%
2014	6.8%	1.2%	0.1%	5.7%	0.3%	1.3%	15.5%

Sources: EIA, LBNL, SEIA/GTM

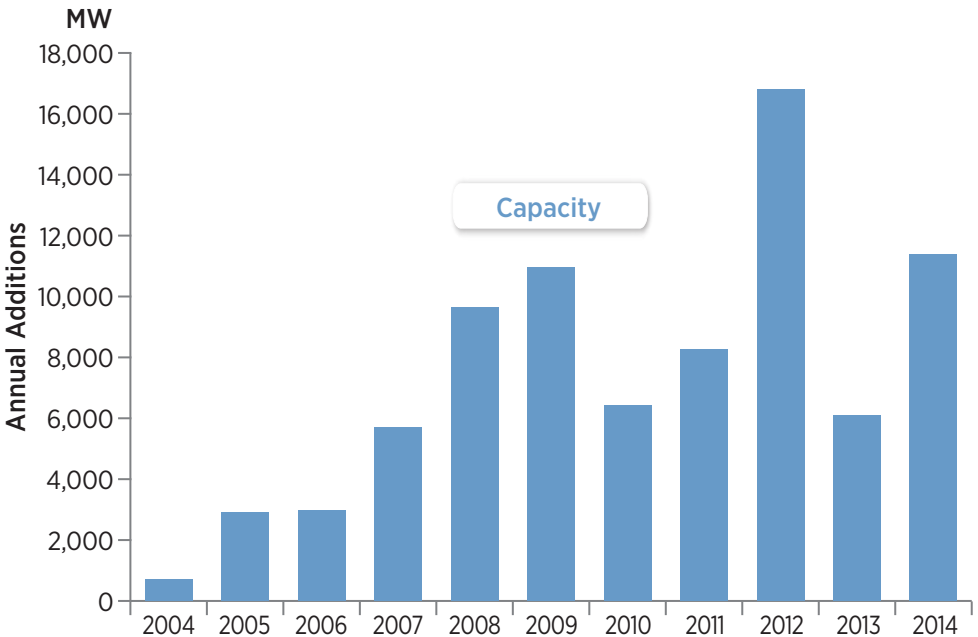
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected only. Solar PV is reported in MWdc

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

U.S. Annual Installed Renewable Electricity Capacity Growth



	Compound Annual Growth Rate (2004–2014)
Wind	**25.6%**
Solar PV[1]	**60.5%**
CSP	**16.9%**
Biomass	**3.4%**
Geothermal[2]	**3.1%**
Hydropower	**0.2%**
All Renewables[3]	**6.2%**

Sources: EIA, LBNL, SEIA/GTM

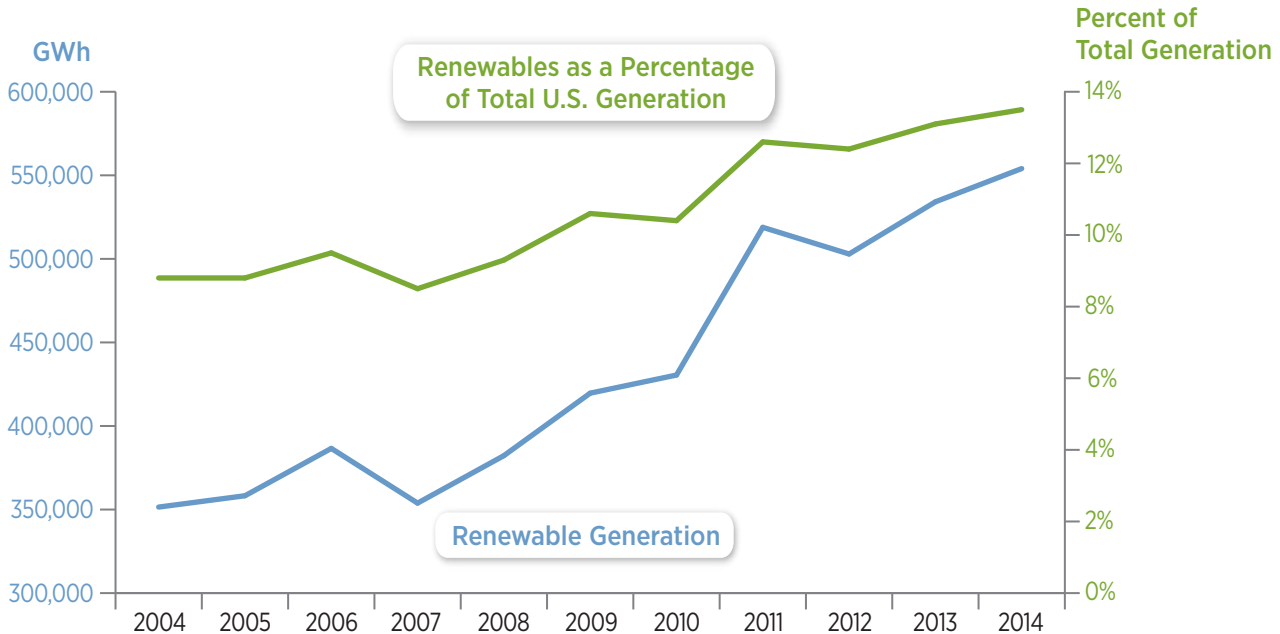
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

U.S. Renewable Electricity Generation

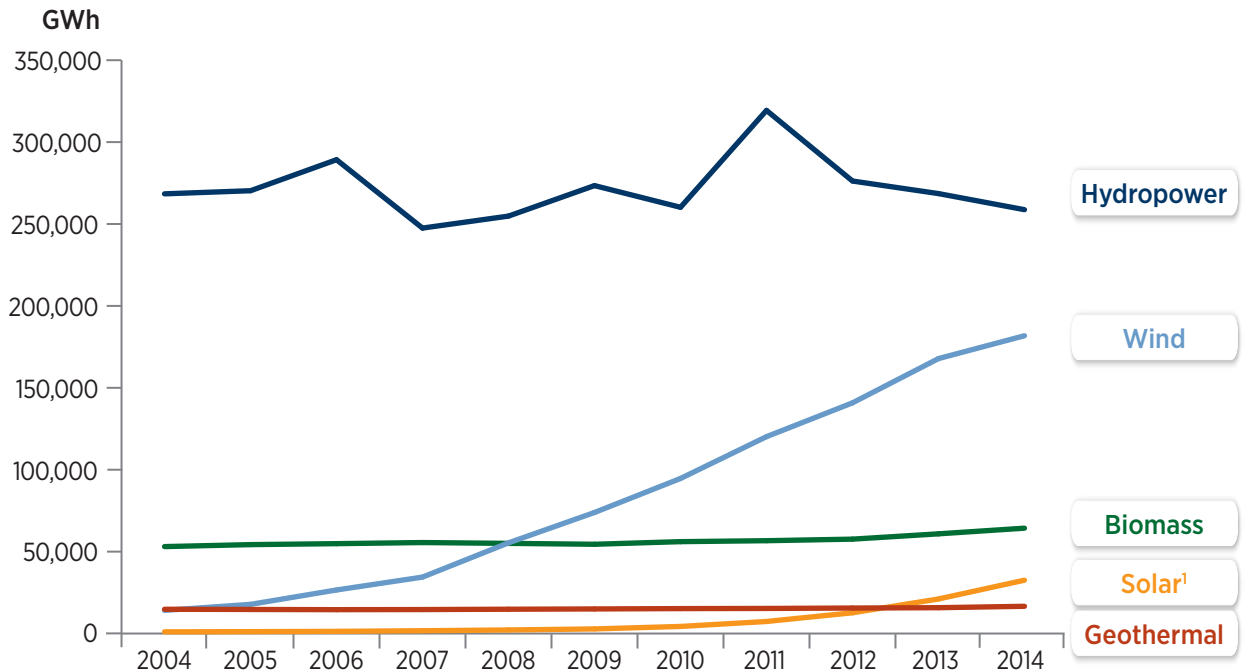


Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

U.S. Renewable Electricity Generation by Technology

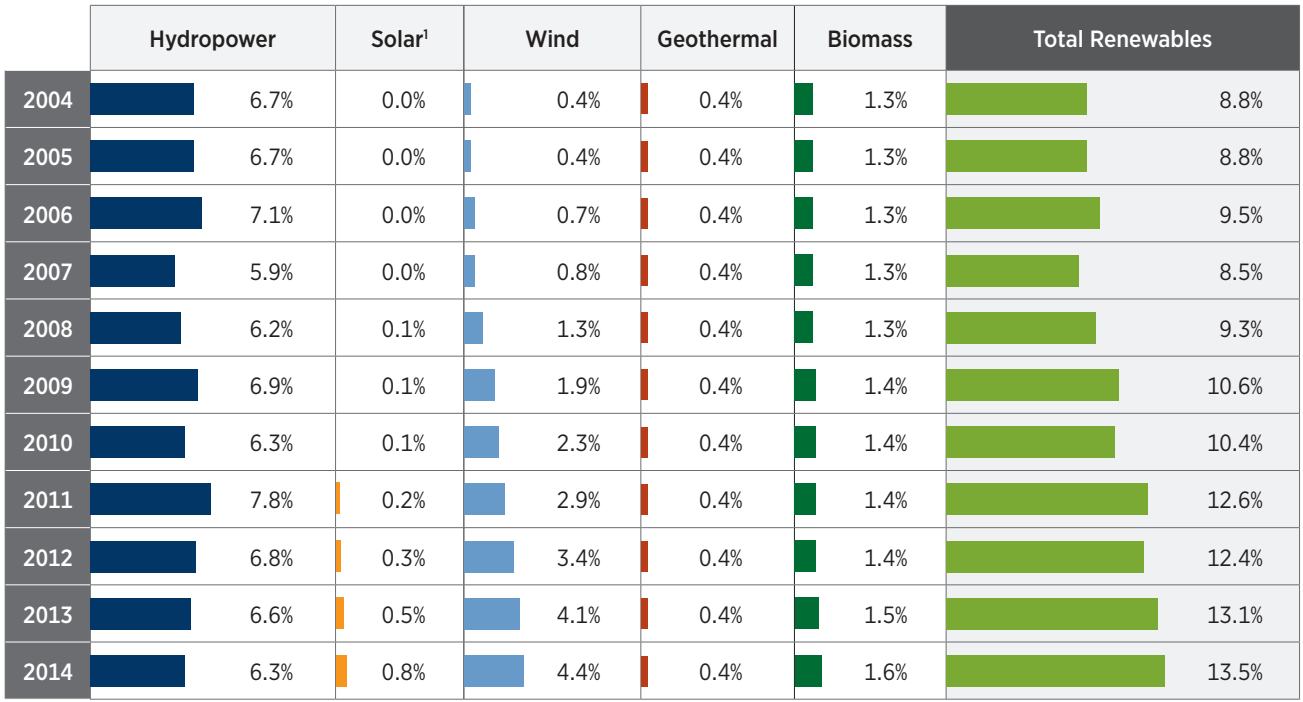


Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

U.S. Renewable Electricity Generation as a Percentage of Total Generation



	Hydropower	Solar[1]	Wind	Geothermal	Biomass	Total Renewables
2004	6.7%	0.0%	0.4%	0.4%	1.3%	8.8%
2005	6.7%	0.0%	0.4%	0.4%	1.3%	8.8%
2006	7.1%	0.0%	0.7%	0.4%	1.3%	9.5%
2007	5.9%	0.0%	0.8%	0.4%	1.3%	8.5%
2008	6.2%	0.1%	1.3%	0.4%	1.3%	9.3%
2009	6.9%	0.1%	1.9%	0.4%	1.4%	10.6%
2010	6.3%	0.1%	2.3%	0.4%	1.4%	10.4%
2011	7.8%	0.2%	2.9%	0.4%	1.4%	12.6%
2012	6.8%	0.3%	3.4%	0.4%	1.4%	12.4%
2013	6.6%	0.5%	4.1%	0.4%	1.5%	13.1%
2014	6.3%	0.8%	4.4%	0.4%	1.6%	13.5%

Sources: EIA, LBNL, SEIA/GTM

Totals may not equal 100% due to rounding.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

U.S. Renewable Electricity Generation (GWh) and Annual Percent Change

	Hydropower	Solar[1]	Wind	Geothermal	Biomass	All Renewables
2004	268,417 (-2.7%)	1,029 (9.8%)	14,144 (26.4%)	14,811 (2.7%)	53,073 (-0.5%)	351,474 (-1.2%)
2005	270,321 (0.7%)	1,154 (12.1%)	17,811 (25.9%)	14,692 (-0.8%)	54,276 (2.3%)	358,254 (1.9%)
2006	289,246 (7.0%)	1,321 (14.5%)	26,589 (49.3%)	14,568 (-0.8%)	54,861 (1.1%)	386,585 (7.9%)
2007	247,510 (-14.4%)	1,714 (29.7%)	34,450 (29.6%)	14,637 (0.5%)	55,539 (1.2%)	353,849 (-8.5%)
2008	254,831 (3.0%)	2,184 (27.4%)	55,363 (60.7%)	14,840 (1.4%)	55,034 (-0.9%)	382,252 (8.0%)
2009	273,455 (7.3%)	2,810 (28.7%)	73,886 (33.5%)	15,009 (1.1%)	54,493 (-1.0%)	419,643 (9.8%)
2010	260,203 (-4.8%)	4,324 (53.9%)	94,652 (28.1%)	15,219 (1.4%)	56,089 (2.9%)	430,487 (2.6%)
2011	319,355 (22.7%)	7,355 (70.1%)	120,177 (27.0%)	15,316 (0.6%)	56,671 (1.0%)	518,874 (20.5%)
2012	276,240 (-13.5%)	12,667 (72.2%)	140,822 (17.2%)	15,562 (1.6%)	57,622 (1.7%)	502,913 (-3.1%)
2013	268,565 (-2.8%)	21,096 (66.5%)	167,840 (19.2%)	15,775 (1.4%)	60,858 (5.6%)	534,134 (6.2%)
2014	258,749 (-3.7%)	32,553 (54.3%)	181,791 (8.3%)	16,628 (5.4%)	64,319 (5.7%)	554,040 (3.7%)

- annual decrease | annual increase +

Sources: EIA, LBNL, SEIA/GTM

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Includes generation from CSP and grid-connected PV; assumes a 25% capacity factor for CSP and an 18% capacity factor for PV.

State Renewable Energy Information: Summary

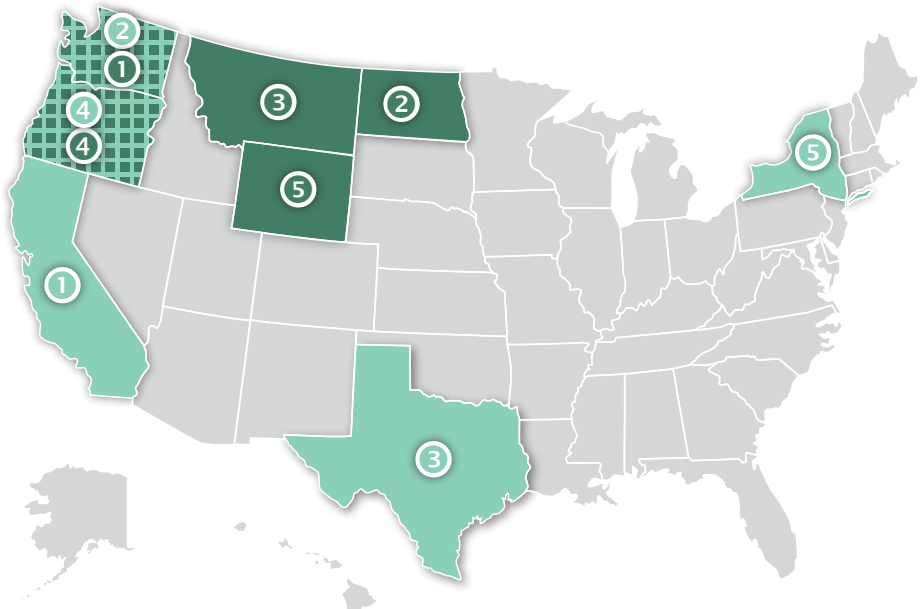
- In 2014, **California had the most installed renewable electricity capacity** of any U.S. state (more than 28 GW), followed by Washington (nearly 25 GW) and Texas (approximately 16 GW).

- In per capita terms, Washington had the most installed renewable electricity capacity, followed by North Dakota and Montana. **Growth in installed renewable electricity capacity** in 2014 was **largest on a percentage basis in Nebraska** (which increased its wind capacity by more than 50%), **Kentucky** (added 24% to its hydropower capacity), and **Mississippi** (added nearly 21% to its biomass capacity).

- **California installed more than 3.5 GW_{dc} of PV capacity** in 2014 (35% more than it installed in 2013) and **nearly 0.8 GW of CSP** (more than five times the capacity it installed in 2013), **the most of any state for both technologies.**

- **Texas installed more than 1.8 GW of wind capacity** in 2014 and continued to lead other states in wind capacity with a cumulative 14 GW installed.

Top States for Cumulative Renewable Electricity Installed Capacity (2014)



Total Renewables	
1	California
2	Washington
3	Texas
4	Oregon
5	New York

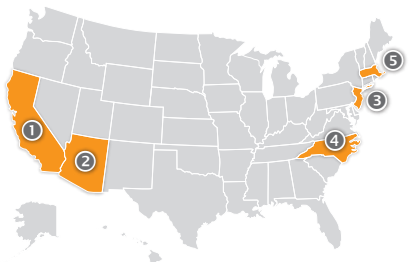
Per Capita Renewables	
1	Washington
2	North Dakota
3	Montana
4	Oregon
5	Wyoming

Sources: EIA, LBNL, SEIA/GTM, U.S. Census

Includes grid-connected PV only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

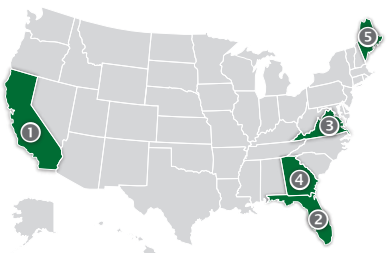
Reflects source change from GEA to EIA for geothermal capacity for all reported years.

Top States for Cumulative Renewable Electricity Installed Capacity (2014)

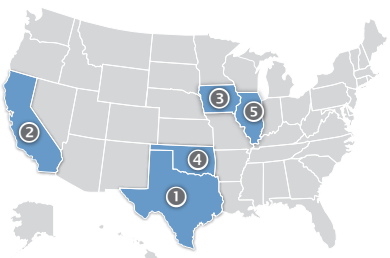


Solar PV[1]
1 California
2 Arizona
3 New Jersey
4 North Carolina
5 Massachusetts

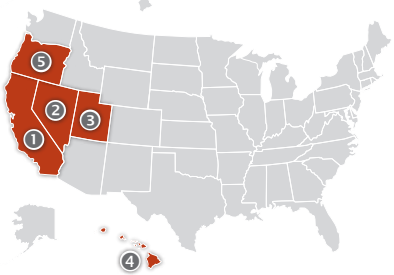
CSP
1 California
2 Arizona
3 Florida
4 Nevada
5 Hawaii



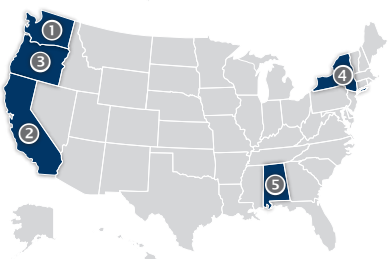
Biomass
1 California
2 Florida
3 Virginia
4 Georgia
5 Maine



Wind
1 Texas
2 California
3 Iowa
4 Oklahoma
5 Illinois



Geothermal[2]
1 California
2 Nevada
3 Utah
4 Hawaii
5 Oregon



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

Sources: EIA, LBNL, SEIA/GTM

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

Cumulative Renewable Electricity Installed Capacity (MW) (2014)
NORTHEAST

	Wind	PV[1]	CSP	Geothermal[2]	Biomass	Hydropower	Total Renewables[3]	Per capita Renewable Electricity watts/person
Connecticut	0	119	0	0	263	119	**473**	**131**
Maine	440	0	0	0	729	717	**1,885**	**1,417**
Massachusetts	107	751	0	0	355	269	**1,309**	**194**
New Hampshire	171	8	0	0	282	448	**907**	**683**
New Jersey	9	1,451	0	0	264	13	**1,404**	**157**
New York	1,748	397	0	0	608	4,669	**7,331**	**371**
Pennsylvania	1,340	245	0	0	649	920	**3,097**	**242**
Rhode Island	9	0	0	0	40	3	**52**	**49**
Vermont	120	70	0	0	86	318	**577**	**921**

Sources: EIA, LBNL, SEIA/GTM, U.S. Census

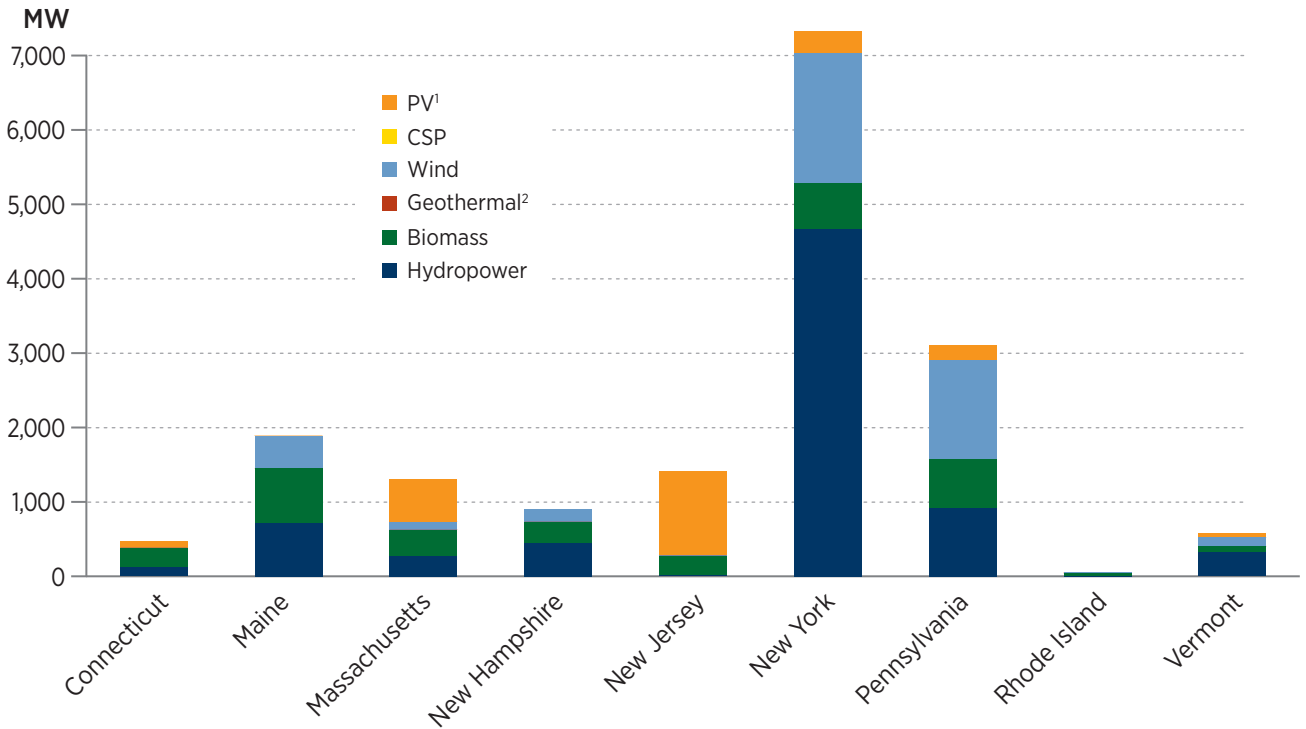
Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. PV is reported in MWdc.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

Cumulative Renewable Electricity Installed Capacity (2014)
NORTHEAST



Sources: EIA, LBNL, SEIA/GTM, U.S. Census

Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

Cumulative Renewable Electricity Installed Capacity (MW) (2014)
MIDWEST

	Wind	PV[1]	CSP	Geothermal[2]	Biomass	Hydropower	Total Renewables[3]	Per capita Renewable Electricity watts/person
Illinois	3,569	54	0	0	138	40	**3,788**	**294**
Indiana	1,745	113	0	0	73	92	**1,996**	**303**
Iowa	5,688	0	0	0	23	129	**5,840**	**1,880**
Kansas	2,967	0	0	0	31	7	**3,005**	**1,035**
Michigan	1,531	0	0	0	469	366	**2,366**	**239**
Minnesota	3,035	20	0	0	530	205	**3,786**	**694**
Missouri	459	111	0	0	17	499	**1,060**	**175**
Nebraska	812	0	0	0	16	332	**1,160**	**616**
North Dakota	1,886	0	0	0	10	614	**2,510**	**3,394**
Ohio	435	102	0	0	198	129	**840**	**72**
South Dakota	803	0	0	0	0	1,602	**2,405**	**2,819**
Wisconsin	648	20	0	0	427	527	**1,618**	**281**

Sources: EIA, LBNL, SEIA/GTM, U.S. Census

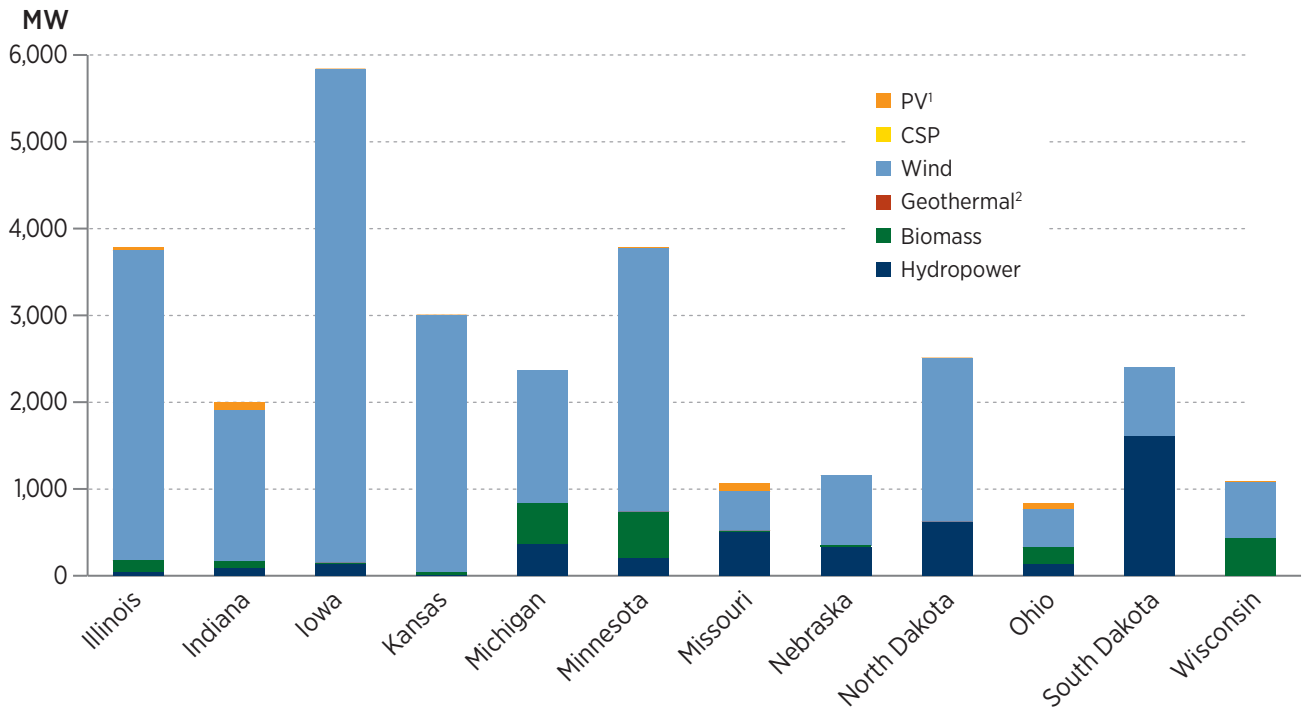
Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. PV is reported in MWdc.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

Cumulative Renewable Electricity Installed Capacity (2014)
MIDWEST



Sources: EIA, LBNL, SEIA/GTM, U.S. Census

Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

Cumulative Renewable Electricity Installed Capacity (MW) (2014)
SOUTH

	Wind	PV[1]	CSP	Geothermal[2]	Biomass	Hydropower	Total Renewables[3]	Per capita Renewable Electricity watts/person
Alabama	0	0	0	0	673	3,319	**3,993**	**823**
Arkansas	0	0	0	0	378	1,321	**1,699**	**573**
Delaware	2	61	0	0	8	0	**57**	**61**
Florida	0	159	75	0	1,424	56	**1,677**	**84**
Georgia	0	161	0	0	781	1,927	**2,832**	**280**
Kentucky	0	0	0	0	112	997	**1,109**	**251**
Louisiana	0	65	0	0	517	192	**759**	**163**
Maryland	160	215	0	0	163	551	**1,040**	**174**
Mississippi	0	0	0	0	296	0	**296**	**99**
North Carolina	0	953	0	0	660	1,890	**3,285**	**330**
Oklahoma	3,782	0	0	0	88	807	**4,677**	**1,206**
South Carolina	0	11	0	0	471	1,364	**1,844**	**2,819**
Tennessee	29	130	0	0	200	2,499	**2,829**	**432**
Texas	14,098	330	0	0	518	676	**15,546**	**577**
Virginia	0	11	0	0	1,008	822	**1,839**	**221**
West Virginia	583	0	0	0	2	327	**912**	**493**

Sources: EIA, LBNL, SEIA/GTM, U.S. Census

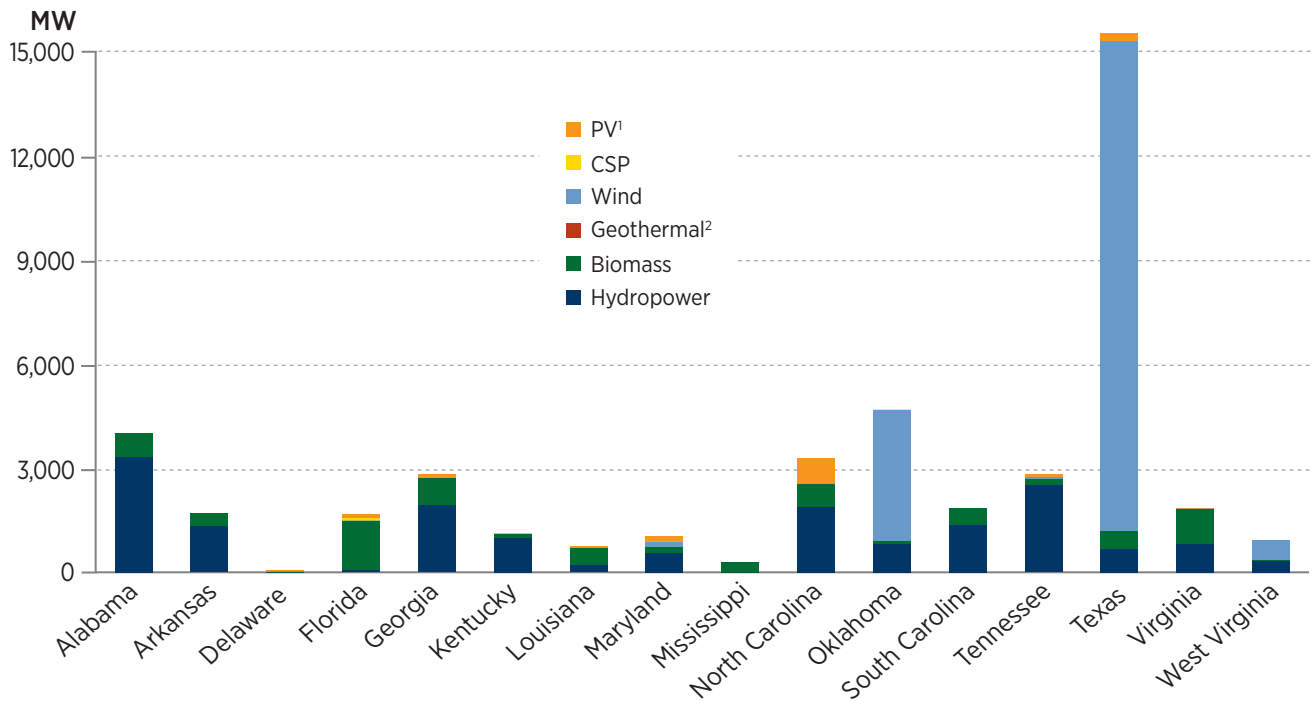
Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. PV is reported in MWdc.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

Cumulative Renewable Electricity Installed Capacity (2014)
SOUTH



Sources: EIA, LBNL, SEIA/GTM, U.S. Census

Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

Cumulative Renewable Electricity Installed Capacity (MW) (2014)
WEST

	Wind	PV[1]	CSP	Geothermal[2]	Biomass	Hydropower	Total Renewables[3]	Per capita Renewable Electricity watts/person
Alaska	62	0	0	0	12	425	**499**	**677**
Arizona	238	1,786	283	0	41	2,718	**4,656**	**692**
California	5,917	8,721	1,256	2,976	1,528	10,041	**28,433**	**733**
Colorado	2,593	398	0	0	33	665	**3,597**	**672**
Hawaii	206	441	7	51	270	26	**899**	**633**
Idaho	973	0	0	18	140	2,541	**3,671**	**2,246**
Montana	665	0	0	0	4	2,628	**3,297**	**3,221**
Nevada	152	725	64	626	3	1,052	**2,456**	**865**
New Mexico	812	325	0	4	7	82	**1,155**	**554**
Oregon	3,153	85	0	37	415	8,322	**11,992**	**3,020**
Utah	325	18	0	77	13	262	**691**	**235**
Washington	3,075	39	0	0	422	20,977	**24,503**	**3,470**
Wyoming	1,410	0	0	0	0	303	**1,713**	**2,933**

Sources: EIA, LBNL, SEIA/GTM, U.S. Census

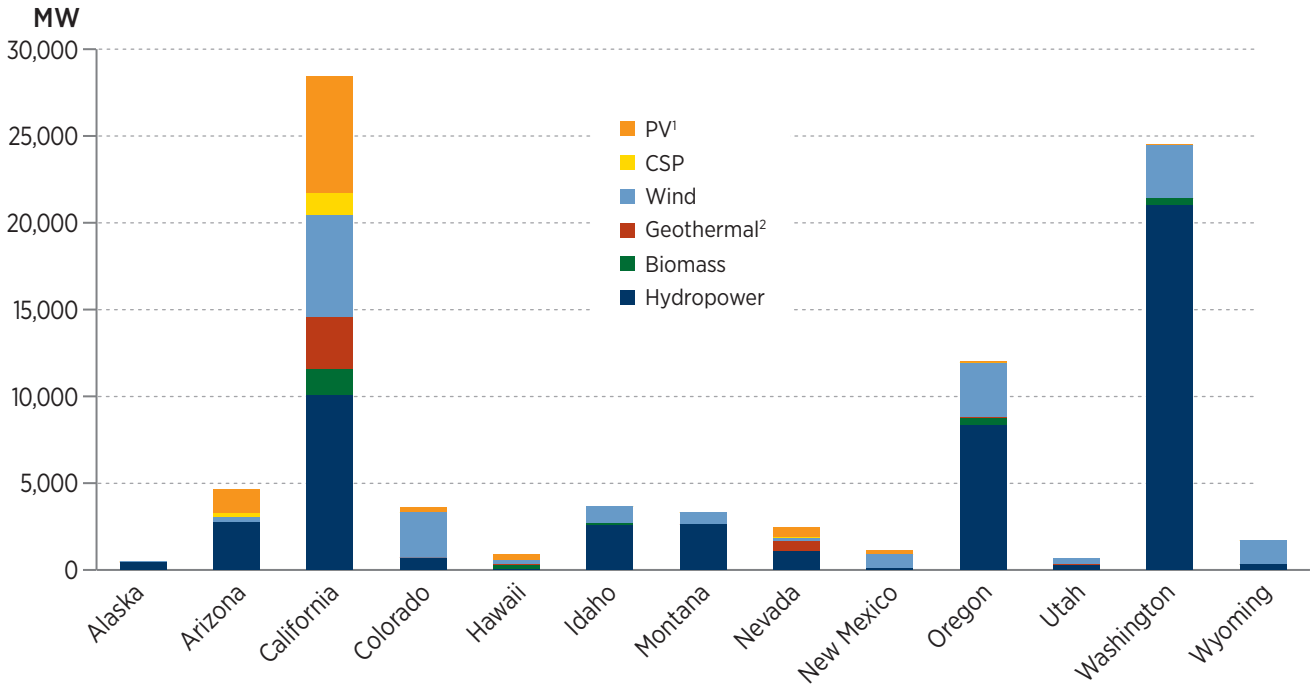
Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. PV is reported in MWdc.

[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

[3] A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

Cumulative Renewable Electricity Installed Capacity (2014)
WEST



Sources: EIA, LBNL, SEIA/GTM, U.S. Census

Regions do not correspond to U.S. Census designations.

[1] Grid-connected only. A de-rate factor of 77% has been applied to convert PV Installed Nameplate Capacity from MWdc to MWac.

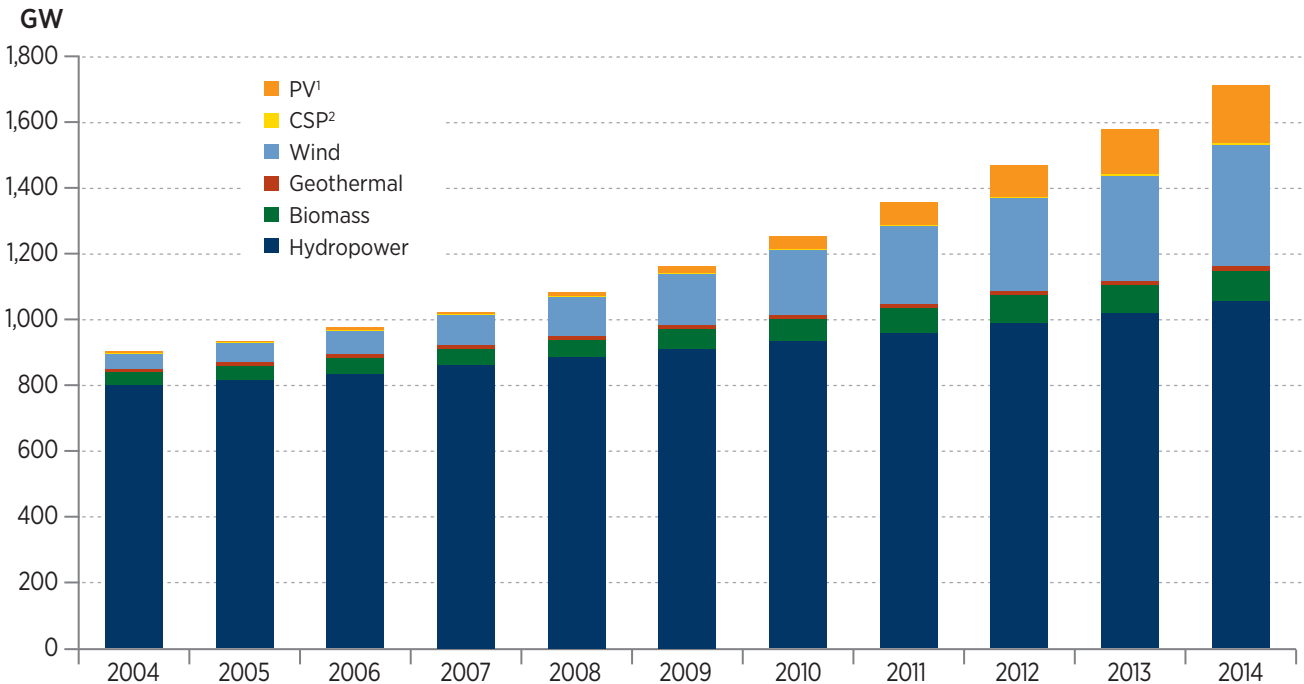
[2] Reflects source change from GEA to EIA for geothermal capacity for all reported years.

III. Global Renewable Energy Development

Global Renewable Energy Development: Summary

- Cumulative global renewable electricity **installed capacity grew by 8%** in 2014 (from 1,579 GW to 1,712 GW), which continues the steady growth (6.6% per year CAGR from 2004–2014) of recent years.
- **Global renewable electricity capacity additions grew by 24%** compared to 2013 (from 108 GW to 134 GW in annual capacity additions), a rate much higher than observed in recent years.
- Renewable sources accounted for almost **24% of all electricity generation worldwide** (5,507 TWh) in 2014.
- Global solar PV and CSP installed capacity increased by 28% and 29% in 2014, respectively. Wind installed capacity grew by 16% globally.
- As in 2013, **China continued to lead the world** in 2014 in **cumulative total renewable electricity installed capacity**, cumulative wind capacity, and hydropower capacity. Germany led the world in cumulative PV installed capacity. The United States continued to lead in geothermal and biomass installed capacity.

Global Renewable Electricity Capacity



Source: Renewable Energy Policy Network for the 21st Century (REN21)

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Grid-connected only.

[2] CSP includes concentrating photovoltaics (CPV).

Global Renewable Cumulative Electricity Capacity Annual Percent Change

	Hydropower	PV[1]	CSP[2]	Wind	Geothermal	Biomass	All Renewables
2004	1%	33%	0%	20%	0%	0%	1%
2005	2%	38%	0%	23%	4%	13%	4%
2006	2%	32%	0%	25%	3%	7%	4%
2007	3%	5%	5%	27%	0%	6%	5%
2008	3%	71%	14%	29%	4%	4%	6%
2009	3%	62%	22%	31%	7%	15%	7%
2010	3%	90%	83%	25%	3%	13%	8%
2011	3%	78%	43%	20%	1%	9%	8%
2012	3%	41%	57%	19%	5%	12%	8%
2013	3%	38%	36%	13%	3%	6%	7%
2014	4%	28%	29%	16%	6%	6%	8%

Source: REN21

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Grid-connected only.

[2] CSP includes CPV.

Renewable Electricity as a Percentage of Total Installed Global Electricity Capacity

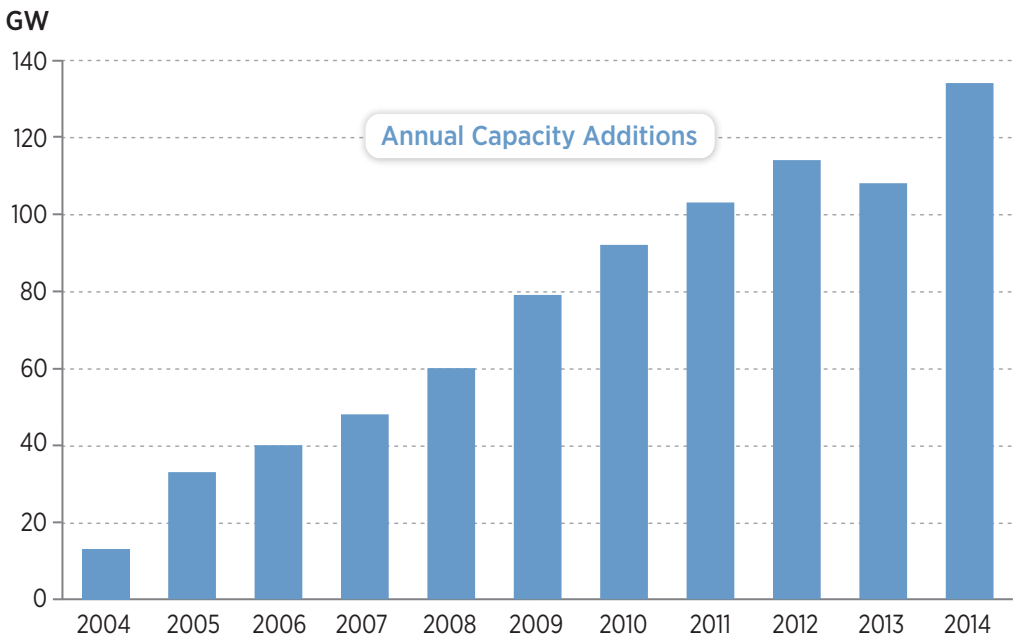
	Hydropower	PV[1]	CSP	Wind	Geothermal	Biomass	All Renewables	Renewable Capacity (GW)
2004	20.1%	0.1%	0.0%	1.2%	0.2%	1.0%	22.6%	901
2005	19.8%	0.1%	0.0%	1.4%	0.2%	1.1%	22.7%	934
2006	19.4%	0.2%	0.0%	1.7%	0.2%	1.1%	22.7%	974
2007	19.2%	0.2%	0.0%	2.1%	0.2%	1.1%	22.8%	1,022
2008	19.1%	0.3%	0.0%	2.6%	0.2%	1.1%	23.3%	1,082
2009	18.8%	0.4%	0.0%	3.3%	0.2%	1.2%	24.0%	1,161
2010	18.4%	0.8%	0.0%	3.9%	0.2%	1.3%	24.6%	1,253
2011	18.0%	1.3%	0.0%	4.5%	0.2%	1.4%	25.4%	1,356
2012	17.8%	1.8%	0.0%	5.1%	0.2%	1.5%	26.5%	1,470
2013	17.6%	2.4%	0.1%	5.5%	0.2%	1.5%	27.3%	1,579
2014	17.5%	2.9%	0.1%	6.1%	0.2%	1.5%	28.5%	1,712

Source: REN21

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Grid-connected only.

Global Annual Installed Renewable Electricity Capacity Growth



III

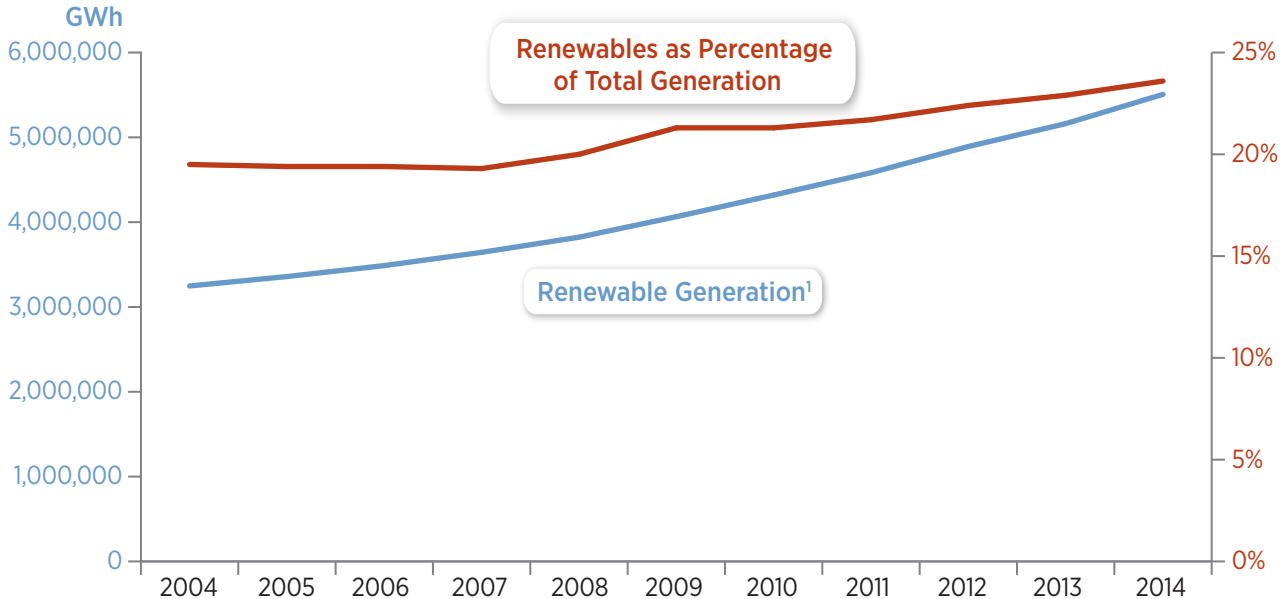
	Compound Annual Growth Rate (2004–2014)
PV[1]	**46.1%**
CSP	**26.5%**
Wind	**22.7%**
Geothermal	**3.7%**
Biomass	**9.1%**
Hydropower	**2.8%**
All Renewables	**6.6%**

Source: REN21

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Grid-connected only.

Global Renewable Electricity Generation



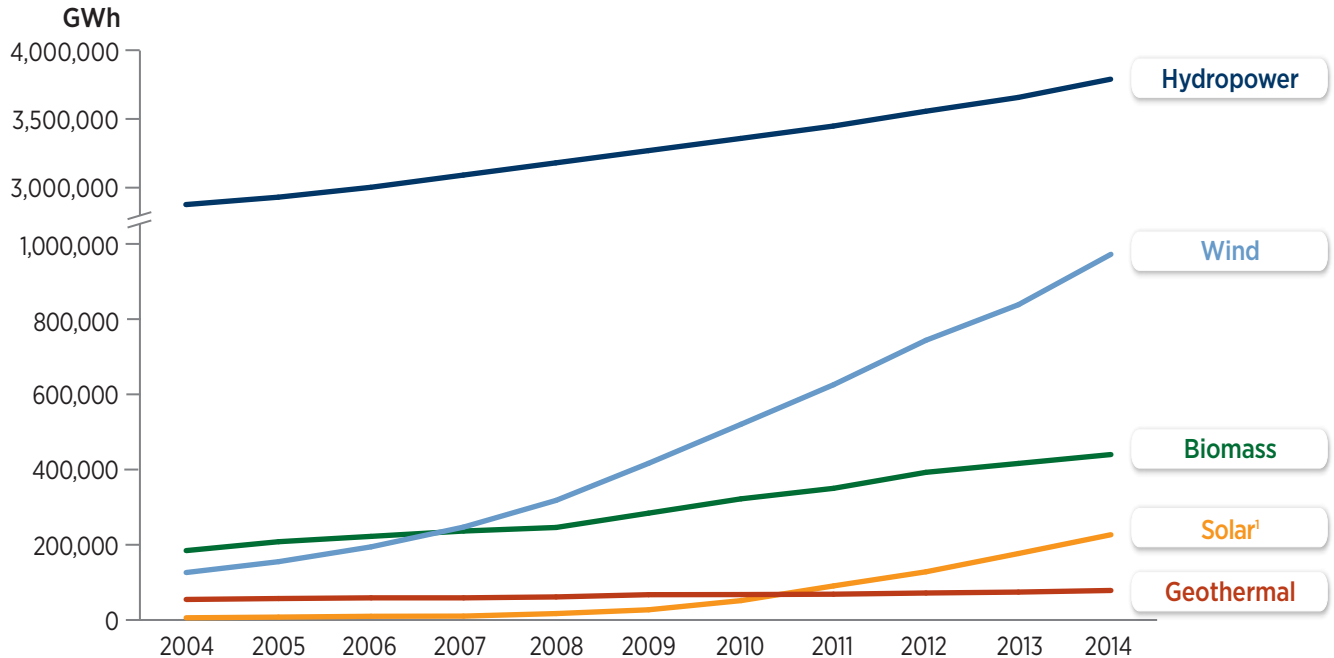
Sources: REN21, EIA

Generation derived using the following capacity factors: 41% for hydropower, 14% for PV, 25% for CSP, 54% for biomass, 30% for wind, and 70% for geothermal.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Global generation is estimated for 2012, 2013, and 2014. All other years based on EIA.

Global Renewable Electricity Generation by Technology



Source: REN21

Generation derived using the following capacity factors: 41% for hydropower, 14% for PV, 25% for CSP, 54% for biomass, 30% for wind, and 70% for geothermal.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

Note vertical scale has a discontinuity.

[1] Includes CSP and grid-connected PV. Capacity is reported in MWac.

Global Renewable Electricity Generation as a Percentage of Total Generation

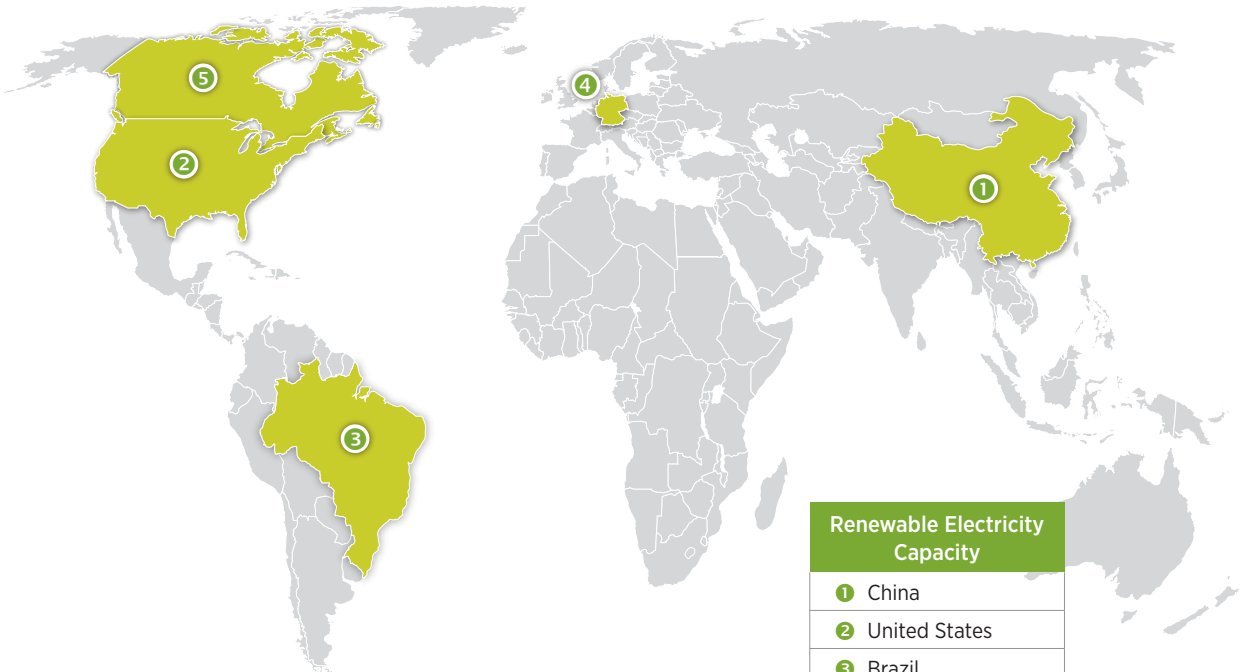
	Hydropower	Solar[1]	Biomass	Wind	Geothermal	All Renewables	Renewable Generation (GWh)
2004	17.3%	0.0%	1.1%	0.8%	0.3%	19.5%	3,247,899
2005	16.9%	0.0%	1.2%	0.9%	0.3%	19.4%	3,358,626
2006	16.7%	0.1%	1.2%	1.1%	0.3%	19.4%	3,488,055
2007	16.4%	0.1%	1.3%	1.3%	0.3%	19.3%	3,644,173
2008	16.6%	0.1%	1.3%	1.7%	0.3%	20.0%	3,822,689
2009	17.2%	0.1%	1.5%	2.2%	0.4%	21.3%	4,064,206
2010	16.6%	0.3%	1.6%	2.6%	0.3%	21.3%	4,319,733
2011	16.4%	0.4%	1.7%	3.0%	0.3%	21.7%	4,582,578
2012	16.3%	0.6%	1.8%	3.4%	0.3%	22.4%	4,891,891
2013	16.2%	0.8%	1.8%	3.7%	0.3%	22.9%	5,161,742
2014	16.3%	1.0%	1.9%	4.2%	0.3%	23.6%	5,506,624

Source: REN21

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by REN21.

[1] Includes CSP and grid-connected PV. Generation derived using the following capacity factors: 41% for hydropower, 14% for PV, 25% for CSP, 54% for biomass, 30% for wind, and 70% for geothermal.

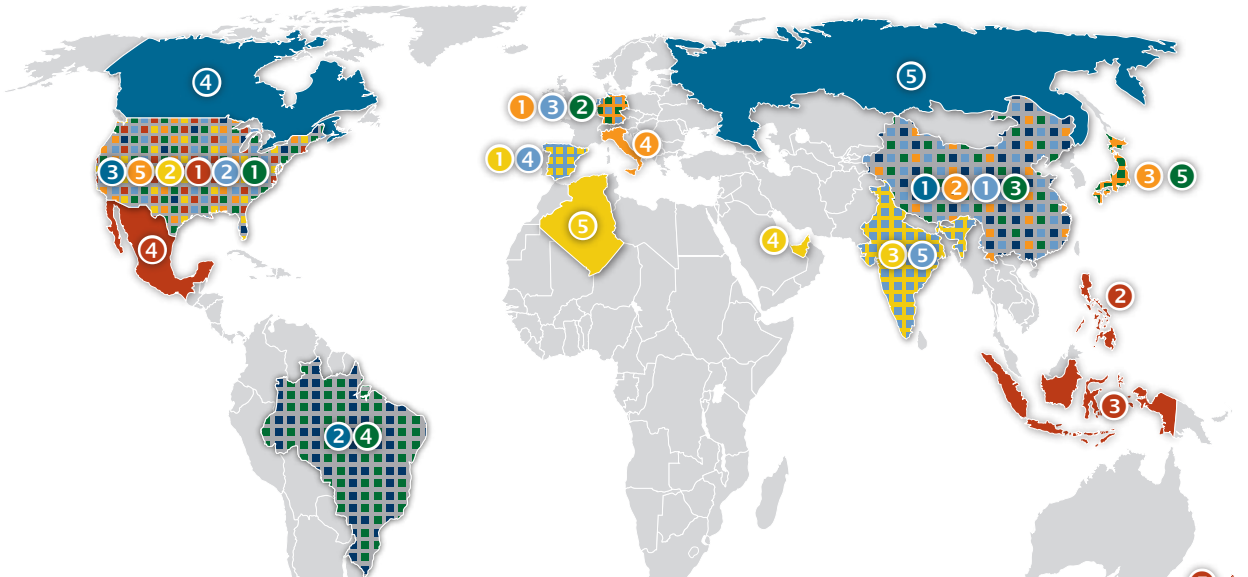
Top Countries for Renewable Electricity Installed Capacity (2014)



Renewable Electricity Capacity	
1	China
2	United States
3	Brazil
4	Germany
5	Canada

Source: REN21

Top Countries with Installed Renewable Electricity by Technology (2014)



Hydropower	PV[1]	CSP	Geothermal	Wind	Biomass
1 China	1 Germany	1 Spain	1 United States	1 China	1 United States
2 Brazil	2 China	2 United States	2 Philippines	2 United States	2 Germany
3 United States	3 Japan	3 India	3 Indonesia	3 Germany	3 China
4 Canada	4 Italy	4 United Arab Emirates	4 Mexico	4 Spain	4 Brazil
5 Russia	5 United States	5 Algeria	5 New Zealand	5 India	5 Japan

Source: REN21

[1]Grid-connected only.

Reported capacity by country may differ from page 74 due to different data sources used.

IV. Wind

Wind: Summary

- In the United States, wind installed capacity grew 7.8% in 2014 compared to 1.8% in 2013. **Nearly 4.8 GW of additional** wind capacity was installed in 2014, leading to a total cumulative capacity of nearly 66 GW.

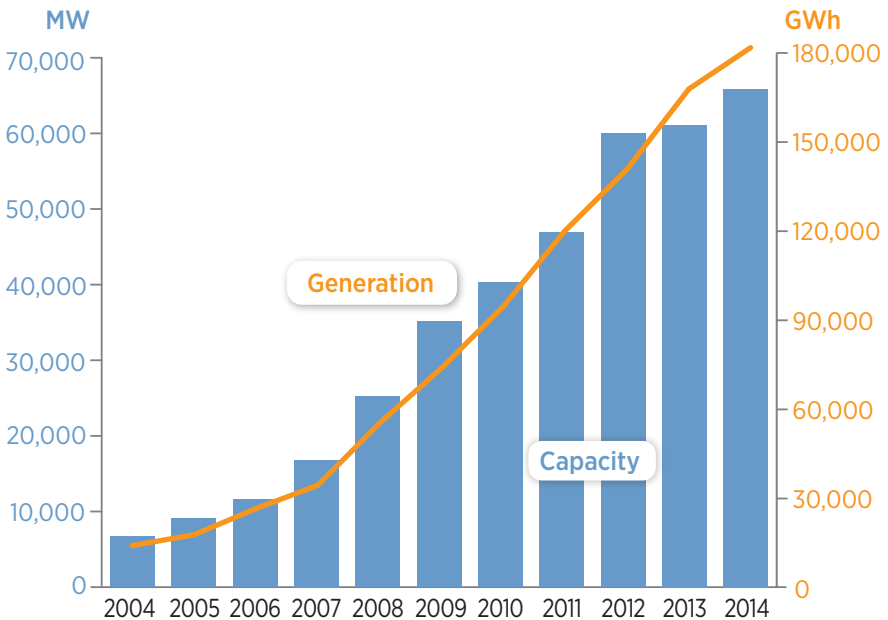
- Some states with the highest cumulative wind installed capacity also experienced the most growth in capacity in 2014, including Texas (1.8 GW), Oklahoma (0.6 GW), and Iowa (0.5 GW).

- In 2014, **China continued to lead the world in cumulative installed wind capacity** with over 114 GW.

- **Global cumulative installed offshore wind capacity reached nearly 8.8 GW** in 2014, largely driven by projects in Europe. A total of 21 U.S. offshore wind projects, comprising more than 15.6 GW, are at various stages of development.[1]

[1] Source: NREL

U.S. Total Installed Wind Electricity Capacity and Generation



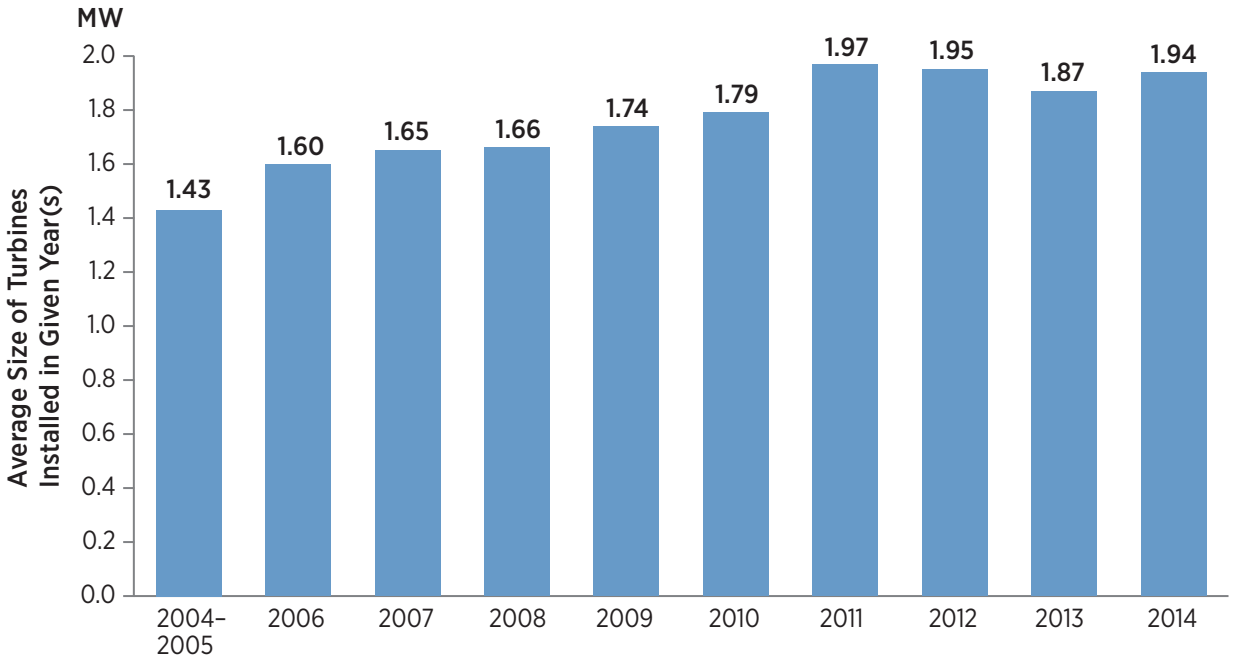
	U.S. Wind Electricity Generation (GWh)	U.S. Wind Electricity Capacity and Percent Increase from Previous Year	
		Total (MW)	% Increase
2000	5,593	2,578	2.6%
2001	6,737	4,275	65.8%
2002	10,354	4,686	9.6%
2003	11,187	6,353	35.6%
2004	14,144	6,725	5.9%
2005	17,811	9,121	35.6%
2006	26,589	11,575	26.9%
2007	34,450	16,812	45.2%
2008	55,363	25,237	50.1%
2009	73,886	35,155	39.3%
2010	94,652	40,267	14.5%
2011	120,177	46,916	16.5%
2012	140,882	60,005	27.9%
2013	167,840	61,107	1.8%
2014	181,791	65,879	7.8%

IV

Sources: LBNL, EIA

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

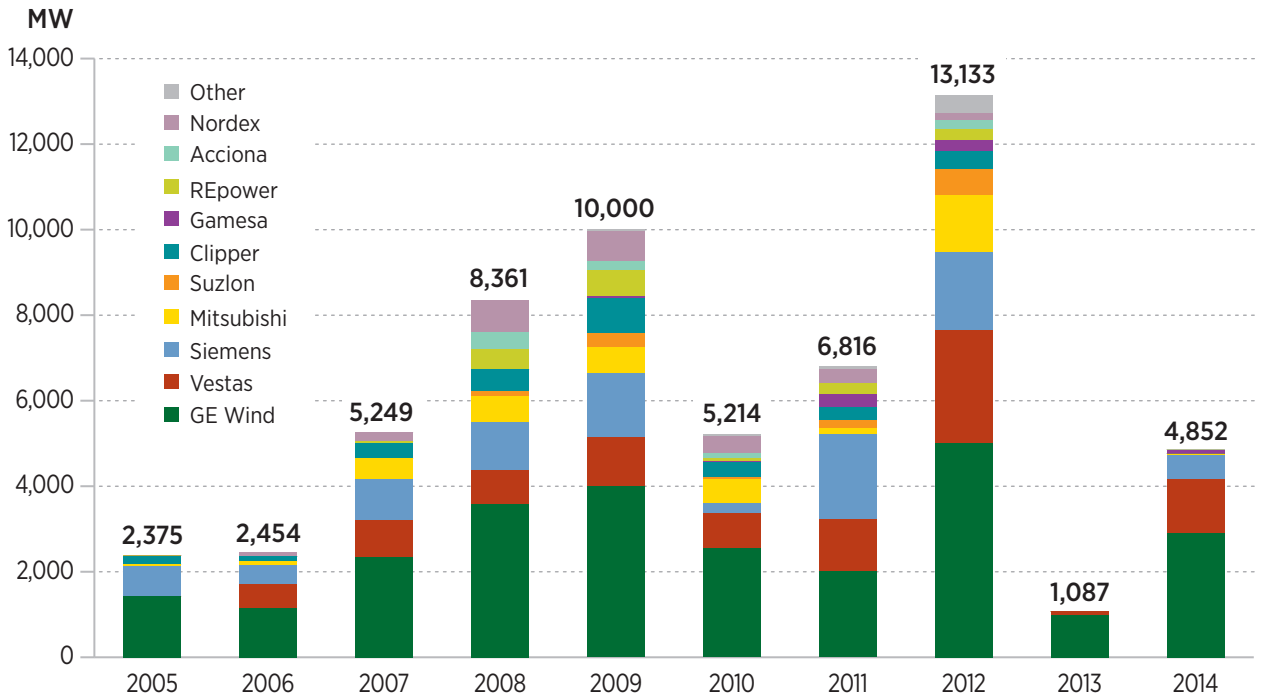
U.S. Average Installed Turbine Size



IV

Source: American Wind Energy Association (AWEA)

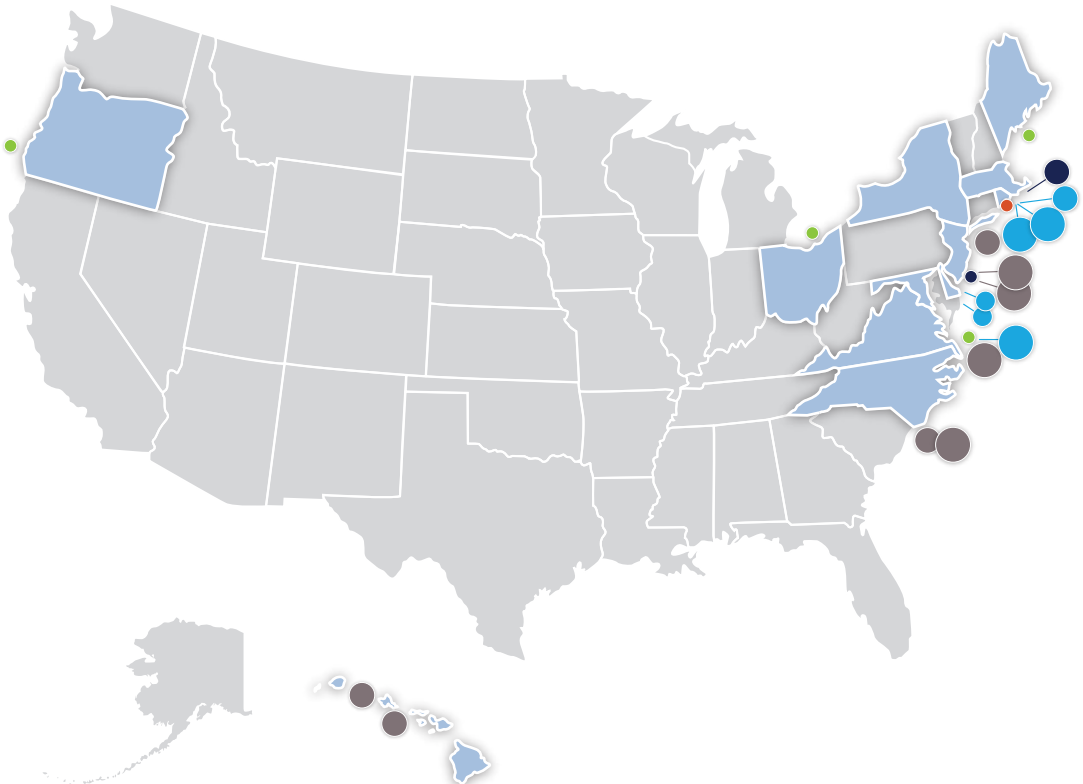
U.S. Annual Wind Turbine Installations by Manufacturer



Source: LBNL

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by LBNL.

U.S. Offshore Wind Electricity Proposed Projects (2014)



Project Status

- Under Construction
- Approved
- Permitting
- Planning—Site Control[1]
- Planning—Early Stage

Project Size

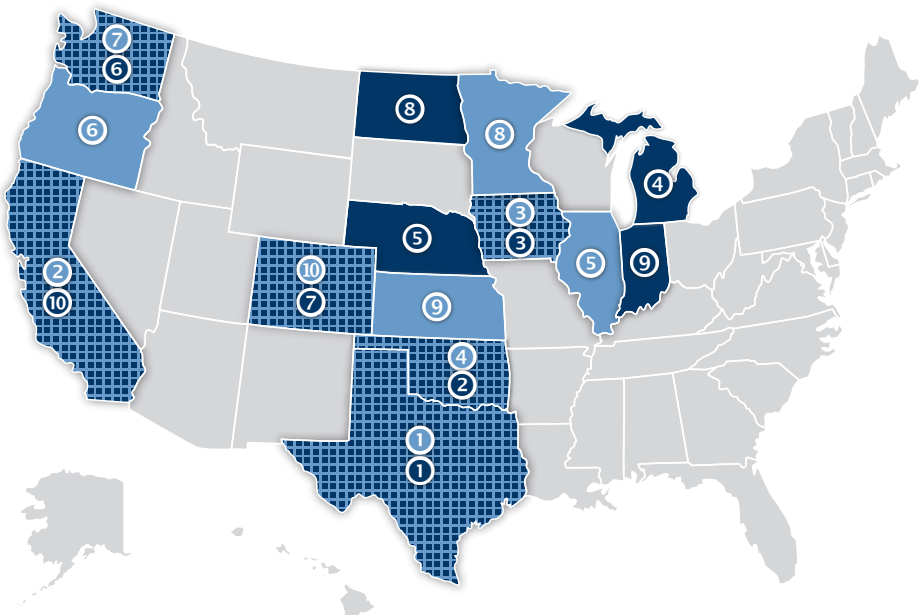
- 0–50 MW
- 51–250 MW
- 501–1,000 MW
- >1,001 MW

IV

Source: NREL

[1] This project status begins when the developer obtains exclusive development rights to a site and ends when the developer files major permit applications.

States Leading Wind Electricity Development (2014)

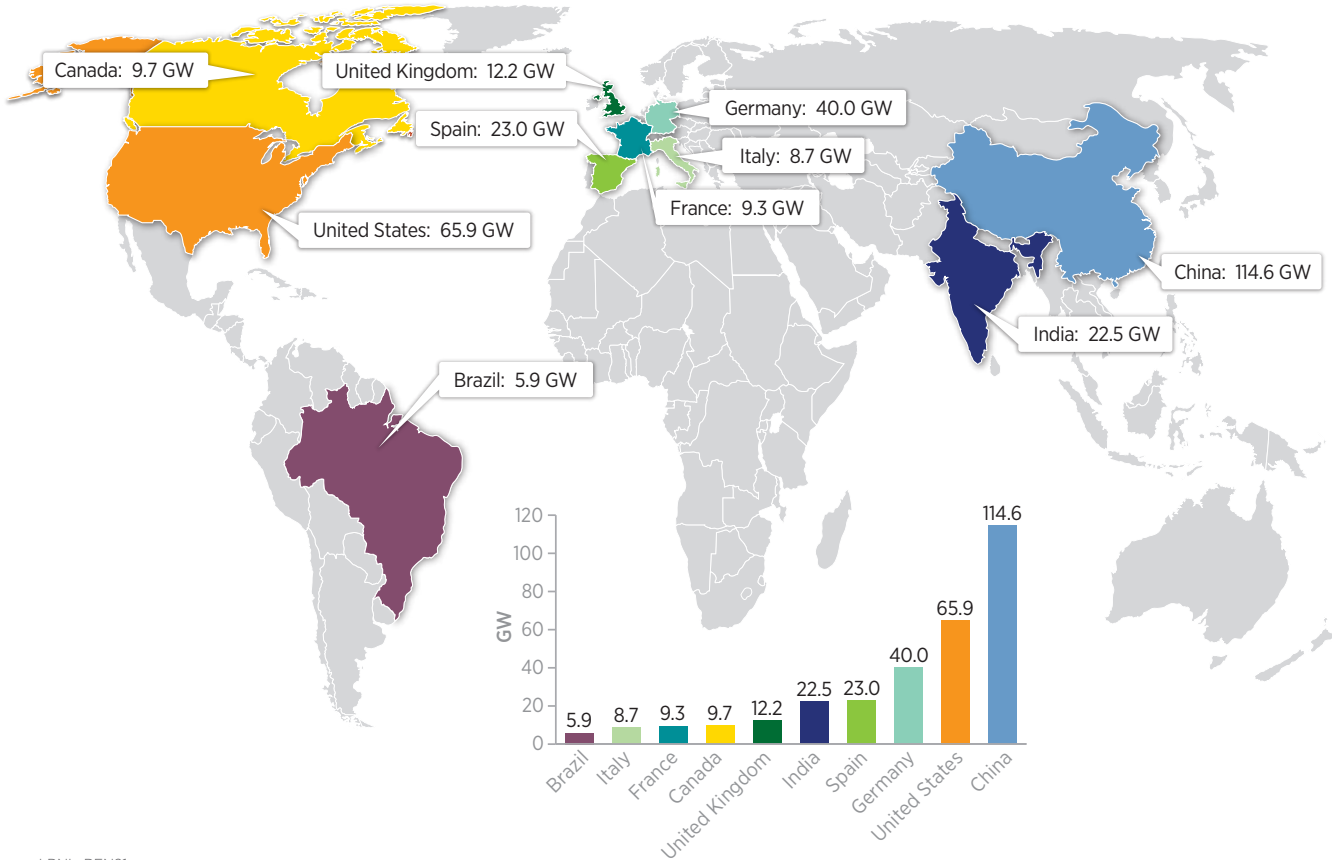


Cumulative Capacity (MW)	
1 Texas	14,098
2 California	5,917
3 Iowa	5,688
4 Oklahoma	3,782
5 Illinois	3,568
6 Oregon	3,153
7 Washington	3,075
8 Minnesota	3,035
9 Kansas	2,967
10 Colorado	2,593

Annual Capacity Additions (MW)	
1 Texas	1,811
2 Oklahoma	648
3 Iowa	511
4 Michigan	368
5 Nebraska	277
6 Washington	267
7 Colorado	261
8 North Dakota	205
9 Indiana	201
10 California	107

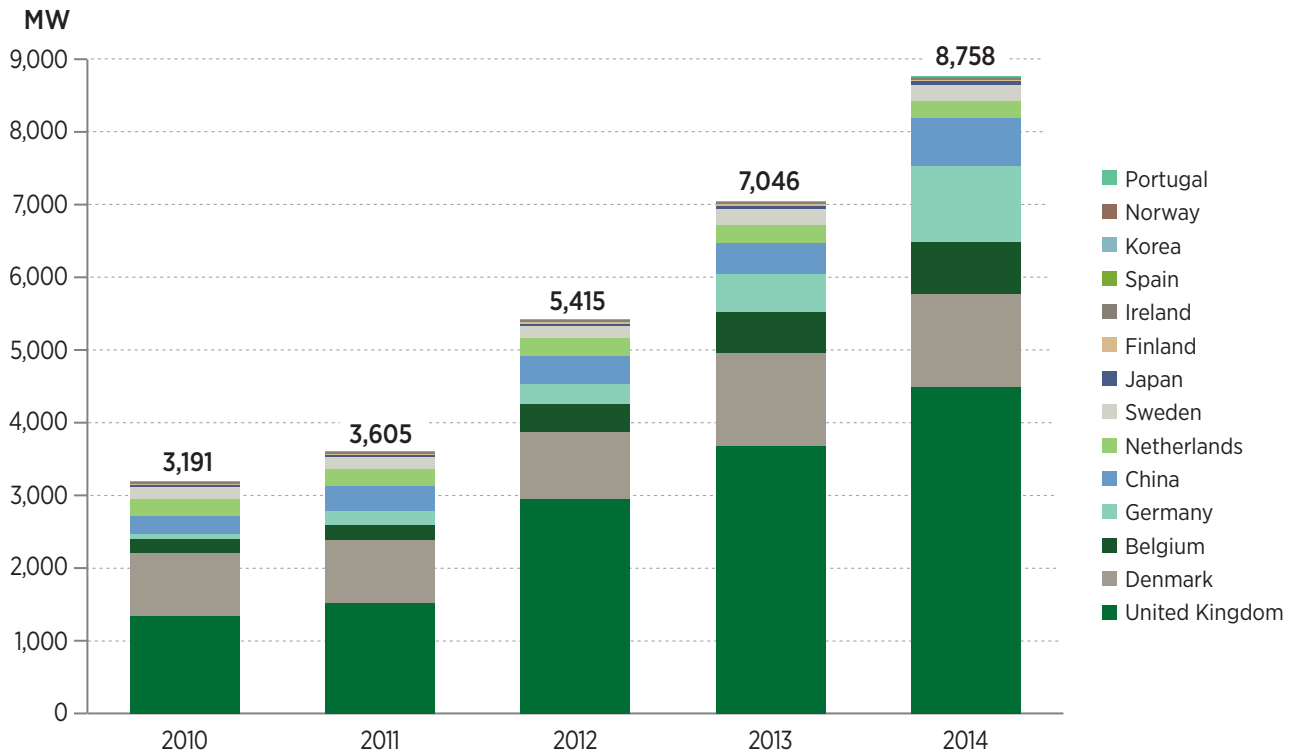
Source: LBNL

Cumulative Wind Electricity Capacity (2014) – Top 10 Countries



Sources: LBNL, REN21
Includes offshore wind.

Cumulative Offshore Wind Electricity Capacity by Country



Source: Global Wind Energy Council (GWEC)

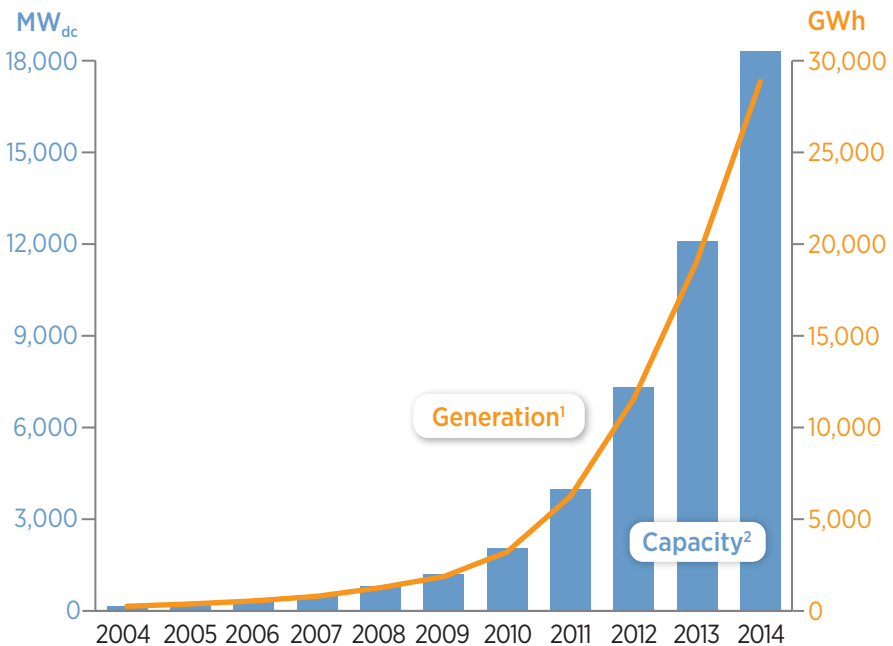
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by GWEC.

V. Solar

Solar: Summary

- **U.S. solar installed capacity increased by 54%** in 2014. PV capacity grew by 51% and CSP capacity expanded by 84%.
- Consistent high growth rates over the last decade have resulted in a total of **18,305 MW_{dc} of PV capacity and 1,685 MW of CSP capacity** in the United States at the end of 2014.
- **U.S. solar generation,** from PV and CSP combined, totaled nearly **33.6 TWh,** approximately **0.8% of total U.S. generation** in 2014.
- Both utility-scale and residential markets have driven PV solar capacity growth over the last five years.
- **California had the largest amounts of installed solar capacity** in 2014—8,721 MW_{dc} (PV) and 1,256 MW (CSP)—followed by Arizona and New Jersey.
- U.S. CSP installed capacity in 2014 continued to be concentrated in a small number of western states.
- **Asian manufacturers continued to lead global photovoltaic module production** in 2014, with China accounting for 66% of global solar module production and the U.S. accounting for approximately 2%.

U.S. PV Electricity Installed Capacity and Generation



	U.S. PV Generation[1] (GWh)	U.S. PV Capacity[2] (MW_{dc}) and % Increase from Previous Year	
		PV[1]	Increase
2000	38	24	—
2001	55	35	46%
2002	92	58	66%
2003	162	103	78%
2004	254	161	56%
2005	378	240	49%
2006	544	345	44%
2007	796	505	46%
2008	1,266	803	59%
2009	1,869	1,185	48%
2010	3,212	2,037	72%
2011	6,243	3,959	94%
2012	11,555	7,328	85%
2013	19,086	12,104	65%
2014	28,863	18,305	51%

Source: SEIA/GTM

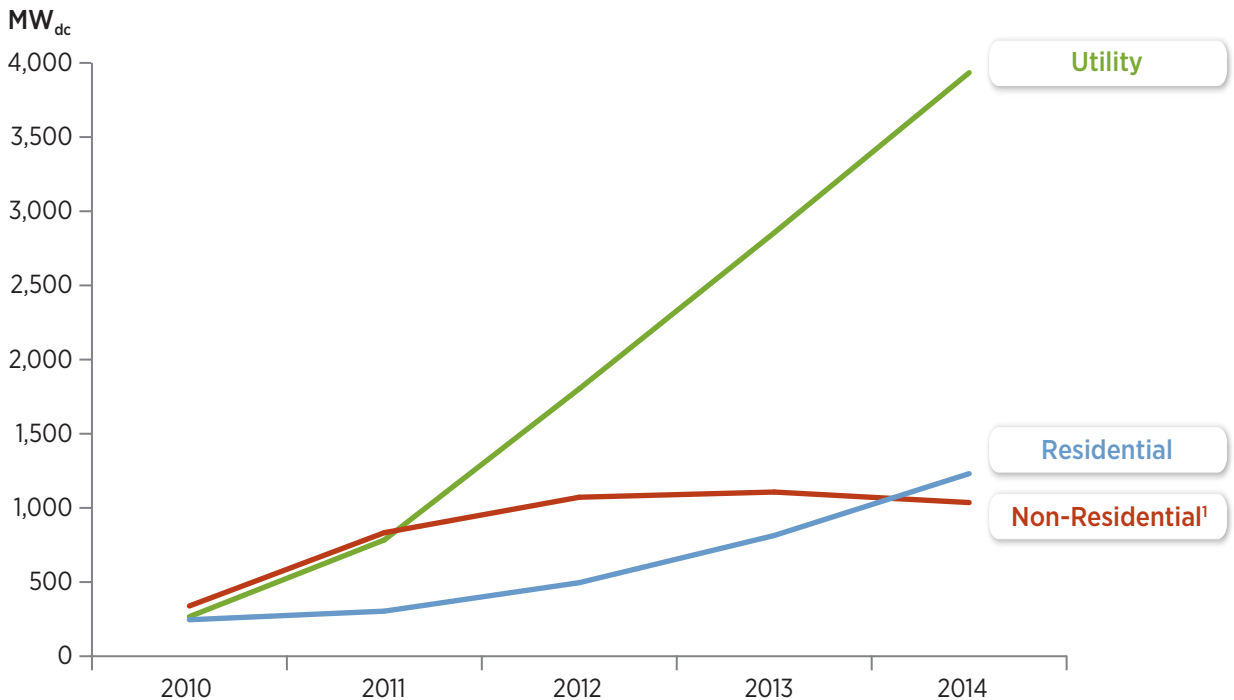
Generation calculated from installed capacity using an 18% capacity factor for PV.

Values may differ from those reported in previous versions of the Data Book due to a source change from Larry Sherwood/IREC to SEIA/GTM for all years included.

[1] Generation numbers calculated from installed capacity using an 18% capacity factor for PV.

[2] Grid-connected only. Capacity is reported in MWdc.

U.S. PV Annual Capacity Additions by Sector

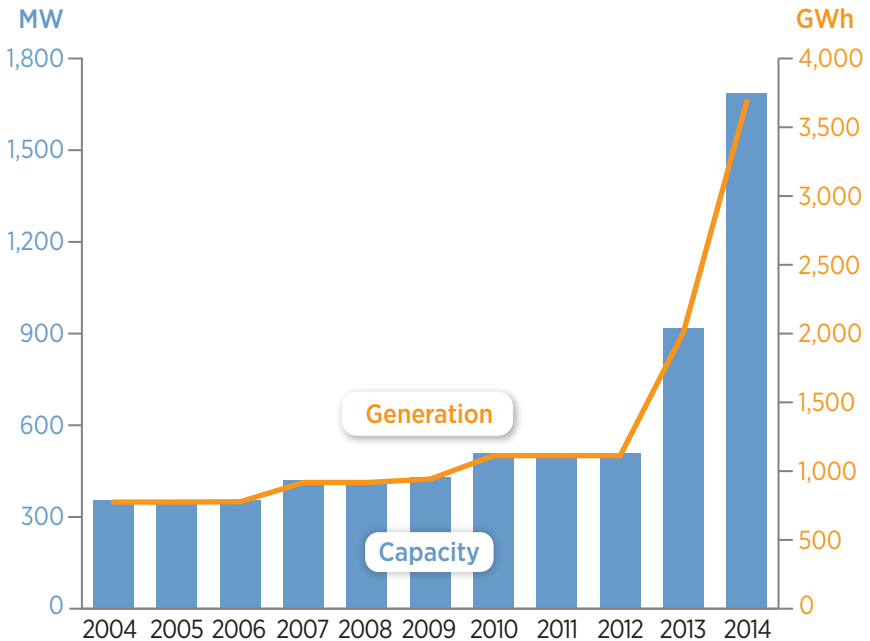


Source: SEIA/GTM

Grid-connected only. Capacity is reported in MWdc.

[1] Non-residential sector includes commercial and industrial.

U.S. CSP Electricity Installed Capacity and Generation



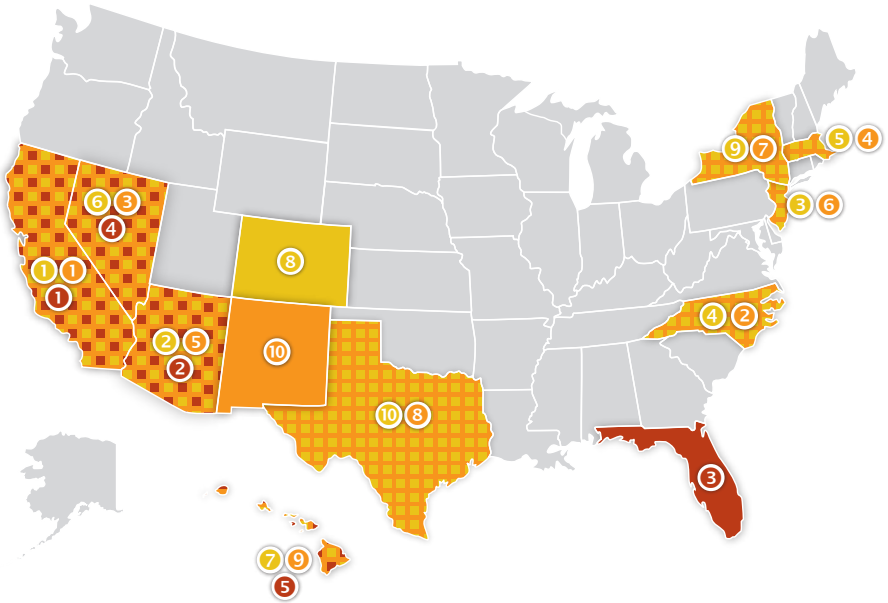
	U.S. CSP Generation (GWh)	U.S. CSP Capacity (MW) and % Increase from Previous Year	
		CSP	Increase
2000	775	354	—
2001	775	354	0%
2002	775	354	0%
2003	775	354	0%
2004	775	354	0%
2005	775	354	0%
2006	778	355	0%
2007	918	419	18%
2008	918	419	0%
2009	942	430	3%
2010	1,113	508	18%
2011	1,113	508	0%
2012	1,113	508	0%
2013	2,010	918	81%
2014	3,690	1,685	84%

V

Source: SEIA/GTM

Capacity is reported in MWac. Generation calculated from installed capacity using a 25% capacity factor for CSP.

States Leading Solar Electricity Development (2014)



PV Cumulative Capacity[1] (MW)	
1 California	8,721
2 Arizona	1,786
3 New Jersey	1,451
4 North Carolina	953
5 Massachusetts	751
6 Nevada	725
7 Hawaii	441
8 Colorado	398
9 New York	397
10 Texas	330

PV Annual Capacity[1] Additions (MW)	
1 California	3,549
2 North Carolina	397
3 Nevada	339
4 Massachusetts	308
5 Arizona	247
6 New Jersey	240
7 New York	147
8 Texas	129
9 Hawaii	107
10 New Mexico	88

CSP Cumulative Capacity[2] (MW)	
1 California	1,256
2 Arizona	283
3 Florida	75
4 Nevada	64
5 Hawaii	7

CSP Annual Capacity Additions (MW)	
California	767

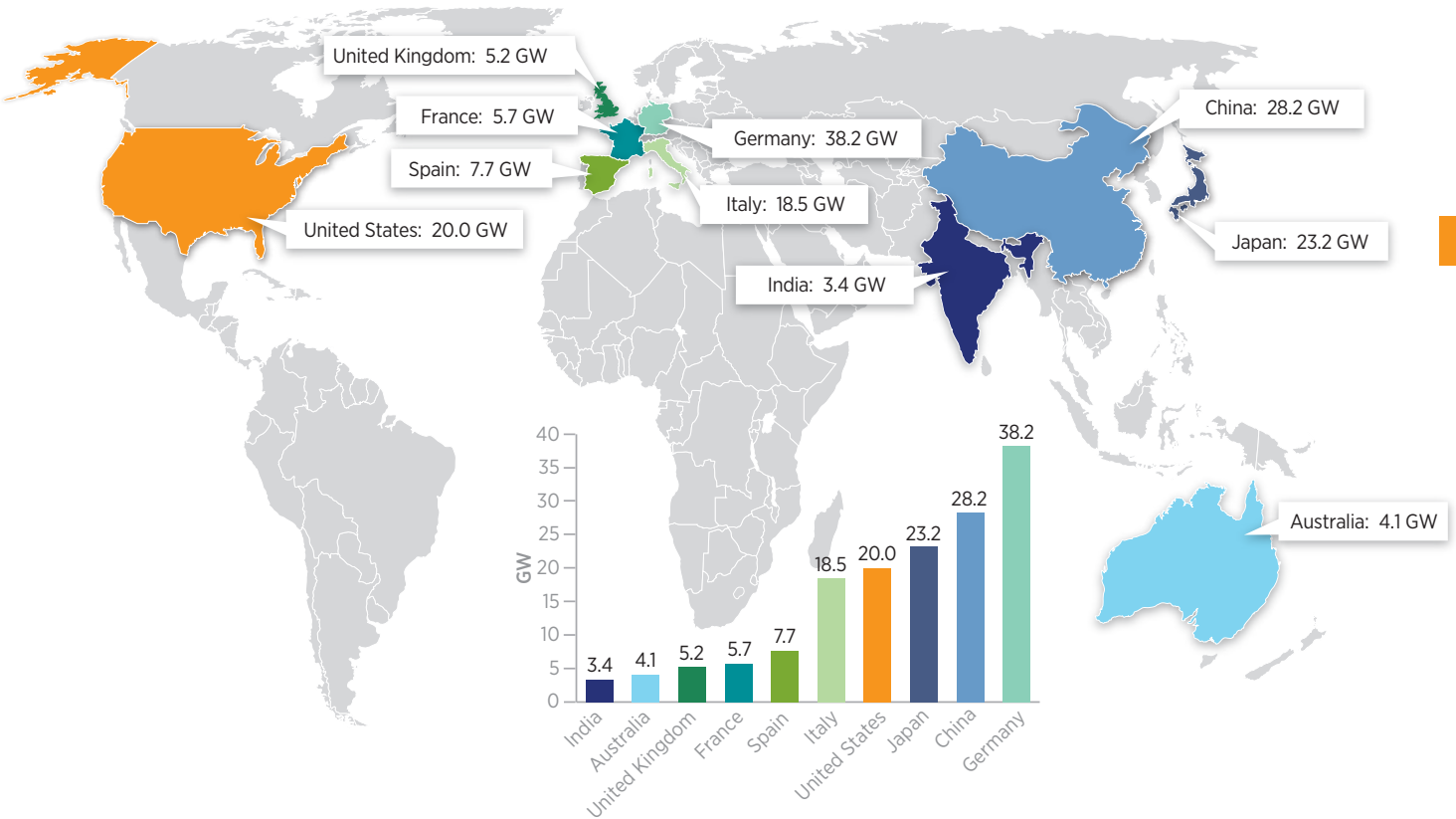
V

Source: SEIA/GTM

[1] Grid-connected only. Capacity is reported in MWdc.

[2] Capacity is reported in MWac.

Cumulative Solar Electricity Capacity (2014) – Select Countries



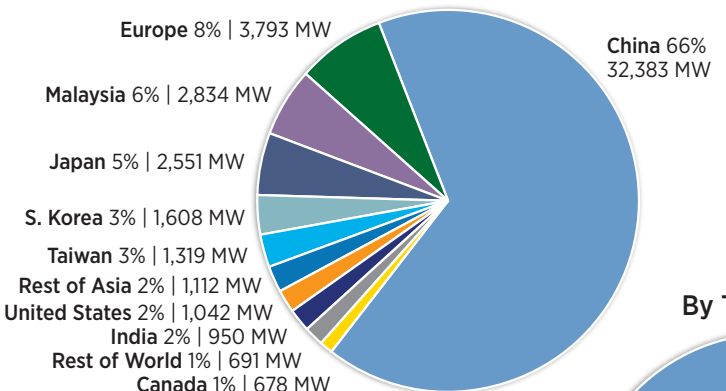
Sources: REN21, SEIA/GTM

Includes CSP and grid-connected PV. Capacity is reported in MWac.

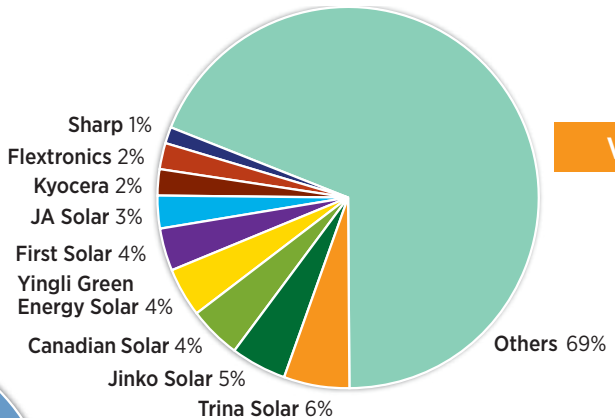
Global Photovoltaic Manufacturing (2014)

Global Solar Module Production, 2014: 48,961 MW

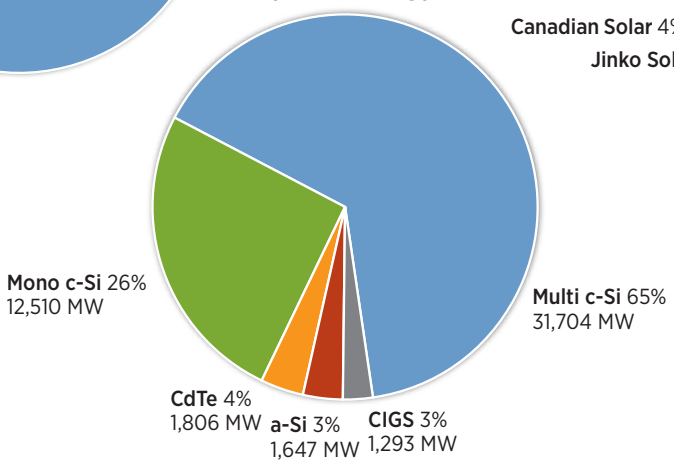
By Country



By Manufacturer



By Technology



Sources: GTM Research, PV Pulse
Module production is reported in MWdc.

VI. Geothermal

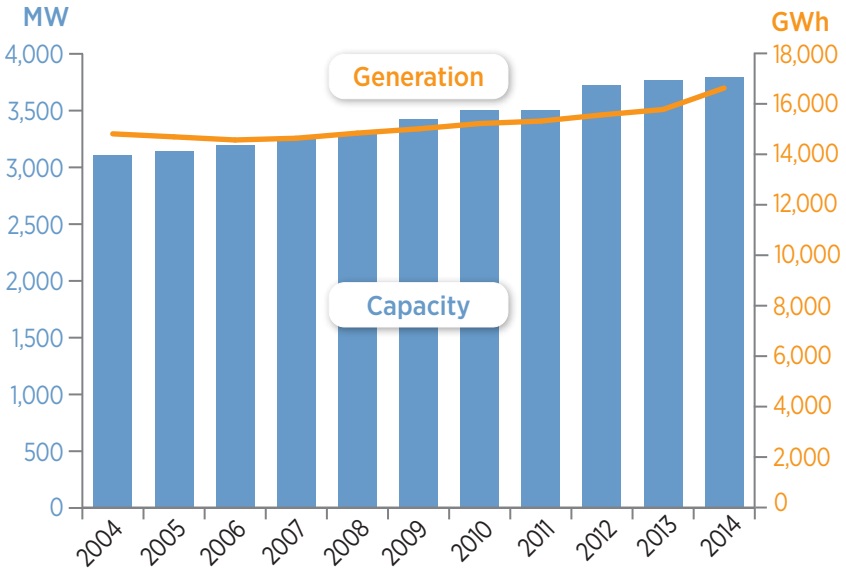
Geothermal: Summary

- U.S. geothermal installed capacity has remained relatively stable since 2000, with a slight increase of 0.7% in 2014.
- **The United States continued to lead the world** in 2014 in installed geothermal electricity **capacity (nearly 3.8 GW) and generation (more than 16 TWh),** with most of that capacity installed in California and Nevada.
- As a base load source of electricity production, geothermal is distinct from variable renewables, such as wind and solar, because **it can provide consistent electricity throughout the day and year.**
- Five Enhanced Geothermal System (EGS) technology multi-year demonstration projects were active in 2014.[1]
- DOE's Frontier Observatory for Research in Geothermal Energy **(FORGE) comprises the first dedicated field site of its kind for testing targeted EGS R&D** and creating a commercial pathway for large-scale, economically viable EGS.[1]

VI

[1] Source: DOE

U.S. Geothermal Electricity Capacity and Generation



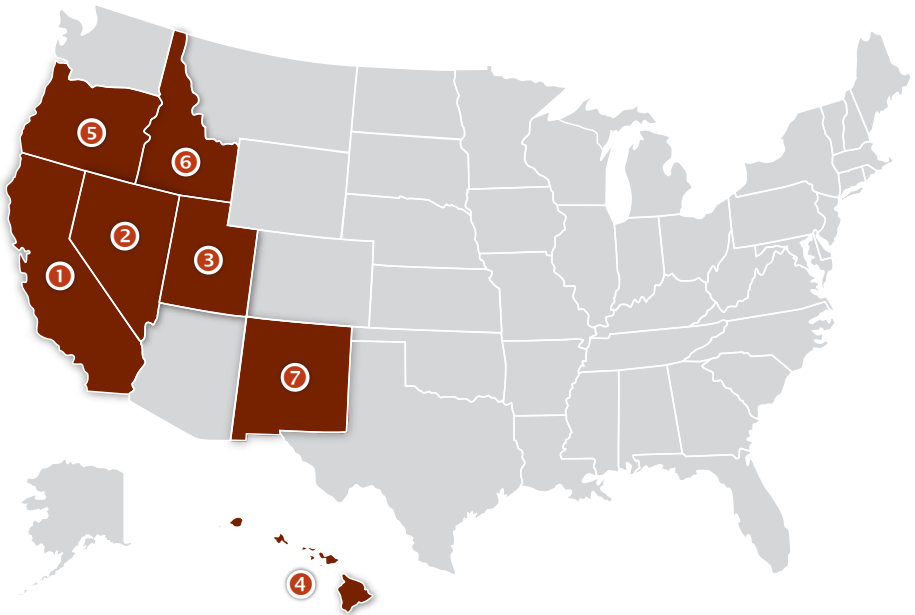
	U.S. Geothermal Electricity Generation (GWh)	U.S. Geothermal Electricity Capacity and % Increase from Previous Year	
		Total (MW)	% Increase
2000	14,093	3,100	—
2001	13,741	3,100	0.0%
2002	14,491	3,108	0.2%
2003	14,424	3,108	0.0%
2004	14,811	3,108	0.0%
2005	14,692	3,143	1.1%
2006	14,568	3,195	1.7%
2007	14,637	3,259	2.0%
2008	14,840	3,306	1.4%
2009	15,009	3,421	3.5%
2010	15,219	3,498	2.3%
2011	15,316	3,500	0.1%
2012	15,562	3,724	6.4%
2013	15,775	3,761	1.0%
2014	16,628	3,789	0.7%

VI

Source: EIA

Reflects source change from GEA in previous versions of the Data Book to EIA for geothermal capacity for all reported years.

Cumulative State Geothermal Electricity Development (2014)



Total Installed Capacity (MW)	
1 California	2,976
2 Nevada	626
3 Utah	77
4 Hawaii	51
5 Oregon	37
6 Idaho	18
7 New Mexico	4

VI

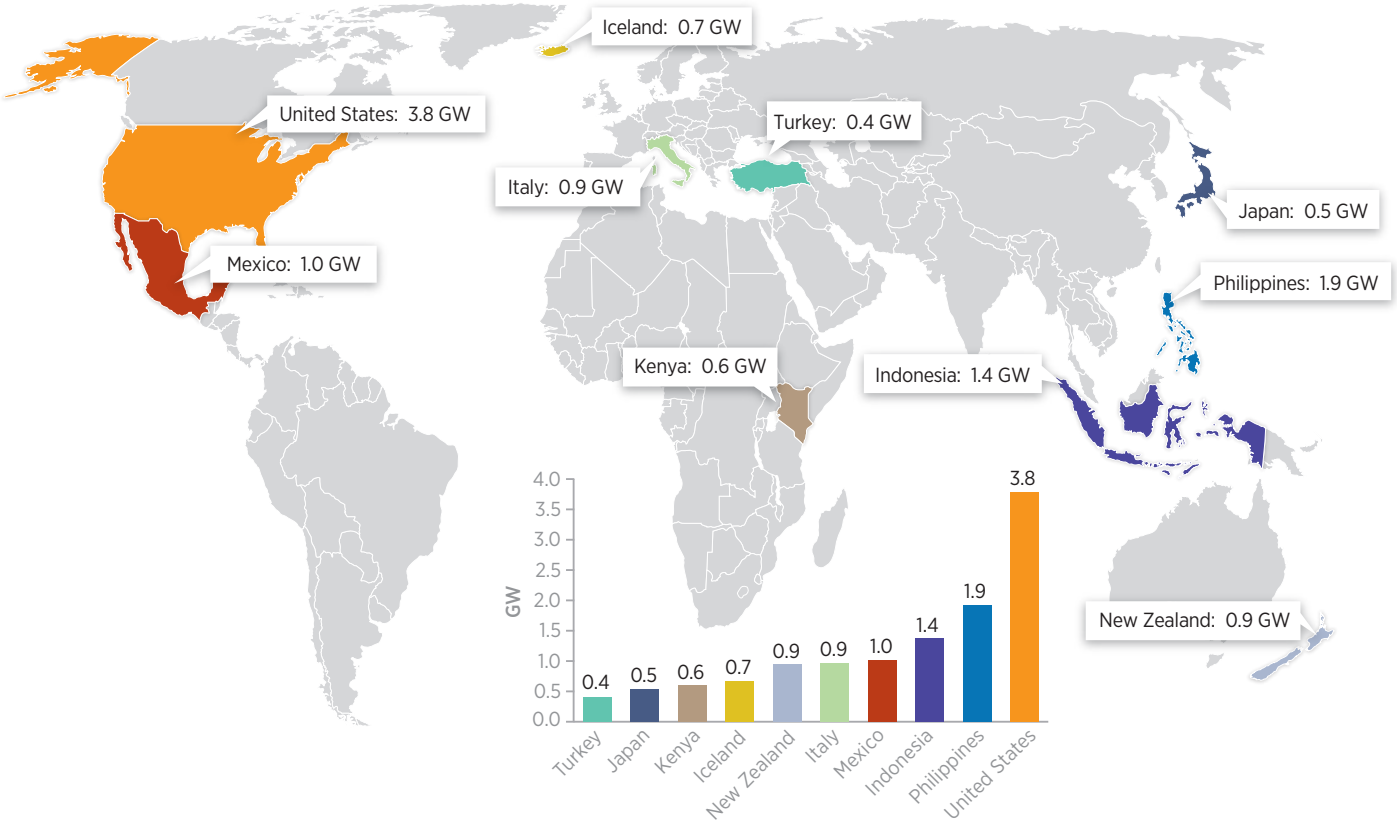
Source: EIA

U.S. Enhanced Geothermal Systems Demonstration Projects (2014)

PROJECT NAME	Company	Project Location	Start Date	End Date	Status
1 Desert Peak East EGS Project	Ormat Technologies, Inc.	Churchill County, Nevada	2002	2014	Successful stimulation, long term monitoring underway
2 Demonstration of an Enhanced Geothermal System at the Northwest Geysers Geothermal Field	Geysers Power Company, LLC	The Geysers, Cloverdale-Geyserville, California	2008	2017	Successful stimulation, long term monitoring underway
3 Feasibility of EGS Development at Brady's Hot Springs	Ormat Technologies, Inc.	Churchill County, Nevada	2008	2016	Initial stimulation completed, evaluating next steps
4 Concept Testing and Development at the Raft River Geothermal Field	University of Utah	Raft River, Idaho	2009	2016	Successful stimulation completed, continuous injection still underway
5 Newberry Volcano EGS Demonstration	AltaRock Energy, Inc.	La Pine, Oregon	2010	2015	Successful stimulation completed

Source: DOE Office of Energy Efficiency and Renewable Energy (EERE) internal data

Cumulative Geothermal Electricity Capacity (2014) – Top 10 Countries



VI

Sources: EIA, GEA

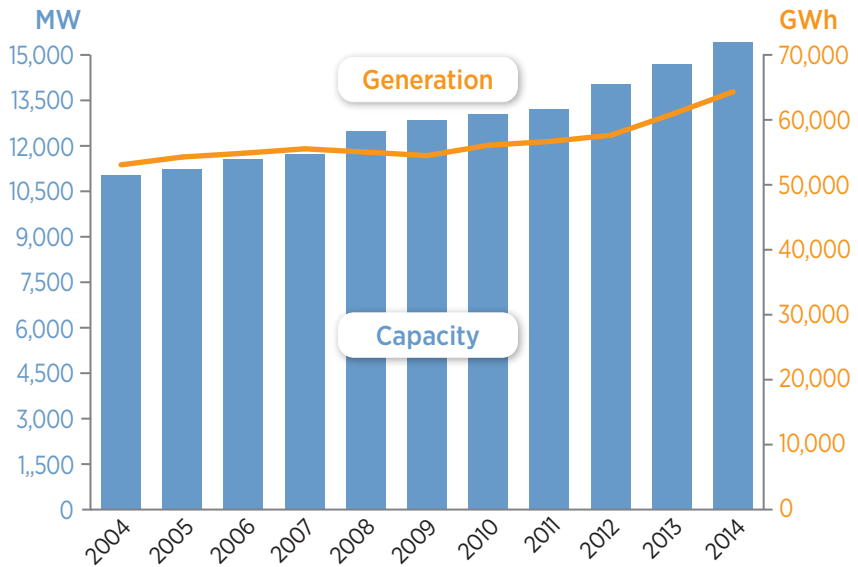
Reported capacity by country may differ from page 51 due to different data sources used.

VII. Biopower

Biopower: Summary

- U.S. biopower installed electricity **capacity grew by 4.5% in 2014 to approximately 15.4 GW.**
- Biopower electricity comes primarily from wood and agricultural residues that are burned as a fuel for cogeneration of electricity and heat in the industrial sector (such as in the pulp and paper industry).
- U.S. biopower installed electricity **capacity has seen steady growth since 2004,** with a CAGR of 3.4%.
- In 2014, biopower electricity generation accounted for about **12% of all renewable energy generated in the United States** and 1.6% of total U.S. electricity generation from all sources.

U.S. Biopower Electricity Capacity and Generation

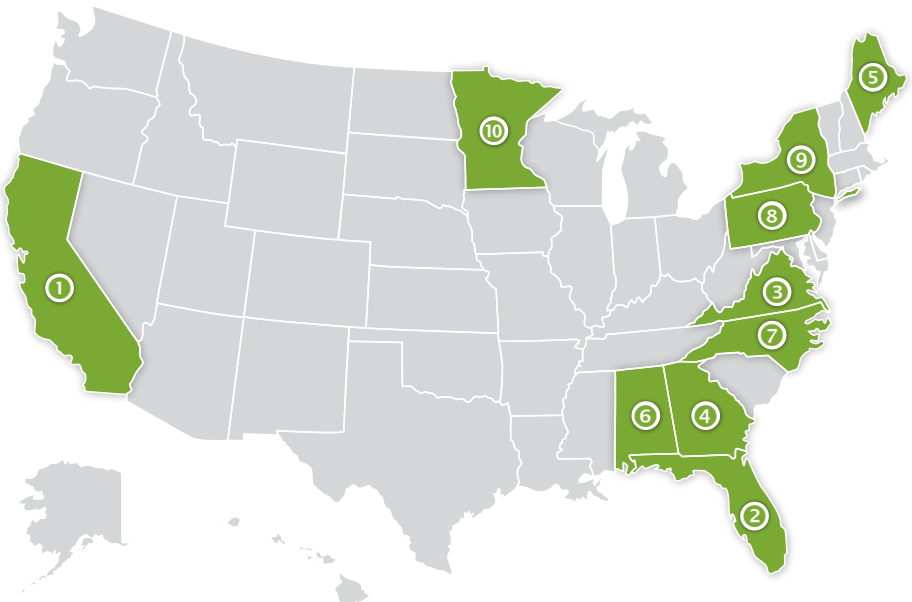


	U.S. Biopower Generation (GWh)	U.S. Biopower Capacity and % Change from Previous Year	
		Total (MW)	% Change
2000	60,726	10,676	- 2.9%
2001	49,748	10,576	- 0.9%
2002	53,709	10,867	2.8%
2003	53,340	10,856	- 0.1%
2004	53,073	11,033	1.6%
2005	54,276	11,222	1.7%
2006	54,861	11,553	2.9%
2007	55,539	11,738	1.6%
2008	55,034	12,485	6.4%
2009	54,493	12,836	2.8%
2010	56,089	13,053	1.7%
2011	56,671	13,207	1.2%
2012	57,622	14,047	6.4%
2013	60,858	14,705	4.7%
2014	64,319	15,408	4.8%

VII

Source: EIA
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

States Leading Biopower Electricity Installed Capacity (2014)



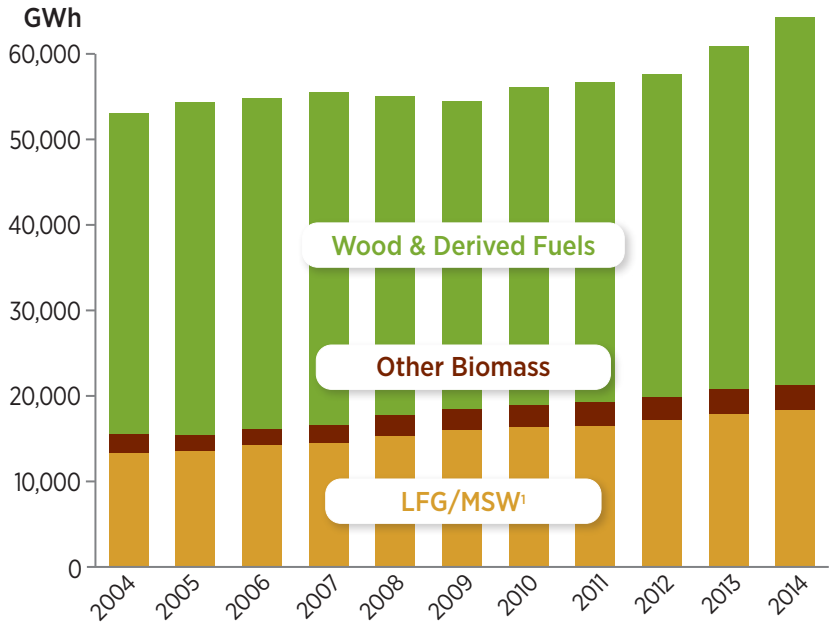
Total Installed Capacity (MW)[1]	
1 California	1,528
2 Florida	1,424
3 Virginia	1,008
4 Georgia	781
5 Maine	729
6 Alabama	673
7 North Carolina	660
8 Pennsylvania	649
9 New York	608
10 Minnesota	530

VII

Source: EIA

[1]Estimated based on proposed capacity additions.

U.S. Biopower Electricity Generation Sources



	LFG/ MSW[1] (GWh)	Other Biomass[2]	Wood and 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	53,340
2004	13,281	2,216	37,576	53,073
2005	13,472	1,948	38,856	54,276
2006	14,155	1,944	38,762	54,861
2007	14,462	2,063	39,014	55,539
2008	15,253	2,481	37,300	55,034
2009	15,982	2,461	36,050	54,493
2010	16,304	2,613	37,172	56,089
2011	16,398	2,824	37,449	56,671
2012	17,123	2,700	37,799	57,622
2013	17,844	2,986	40,028	60,858
2014	18,354	2,915	43,050	64,319

VII

Source: EIA

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

[1] LFG = landfill gas; MSW = municipal solid waste.

[2] Other includes biogenic municipal solid waste, landfill gas, sludge waste, agricultural byproducts, and other biomass.

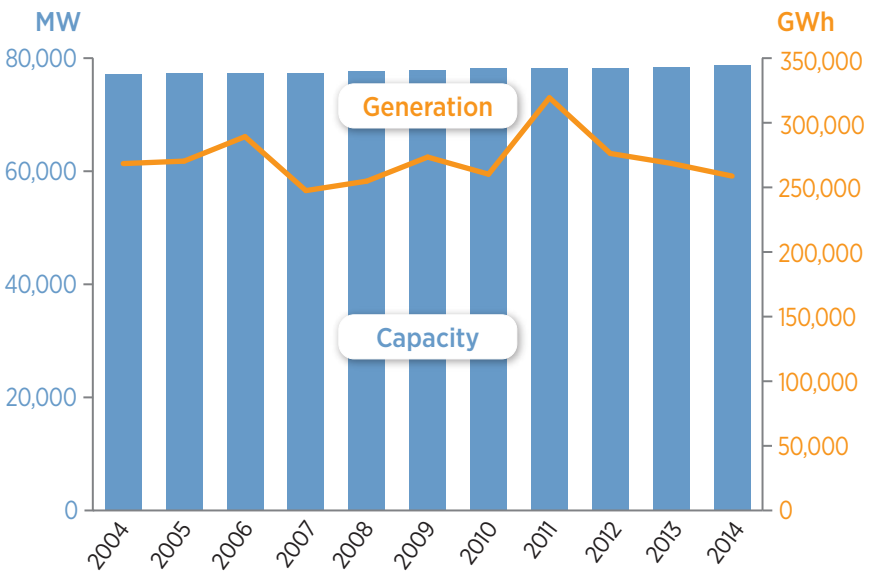
VIII. Hydropower

Hydropower: Summary

- Hydropower in the United States was comprised of almost 2,200 projects in 2014 totaling an **installed capacity reaching almost 79 GW.**[1]
- An **additional 2 GW of pumped storage hydropower capacity** exists across 42 plants.[1]
- Development activities in 2014 included unit additions and upgrades to existing facilities, new non-powered dam and conduit projects, and new low-impact stream-reach developments.[1]
- Hydropower installed capacity continued to be **concentrated in the western United States**, led by Washington, California, and Oregon.
- Hydropower, primarily large-scale, remained the **largest source of renewable electricity generation** in 2014, **accounting for 6.3% of U.S. total electricity generation and 46.7% of U.S. renewable electricity generation**. Annual hydropower generation, which fluctuates depending on water supply, fell by 3.7% in 2014, continuing a declining trend since 2011.
- DOE is examining the current state of the hydropower industry, the costs and benefits arising from additional hydropower, and challenges to achieving higher levels of hydropower deployment as part of its **Hydropower Vision**.[1]

[1] Source: Oak Ridge National Laboratory

U.S. Hydropower Electricity Capacity and Generation

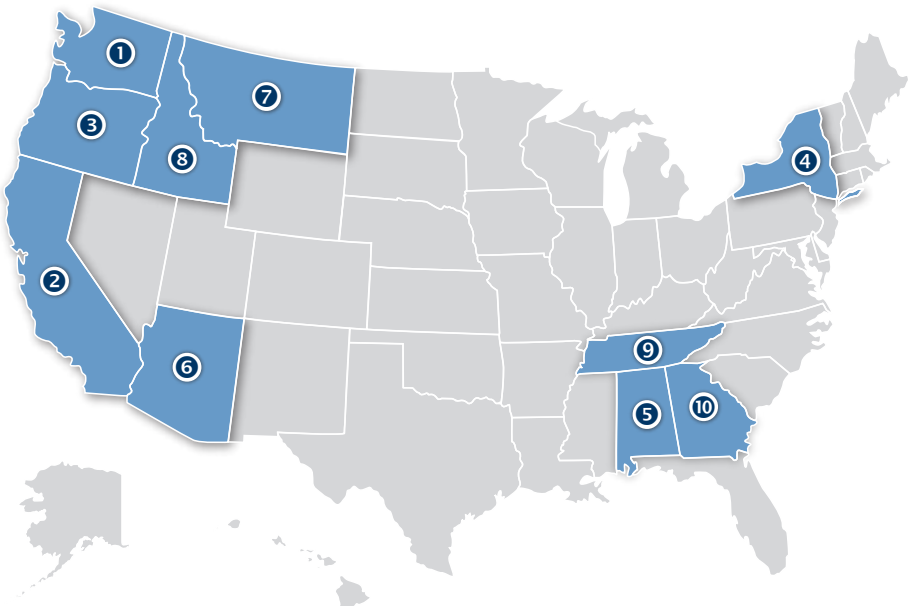


	U.S. Hydropower Generation (GWh)	U.S. Hydropower Capacity and % Increase from Previous Year	
		Total (MW)	% Increase
2000	275,573	76,946	0.0%
2001	216,961	76,911	0.0%
2002	264,329	77,047	0.2%
2003	275,806	77,020	0.0%
2004	268,417	77,130	0.1%
2005	270,321	77,354	0.3%
2006	289,246	77,419	0.1%
2007	247,510	77,432	0.0%
2008	254,831	77,640	0.3%
2009	273,445	77,910	0.3%
2010	260,203	78,204	0.4%
2011	319,355	78,194	0.0%
2012	276,240	78,241	0.1%
2013	268,565	78,457	0.3%
2014	258,749	78,810	0.4%

VIII

Source: EIA
Excludes pumped storage.
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes by EIA.

States Leading Hydropower Electricity Installed Capacity



Total Installed Capacity (MW)	
1 Washington	20,977
2 California	10,041
3 Oregon	8,322
4 New York	4,669
5 Alabama	3,319
6 Arizona	2,718
7 Montana	2,628
8 Idaho	2,541
9 Tennessee	2,499
10 Georgia	1,927

VIII

Source: EIA
Excludes pumped storage.
Estimated based on proposed capacity additions.

IX. Marine and Hydrokinetic Power

Marine and Hydrokinetic Power: Summary

- Resource assessments for marine and hydrokinetic power, including tidal, river, ocean current, and ocean wave energy, identify **U.S. technical resource potential of up to 1,846 TWh** of generation per year.[1]

- The vast majority of marine and hydrokinetic power projects worldwide are in a **pilot-deployment and test-site status.** Development activity is concentrated in North America and Europe.

- Information on existing and planned pilot deployment and test sites may be found at these websites:

  - Federal Energy Regulatory Commission (FERC): www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics.asp

  - The Water Power Program at the U.S. Department of Energy: www1.eere.energy.gov/water

  - The Ocean Energy Systems Implementing Agreement, established by the International Energy Agency: http://report2014.ocean-energy-systems.org/

IX

[1] Ocean Energy Systems (OES)

Global Marine and Hydrokinetic Power – Examples of Pilot Deployment and Test Sites

IX

Sources: EERE, OES

See following pages for additional information about these projects.

Information about additional projects can be found in the EERE Marine and Hydrokinetic Technology Database, accessible at: http://en.openei.org/wiki/Marine_and_Hydrokinetic_Technology_Database.

Global Marine and Hydrokinetic Power – Examples of Pilot Deployment and Test Sites

COMPANY	Project Name	Type	Country	Location
1 Northwest National Marine Renewable Energy Center/ Pacific Marine Energy Center	Test Centers	Wave, River Current, Tidal	United States	Oregon, Washington, Alaska
2 U.S. Navy Wave Energy Test Site (WETS)	Test Center	Wave	United States	Kaneohe Bay, Hawaii
3 Southeast National Marine Renewable Energy Center	Test Center	Ocean Current	United States	Boca Raton, Florida
4 Center for Ocean Renewable Energy	Test Center	Wave, Tidal	United States	Isles of Shoals, Maine/New Hampshire
5 California Wave Energy Test Center	Test Center	Wave	United States	San Luis Obispo, California
6 Northwest Energy Innovations	Pilot Deployment	Wave	United States	Kaneohe Bay, Hawaii
7 Oscilla Power	Pilot Deployment	Wave	United States	Isles of Shoals, Maine/New Hampshire
8 Ocean Renewable Power Corporation – OcGen	Pilot Deployment	Tidal	United States	Cobscook Bay, Maine
9 M3 Wave	Pilot Deployment	Wave	United States	Puget Sound, Washington
10 Ocean Renewable Power Corporation – RivGen	Pilot Deployment	Tidal	United States	Kvichak River, Alaska

Sources: EERE, OES

Information about additional projects can be found in the EERE Marine and Hydrokinetic Technology Database, accessible at: http://en.openei.org/wiki/Marine_and_Hydrokinetic_Technology_Database.

Global Marine and Hydrokinetic Power – Examples of Pilot Deployment and Test Sites (continued)

COMPANY	Project Name	Type	Country	Location
11 Fundy Ocean Research Centre for Energy (FORCE)	Test Center	Tidal	Canada	Minas Passage, Nova Scotia
12 Canadian Hydrokinetic Turbine Test Centre	Test Center	Current	Canada	Winnipeg River, Manitoba
13 SEAI/Marine Institute/Smart Bay Ltd	Test Center	Wave	Ireland	Galway
14 European Marine Energy Centre	Test Center	Wave/Tidal	UK	Orkney
15 WaveHub	Test Center	Wave	UK	Hayle, Cornwall
16 Claire Gibson	Pilot Deployment	Wave	UK	Hayle, Cornwall
17 Hans Jorgen Brodersen – DanWEC	Pilot Deployment	Wave	Denmark	Hanstholm & Nissum Bredning
18 FaBTest	Pilot Deployment	Wave	UK	Cornwall
19 EVE – Bimep	Pilot Deployment	Wave	Spain	Basque Country
20 Oceanic Platform of the Canary Islands – PLOCAN	Pilot Deployment	Wave	Spain	Gran Canaria, Canary Islands
21 Mats Leijon/Rafael Waters	Pilot Deployment	Wave	Sweden	Lysekil
22 Uppsala University – Soederfors	Pilot Deployment	Wave	Sweden	Soederfors/Dalaelven

Sources: EERE, OES

Information about additional projects can be found in the EERE Marine and Hydrokinetic Technology Database, accessible at: http://en.openei.org/wiki/Marine_and_Hydrokinetic_Technology_Database.

X. Hydrogen and Fuel Cells

Hydrogen and Fuel Cells: Summary

- The cumulative installed global fuel cell capacity for stationary power more than doubled between 2008 and 2014, reaching an estimated 240–260 MW in 2014.

- In 2014, **global electricity generation capacity from stationary fuel cells increased by nearly 60%** from the previous year.

- In 2014, **global fuel cell shipments increased by more than 40%** from 2013, while **revenues from fuel cell systems shipped increased by more than 50%** over the previous year.

- The United States produced **11 million metric tons of hydrogen** in 2014, and has more than 1,200 miles of hydrogen pipelines.

Source: EERE

- A 19.6 MW fuel cell power generation plant is being planned for construction in Seoul City, South Korea.

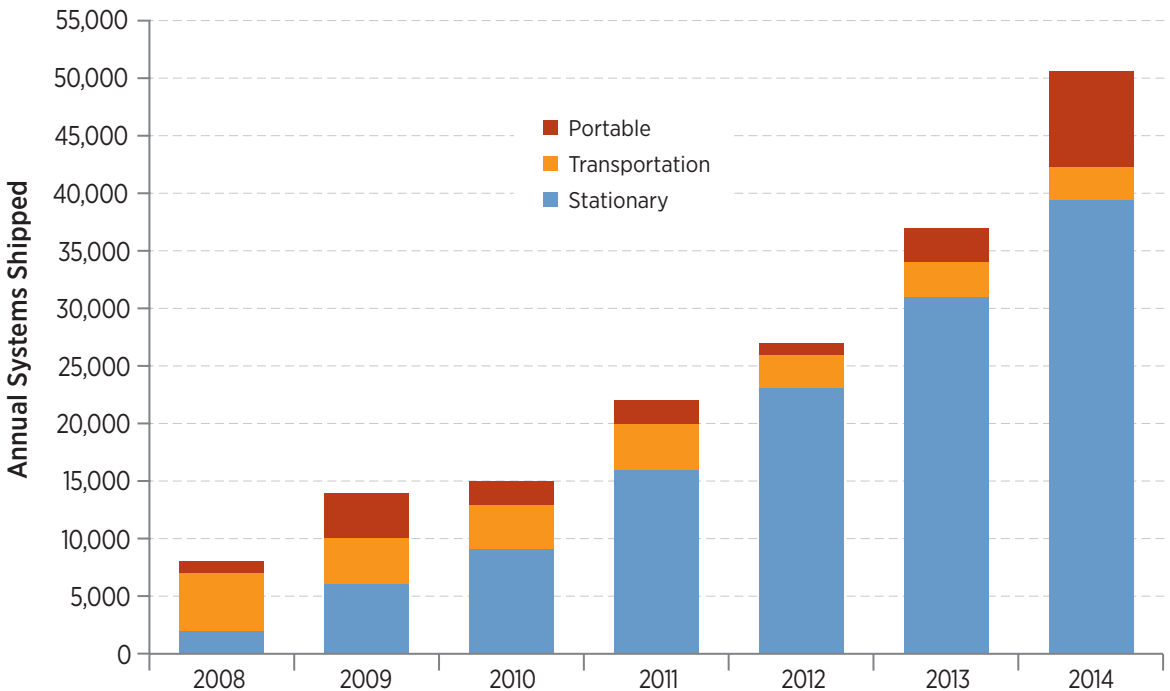
- Globally, more than 6,400 fuel cell units have been installed or ordered for backup power applications. These units have a successful startup rate of more than 99.7%.

- More than 9,000 fuel cells have been ordered or installed worldwide in forklifts for use in material handling applications.

X

Source: EERE

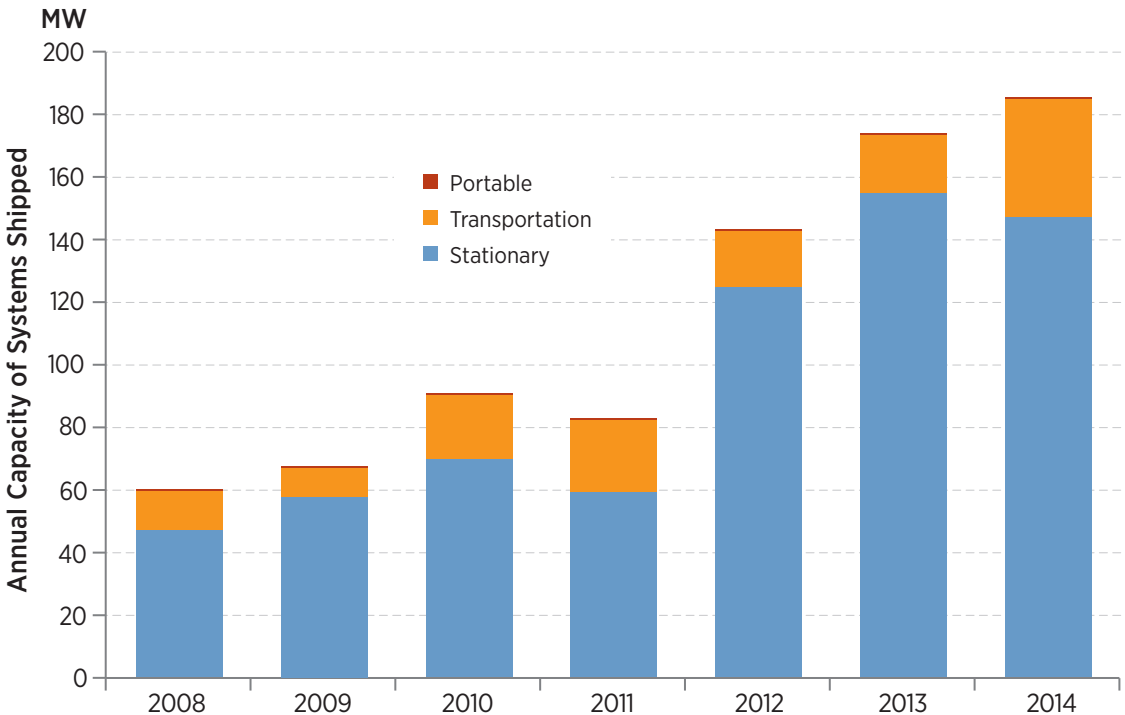
Annual Fuel Cell Systems Shipped by Application, World Markets



Sources: EERE, Navigant Research (2008–2013), E4tech (2014)

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

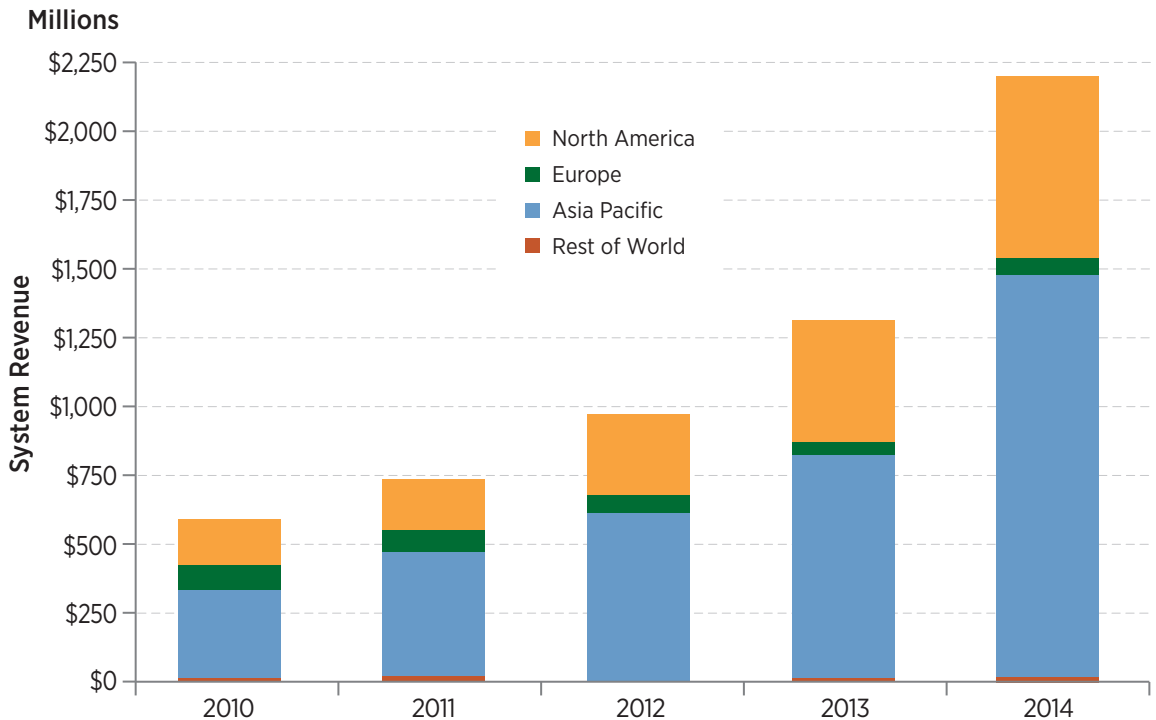
Annual Capacity of Systems Shipped by Application, World Markets



Sources: EERE, Navigant Research (2008–2013), E4tech (2014)

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

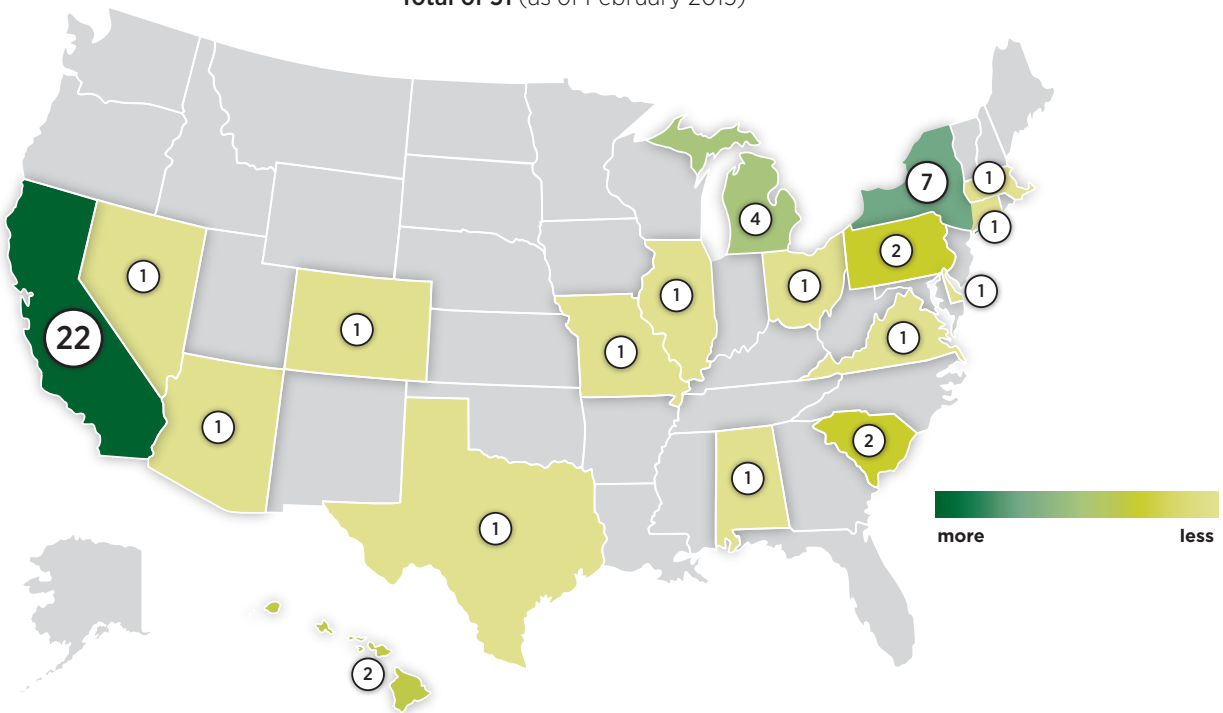
Fuel Cell System Revenue by Region of Manufacture



Sources: EERE, Navigant Research (2008–2013), 4th Energy Wave (2014)
Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

Number of Operational U.S. Hydrogen Fueling Stations

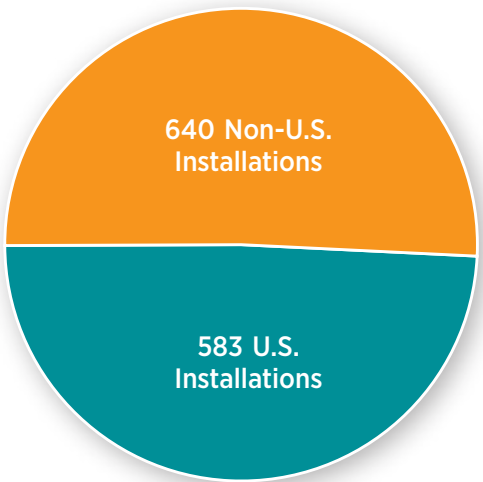
Total of 51 (as of February 2015)



X

Sources: EERE, FuelCells.org

Stationary Fuel Cell Installations, 2014



X

Source: FuelCells.org

XI. Renewable and Alternative Fuels

Renewable and Alternative Fuels: Summary

- **U.S. ethanol production increased by nearly 7.6% to 14,300 million gallons** in 2014, despite sharp ethanol and gasoline price decreases.

- In 2014, the United States **produced 58% of the world's ethanol,**[1] followed by Brazil at 25%, the European Union at 6%, China at 3%, and Canada at 2%.

- Several cellulosic ethanol plants were under construction in 2014.[2]

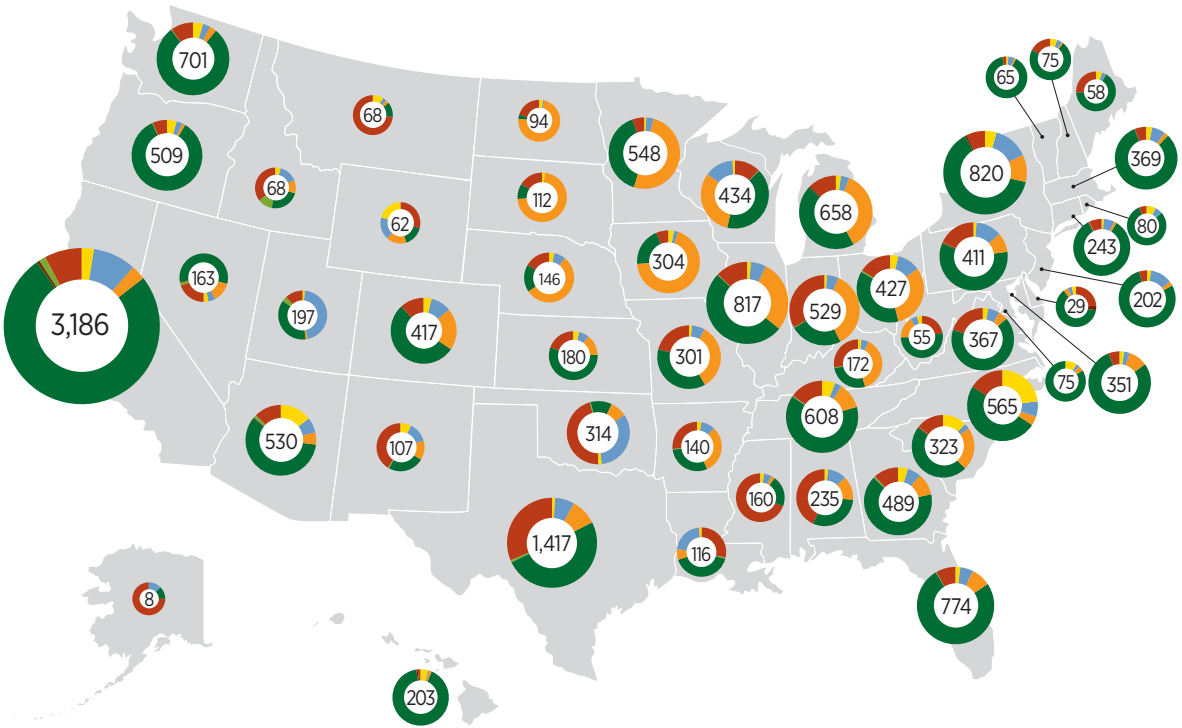
- In 2014, **the number of public and private electric vehicle charging stations in the United States increased by nearly 20% to a total of more than 11,000** with more than 26,000 charging outlets.

XI

[1] The Renewable Fuels Standard (RFS) in the United States sets targets that limit the amount of renewable fuel (including corn ethanol) and increase levels of cellulosic and advanced biofuels (including cellulosic ethanol). Substantial growth in ethanol market size faces the challenge that gasoline in the United States is generally sold as a 10% ethanol (E10), and ethanol production volumes above that level would need to enter the E15 or E85 markets

[2] Source: EERE

Renewable and Alternative Fueling Stations by State



Breakdown of Stations by State

- B20 (20% biodiesel)
- CNG (compressed natural gas)
- E85 (85% ethanol)
- Electric[1]
- Hydrogen
- LNG (liquefied natural gas)
- Propane

Total Renewable and Alternative Fueling Stations by State

XI

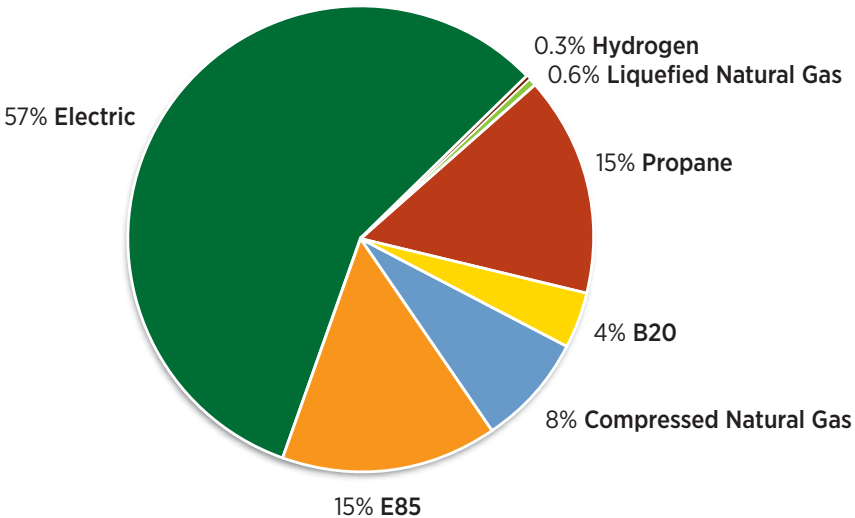
Source: EERE

Data as of February 26, 2015. For the full list of fueling station counts by state, visit http://www.afdc.energy.gov/afdc/fuels/stations_counts.html.

[1]Public and private electric vehicle charging stations. There were over 26,000 public and private fueling outlets.

Renewable and Alternative Fueling Stations by Type

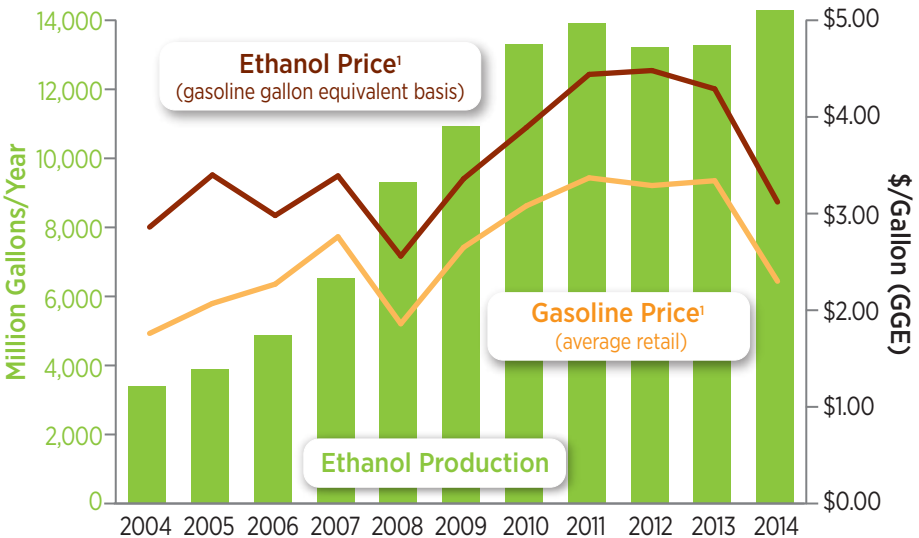
19,282 Alternative Fueling Stations in the United States



XI

Source: EERE
Data as of February 26, 2015.

U.S. Corn Ethanol Production and Prices



	Gasoline Price (average retail, $/gallon)	Ethanol Price (gasoline gallon equivalent basis, $/gallon)	Ethanol Production (million gallons/ year)
2000	$1.56	$2.16	1,622
2001	$1.50	$2.38	1,765
2002	$1.38	$1.97	2,140
2003	$1.54	$2.27	2,810
2004	$1.76	$2.86	3,404
2005	$2.07	$3.40	3,904
2006	$2.27	$2.98	4,884
2007	$2.76	$3.39	6,521
2008	$1.86	$2.56	9,309
2009	$2.65	$3.36	10,938
2010	$3.08	$3.89	13,298
2011	$3.37	$4.44	13,929
2012	$3.29	$4.48	13,218
2013	$3.34	$4.29	13,293
2014	$2.30	$3.12	14,300

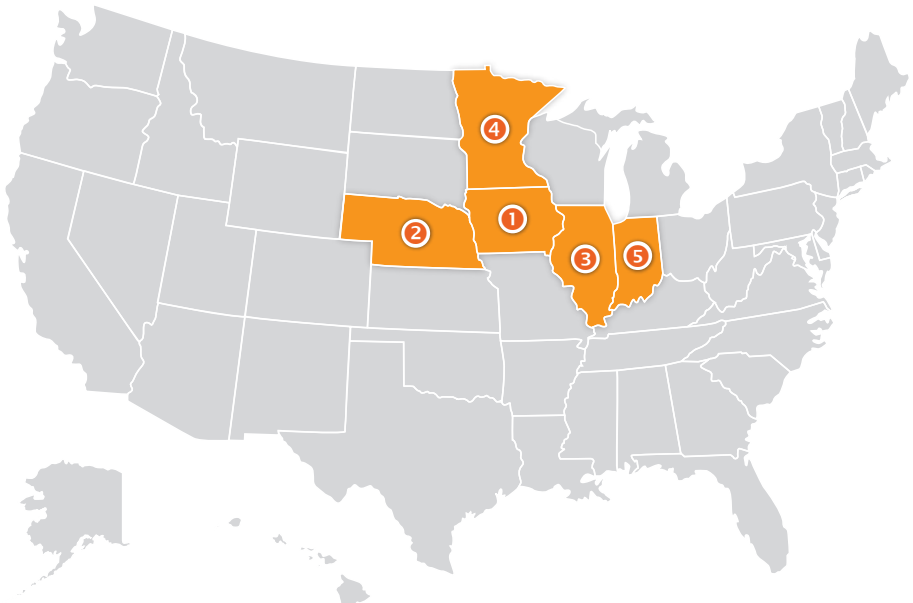
XI

Sources: Renewable Fuels Association (RFA), EERE

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1]Prices include taxes.

U.S. Corn Ethanol Production Capacity (2014)



Top Five States for U.S. Ethanol (operating) Production Capacity in 2014 (millions of gallons/year)	
1 Iowa	3,985
2 Nebraska	1,991
3 Illinois	1,434
4 Minnesota	1,129
5 Indiana	1,046

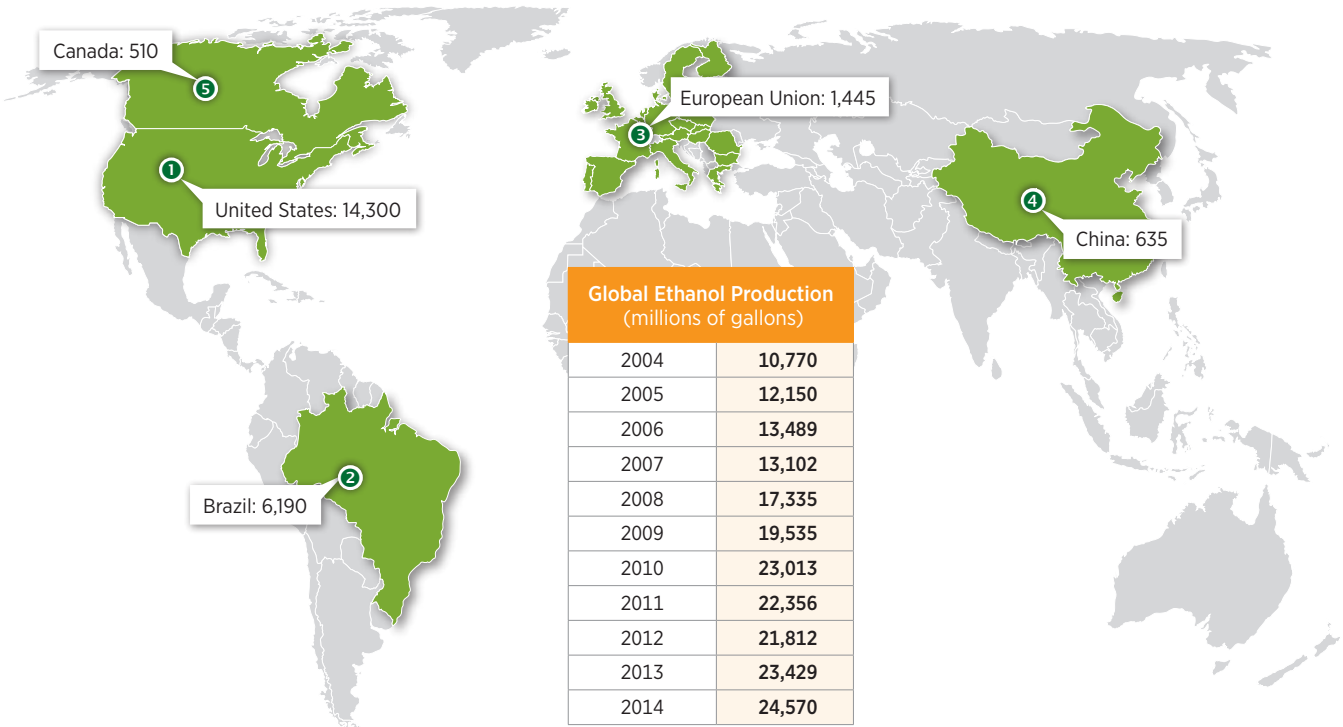
XI

Source: RFA

No sugarcane ethanol is currently produced in the United States.

Global Ethanol[1] Production

Top Five Regions (2014) **Ethanol Production** (millions of gallons)



Global Ethanol Production (millions of gallons)	
2004	**10,770**
2005	**12,150**
2006	**13,489**
2007	**13,102**
2008	**17,335**
2009	**19,535**
2010	**23,013**
2011	**22,356**
2012	**21,812**
2013	**23,429**
2014	**24,570**

XI

Source: RFA

[1] Various feedstocks

Biodiesel: Summary

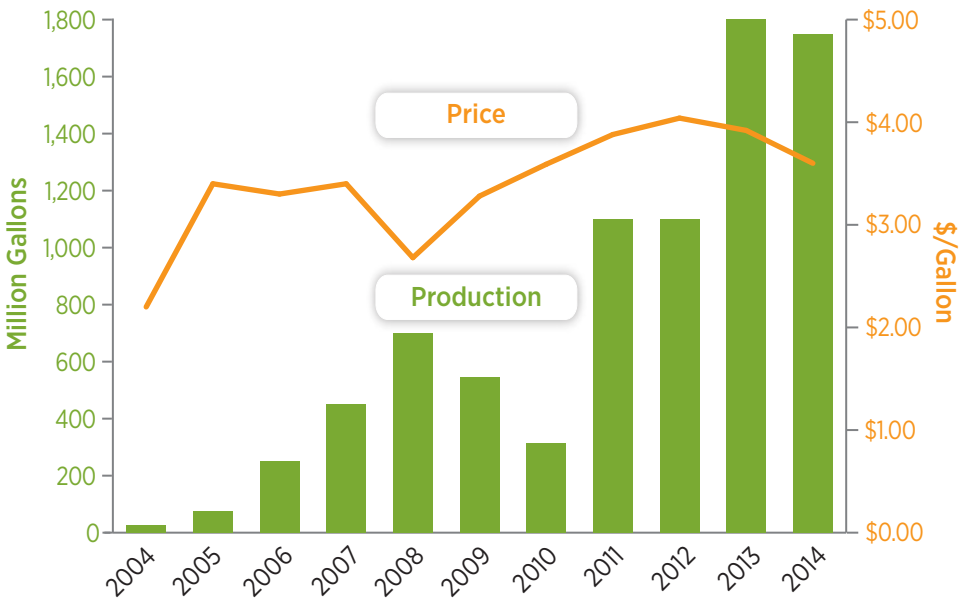
- **U.S. biodiesel production decreased slightly to 1.75 billion gallons** (1.85 billion gasoline gallons equivalent) in 2014 from 1.8 billion gallons in 2013.

- Biodiesel production in the United States has increased rapidly over the last decade (by 70 times).

- In 2014, **the United States led the world in biodiesel production,** followed by Germany, Brazil, Argentina, France, and Indonesia.

XI

U.S. Biodiesel Production and Price



	Biodiesel Price[1] (gasoline gallon equivalent basis) ($ per gallon)	Total U.S. Production (million gallons)
2001	1.80	5
2002	1.70	15
2003	1.80	20
2004	2.20	25
2005	3.40	75
2006	3.30	250
2007	3.40	450
2008	2.68	700
2009	3.28	545
2010	3.59	315
2011	3.88	1,100
2012	4.04	1,100
2013	3.92	1,800
2014	3.60	1,750

XI

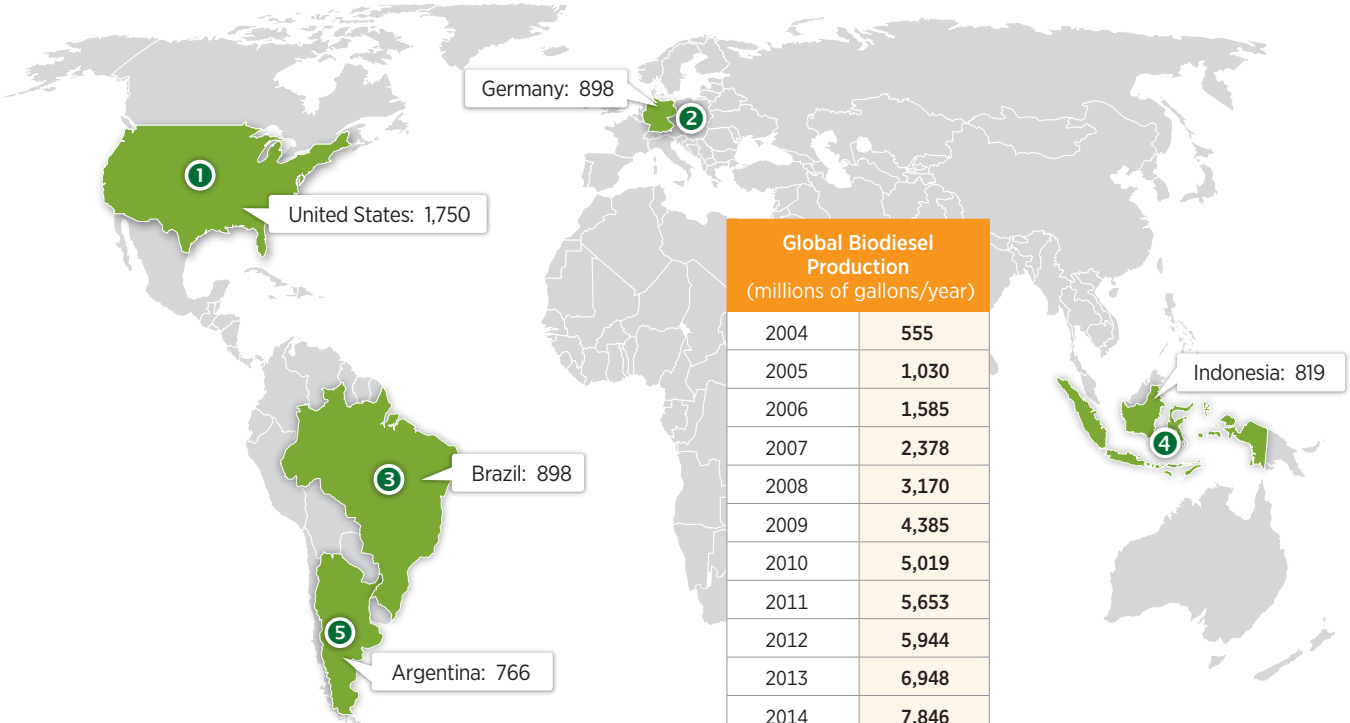
Sources: EERE; Production data: Biodiesel.org (2004–2013), National Biodiesel Board estimate according to U.S. Environmental Protection Agency Moderated Transaction System data (2014)

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

[1] Average price of B20 and B99–B100.

Global Biodiesel Production

Top Countries (2014) **Biodiesel Production** (millions of gallons/year)



Global Biodiesel Production (millions of gallons/year)	
2004	**555**
2005	**1,030**
2006	**1,585**
2007	**2,378**
2008	**3,170**
2009	**4,385**
2010	**5,019**
2011	**5,653**
2012	**5,944**
2013	**6,948**
2014	**7,846**

Source: REN21

XII. Clean Energy Investments

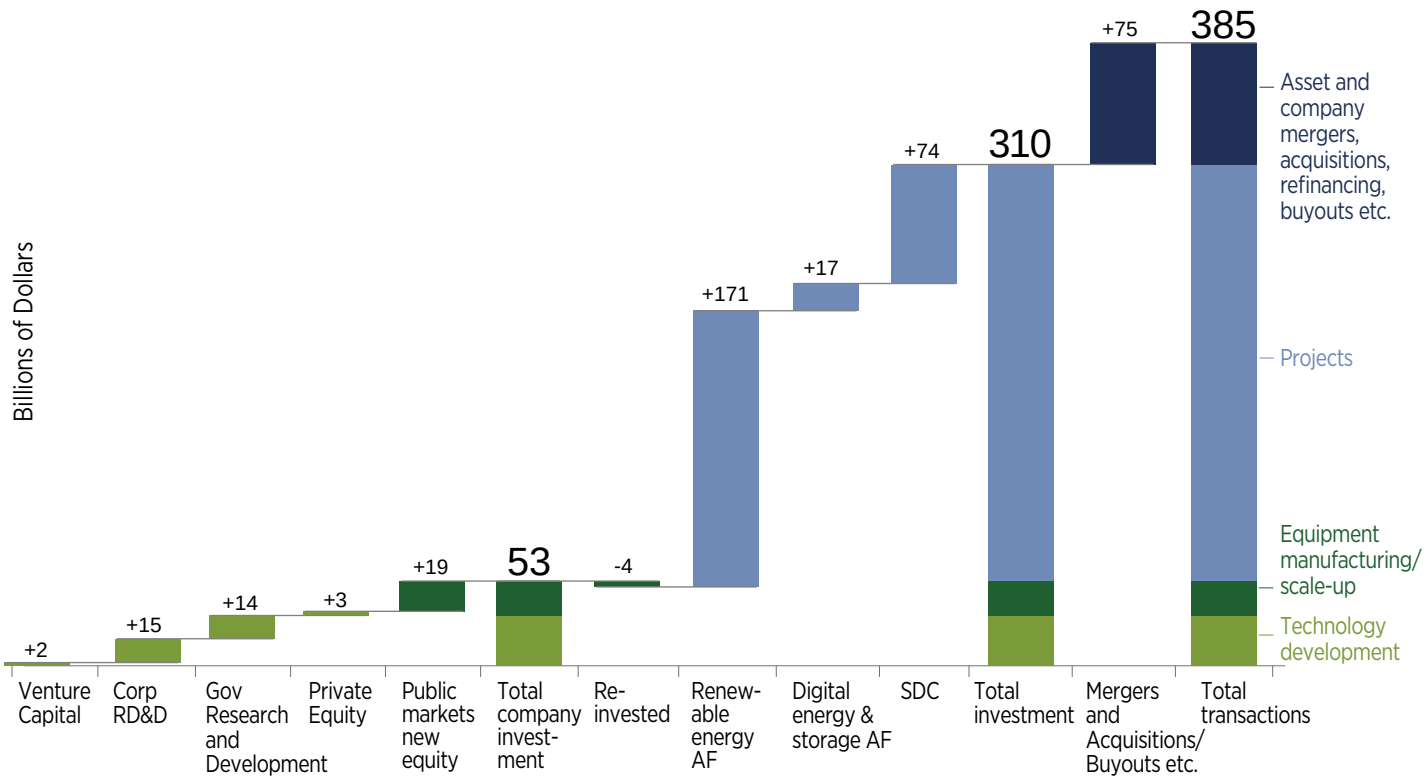
Clean Energy Investment: Summary

- After two years of decline, global investment in renewable energy grew in 2014.
- New investment in clean energy in the United States grew 11% to **$40.8 billion in 2014.**
- Wind and solar continued to experience the highest levels of new investment in 2014 globally.
- **Globally, new venture capital and private equity i**nvestment in clean energy has increased from $1.4 billion in 2004 to $4.8 billion in 2014.

XII

Source: Bloomberg New Energy Finance (BNEF)

Clean Energy Investment Types & Flows (2014)



XII

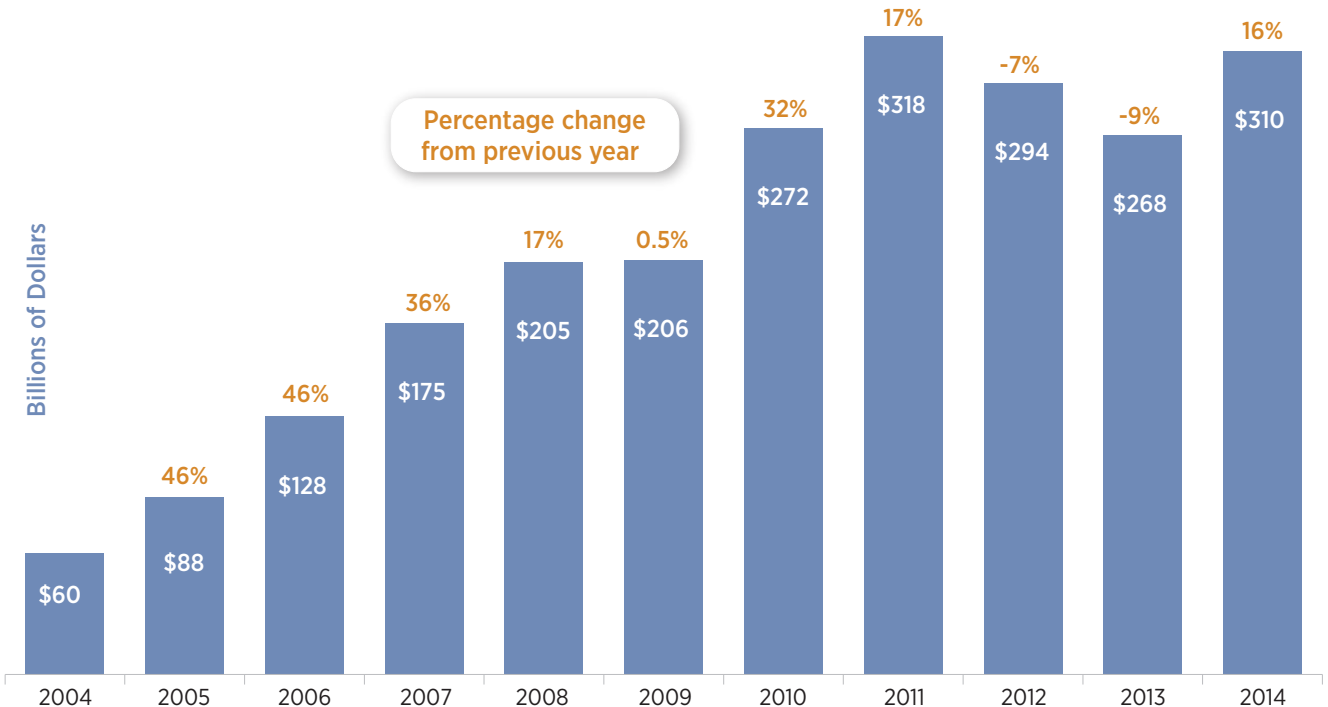
Source: BNEF

Total values include estimates for undisclosed deals.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

AF = asset finance; RD&D = research, development, and demonstration; SDC = small distributed capacity.

New Investment in Clean Energy – Global

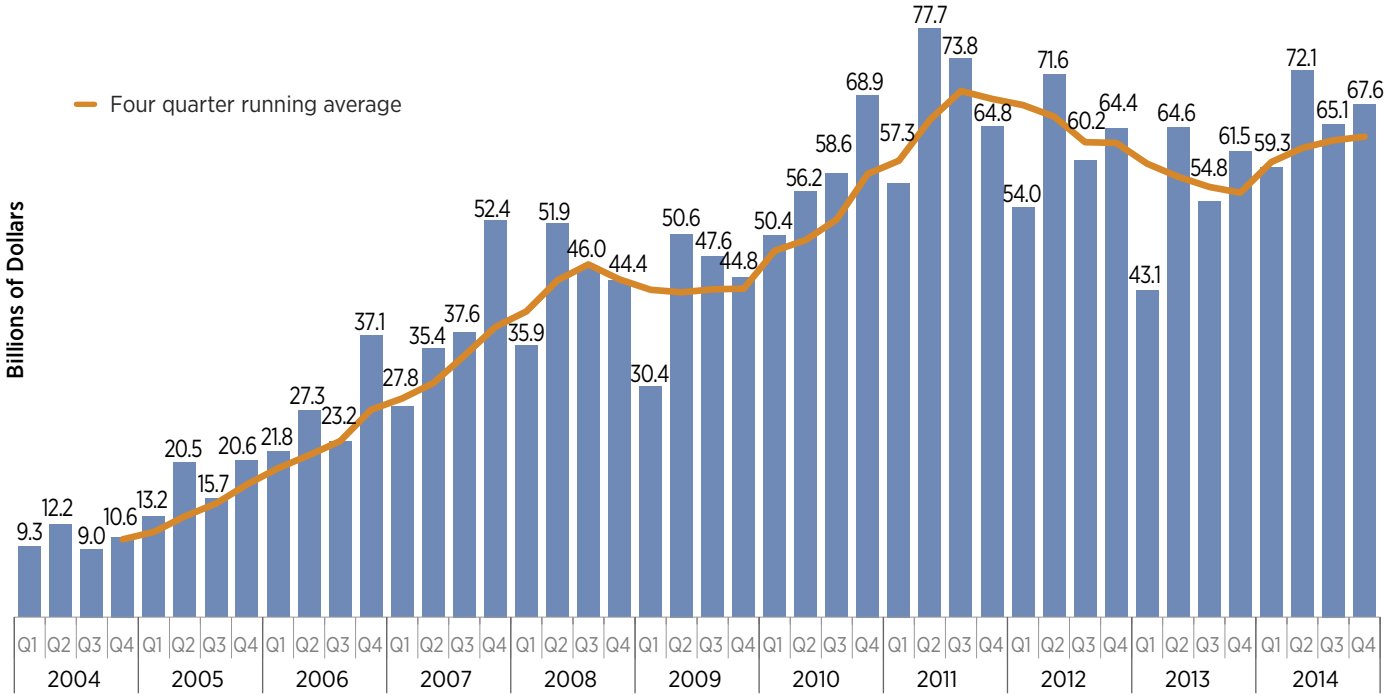


Source: BNEF

Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

New Investment in Clean Energy – Global

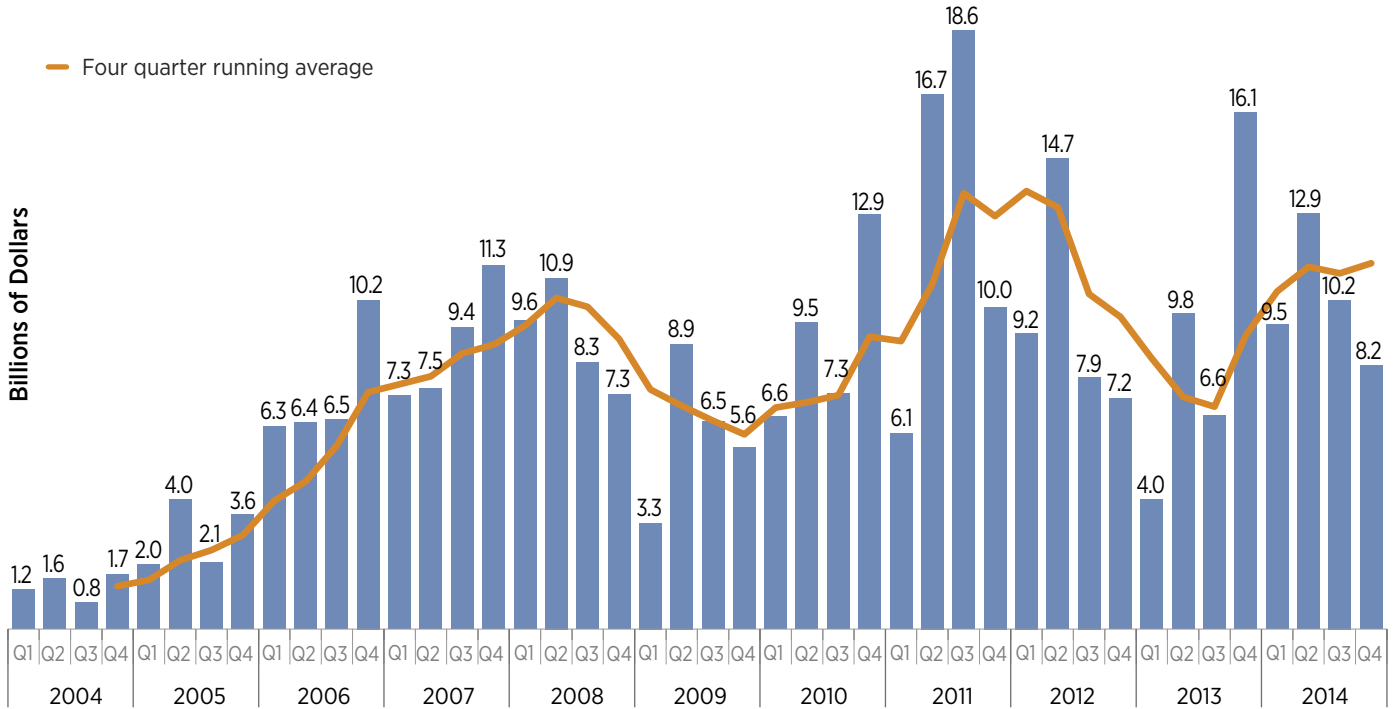


Source: BNEF

Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

New Investment in Clean Energy – United States

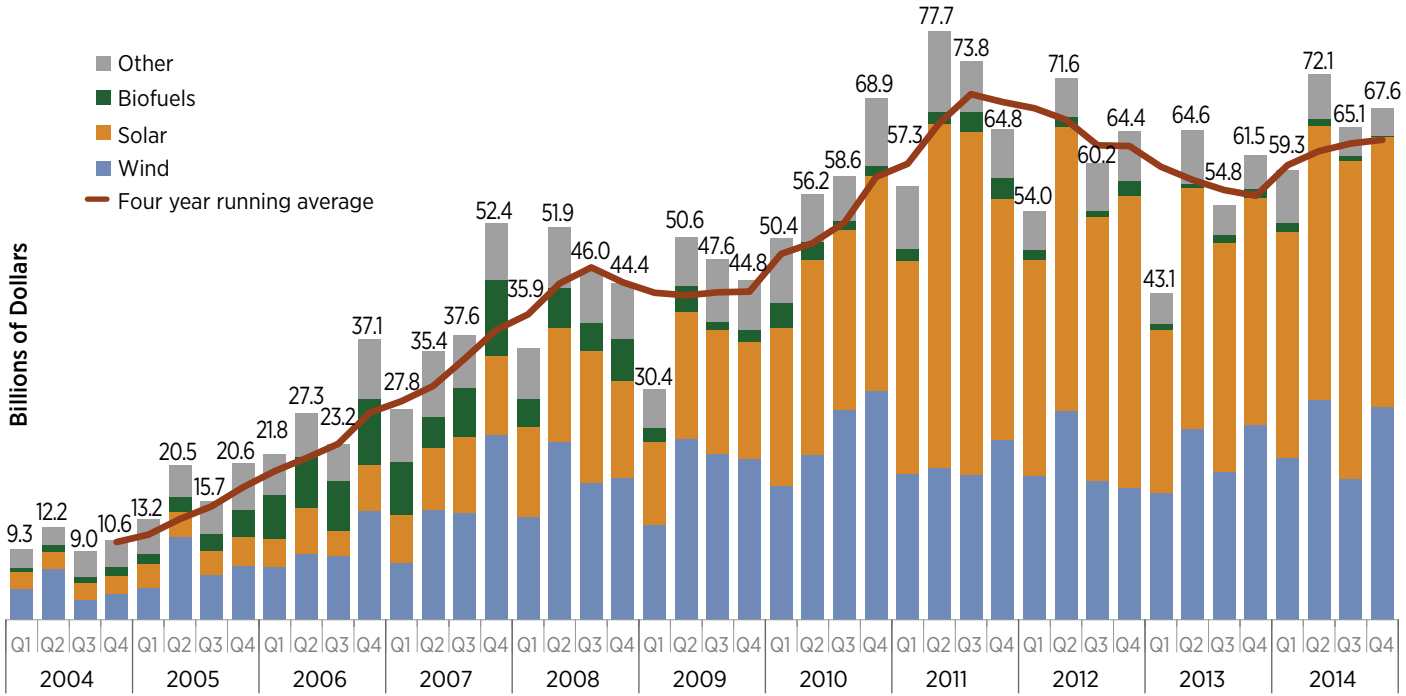


Source: BNEF

Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

New Investment in Clean Energy By Technology – Global



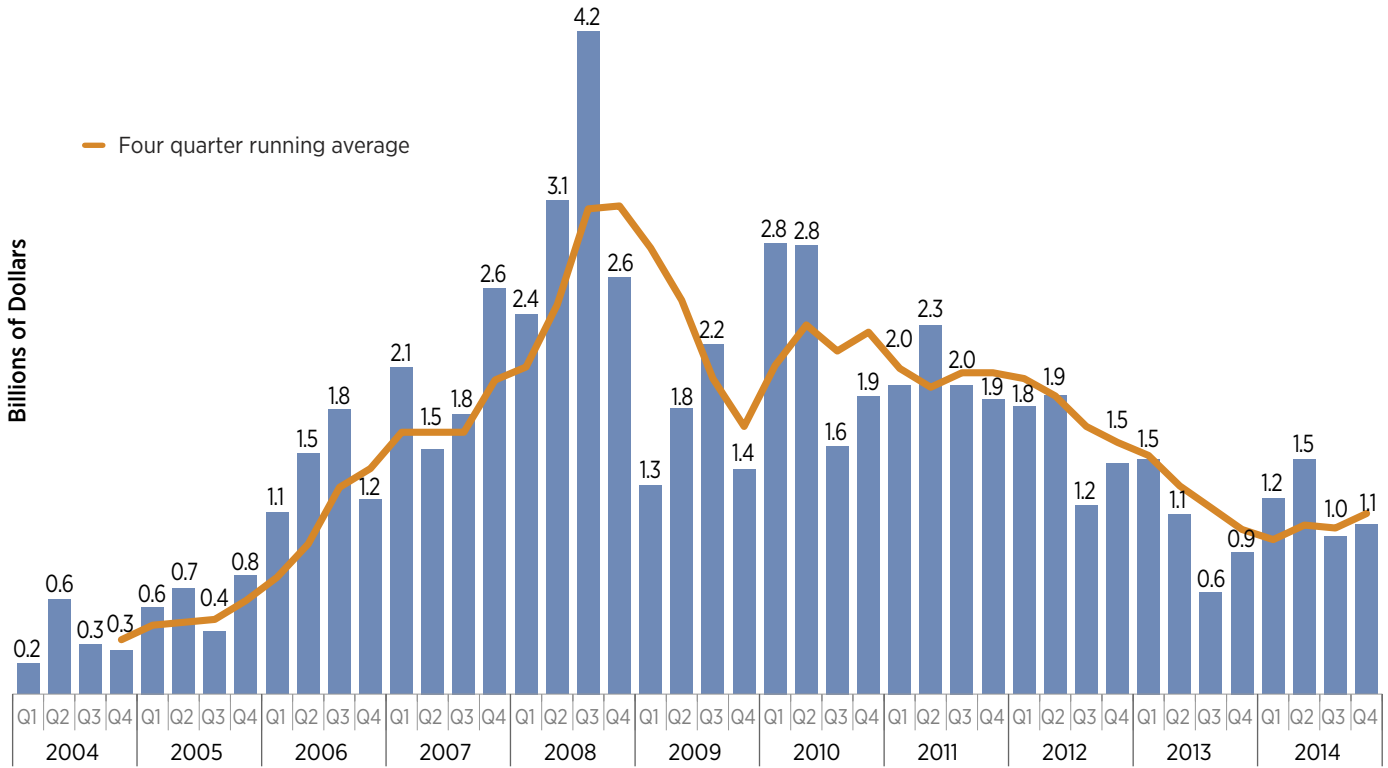
XII

Source: BNEF

Total values include estimates for undisclosed deals. Includes corporate and government R&D, and spending for digital energy and energy storage projects (not reported in quarterly statistics).

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

Venture Capital and Private Equity New Investment in Clean Energy – Global

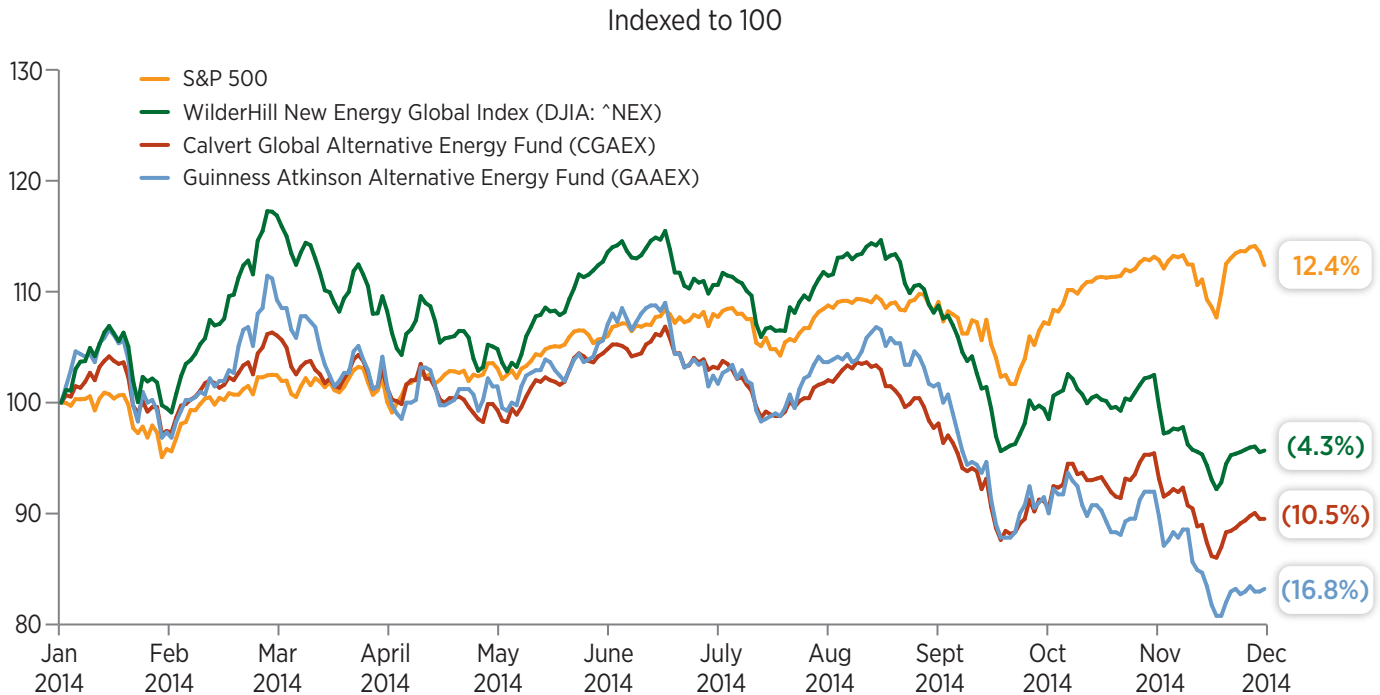


Source: BNEF

Total values include estimates for undisclosed deals.

Reported values may vary from those included in previous versions of the Data Book due to retroactive changes in source data.

Public Renewable Energy Index Performance (2014)



XII

Source: Public data; downloaded from the Yahoo! Finance website.

Glossary

Alternating Current (AC)

An electrical current that periodically reverses the direction of electrons. The electric grid infrastructure, including most conventional and renewable utility-scale generation sources (other than solar photovoltaics [PV]) operates in AC. PV systems must use an inverter to convert DC into AC in order to operate within the grid. For the purpose of this report, an overall DC-to-AC de-rate factor of 0.77 was assumed.

Asset Financing (AF)

Using balance sheet assets (such as accounts receivable, short-term investments or inventory) to obtain a loan or borrow money—the borrower provides a security interest in the assets to the lender. This differs from traditional financing methods, such as issuing debt or equity securities, as the company simply pledges some of its assets in exchange for a quick cash loan.

B2O

A fuel containing a mixture of 20% biodiesel and 80% petrodiesel.

Baseload 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 those derived from 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.

British Thermal Unit (Btu)

The quantity of heat required to increase 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 a given period of time 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 during 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.

Direct Current (DC)

An electrical current that has unidirectional flow. DC is the type of electrical current often seen in batteries and solar photovoltaic (PV) cells. PV modules are commonly rated under standardized testing conditions in terms of DC output. For the purpose of this report, an overall DC-to-AC de-rate factor of 0.77 was assumed.

Digital Energy

The integration of digital communication technologies into energy systems, especially the electrical grid. Smart meters, along with other digital communication devices embedded in electrical transmission and distribution systems, allow for a two-way flow of information between utilities and their customers as well as greater digital control of the electrical grid, a concept known as the Smart Grid.

E85

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

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% concentration). Ethanol can also be used in high concentrations (E85) in vehicles designed for its use.

Federal Energy Regulatory Commission (FERC)

The U.S. federal agency with jurisdiction over interstate electricity sales, wholesale electric rates, hydroelectric licensing, some natural gas pricing, oil pipeline rates, and gas pipeline certification. FERC is an independent regulatory agency within DOE 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% 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 that produces electricity 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 Gallon Equivalent (GGE)

The amount of alternative fuel it takes to equal the energy content of one liquid gallon of gasoline. GGE allows consumers to compare the energy content of competing fuels against a commonly known fuel—gasoline.

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).

Ground Source (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 injected 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 or one million kW.

Gigawatt-hour (GWh)
One billion watt-hours.

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 electrical energy 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% methane and 50% carbon dioxide and water vapor by volume. The methane in landfill gas may be vented, flared, or combusted to generate electricity or useful thermal energy on-site, or injected into a pipeline for combustion off site.

Megawatt (MW)
One million watts of electricity.

Megawatt-hour (MWh)
One thousand kilowatt-hours or 1 million watt-hours.

Mergers and Acquisitions (M&A)
A general term used to refer to the consolidation of companies. A merger is a combination of two companies to form a new company, while an acquisition is the purchase of one company by another in which no new company is formed.

Municipal Solid Waste (MSW)
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

PV cells convert incident light directly into electricity (direct current). 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.

Private Equity (PE)

Equity capital that is not quoted on a public exchange. Private equity consists of investors and funds that make investments directly into private companies or conduct buyouts of public companies that result in a delisting of public equity. Capital for private equity is raised from retail and institutional investors, and can be used to fund new technologies, expand working capital within an owned company, make acquisitions, or to strengthen a balance sheet.

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.

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, hydropower, geothermal, solar, wind, and ocean energy.

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.

Venture Capital (VC)

Money provided by investors to startup firms and small businesses with perceived long-term growth potential. This is a very important source of funding for startups that do not have access to capital markets. It typically entails high risk for the investor, but it has the potential for above-average returns.

Wind Energy

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

Principal Data Sets

DATA PROVIDER	Data Set/Report	Geographic Scope	Technologies Addressed	Date Available/ Accessed
American Wind Energy Association (AWEA)	Fourth Quarter 2014 Market Report	United States	Wind	January 2015
	U.S. Wind Industry Annual Market Report 2014	United States	Wind	April 2015
Bloomberg New Energy Finance (BNEF)	Global Trends in Clean Energy Investment	Global	Biofuels, Solar, Wind, Energy Storage, Digital Energy	January 2015
Energy Information Administration (EIA)	Form 860	United States	Biopower, Geothermal, Hydropower, Solar, Wind[1]	February 2015
	Monthly Energy Review	United States	Biopower, Coal, Geothermal, Hydropower, Natural Gas, Nuclear, Petroleum, Solar, Wind[2]	March 2015
	Electric Power Monthly	United States	Biopower, Geothermal, Hydropower, Solar, Wind	March 2015
Global Wind Energy Council (GWEC)	Global Wind Report 2014: Annual Market Update	Global	Wind	April 2015
Lawrence Berkeley National Laboratory (LBNL)	2014 Wind Technologies Market Report	United States	Wind	August 2015
Renewable Energy Policy Network for the 21st Century (REN21)	2014 Renewables Global Status Report	Global	Biomass, Geothermal, Hydropower, Solar, Wind	June 2015
Renewable Fuels Association (RFA)	2014 Ethanol Industry Outlook	United States	Ethanol	February 2015
Solar Energy Industries Association and GTM Research (SEIA/GTM)	2014 Solar Industry Year in Review	United States	Solar	March 2015

[1]Includes installed capacity, planned capacity additions, and planned capacity retirements
[2]Includes production and consumption by end use sector and electricity

References

Key Findings - Pages 3–4

- Energy Information Administration (EIA) – Monthly Energy Review

U.S. Energy Production and Consumption – Pages 7–9

- EIA – Monthly Energy Review
- Production: EIA – Monthly Energy Review, March 2015, Table 1.2, http://www.eia.gov/totalenergy/data/monthly/archive/00351503.pdf.
- Consumption: EIA – Monthly Energy Review, March 2015, Table 1.3, http://www.eia.gov/totalenergy/data/monthly/archive/00351503.pdf.

U.S. Nameplate Capacity and Generation – Pages 10–13

- EIA – Electric Power Monthly, March 2015, Table 1.1, http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.
- EIA – Form 860, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- Solar Energy Industries Association and GTM Research (SEIA/GTM) – U.S. Solar Market Insight: 2014 Year in Review.

U.S. Energy Consumption by Sector – Pages 14–16

- EIA – Monthly Energy Review, March 2015, Section 2, "Energy Consumption by Sector," http://www.eia.gov/totalenergy/data/monthly/archive/00351503.pdf.

References

U.S. Renewable Energy Capacity and Generation – Pages 20–29

- EIA – 2014 Installed Capacity, EIA Form 860, 2014 Early Release, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Additions, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Proposed" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Retirements, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Operable" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – Electric Power Monthly, March 2015, Table 1.1 and 1.1.A, http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.
- SEIA/GTM – U.S. Solar Market Insight: 2014 Year in Review.
- Lawrence Berkeley National Laboratory (LBNL) – 2014 Wind Technologies Market Report, http://emp.lbl.gov/publications/2014-wind-technologies-ma.

Renewable Energy Capacity by State – Pages 31–40

- EIA – 2014 Installed Capacity, EIA Form 860, 2014 Early Release, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Additions, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Proposed" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Retirements, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Operable" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- LBNL – 2014 Wind Technologies Market Report, http://emp.lbl.gov/publications/2014-wind-technologies-ma.
- SEIA/GTM – U.S. Solar Market Insight: 2014 Year in Review.
- United States Census 2014 – Annual Population Estimates, http://www.census.gov/popest/data/state/totals/2014/index.html.

XIV

References

Global Renewable Energy – Pages 43–51

- Renewable Energy Policy Network for the 21st Century (REN21) – 2015 Renewables Global Status Report, http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.
- EIA – International Energy Statistics, Capacity, http://www.eia.gov/cfapps/ipdbproject/iedindex3.cfm?tid=2&pid=2&aid=7&cid=regions&syid=2000&eyid=2011&unit=MK; estimated for 2012–2014.
- World generation data were derived from global capacity data using capacity factors of 14% for PV, 30% for wind, 70% for geothermal, 54% for biomass, 25% for CSP, and 41% for hydropower.

U.S. Wind – Pages 54–58

- NREL – 2014–2015 Offshore Wind Technologies Market Report, http://www.nrel.gov/docs/fy15osti/64283.pdf.
- LBNL – 2014 Wind Technologies Market Report, http://emp.lbl.gov/publications/2014-wind-technologies-ma.
- EIA – Electric Power Monthly, March 2015, Table 1.1.A, http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.
- American Wind Energy Association (AWEA) – U.S. Wind Industry Fourth Quarter 2014 Market Report, http://www.awea.org/Resources/Content.aspx?ItemNumber=7150.
- AWEA – US Wind Industry Annual Market Report 2014, April 2015, http://www.awea.org/AMR2014.

Global Wind – Pages 59–60

- REN21 – 2015 Renewables Global Status Report, http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.
- LBNL – 2014 Wind Technologies Market Report, http://emp.lbl.gov/publications/2014-wind-technologies-ma.
- Global Wind Energy Council (GWEC) – Global Wind Report 2014: Annual market update, http://www.gwec.net/wp-content/uploads/2015/03/GWEC_Global_Wind_2014_Report_LR.pdf.

References

U.S. Solar – Pages 63–66

- SEIA/GTM – U.S. Solar Market Insight: 2014 Year in Review.

Global Solar – Pages 67–68

- REN21 – 2015 Renewables Global Status Report, http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.
- SEIA/GTM – U.S. Solar Market Insight: 2014 Year in Review.
- GTM Research – PV Pulse.

Geothermal – Pages 71–74

- DOE – "What is FORGE?" http://energy.gov/eere/geothermal/what-forge.
- EIA – 2014 Planned Capacity Additions, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Proposed" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Retirements, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Operable" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – Electric Power Monthly, March 2015, Table 1.1.A, http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.
- Geothermal Energy Association (GEA) – 2014 Annual U.S. Geothermal Power Production and Development Report, http://geo-energy.org/reports/2015/2015%20Annual%20US%20%20Global%20Geothermal%20Power%20Production%20Report%20Draft%20final.pdf.

XIV

References

Biopower – Pages 77–79

- EIA – 2014 Installed Capacity, EIA Form 860, 2014 Early Release, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Additions, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Proposed" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Retirements, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Operable" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – Electric Power Monthly, March 2015, Table 1.1.A, "Net Generation from Renewable Sources: Total (All Sectors)," http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.

Hydropower – Pages 82–83

- EIA – 2014 Installed Capacity, EIA Form 860, 2014 Early Release, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Additions, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Proposed" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – 2014 Planned Capacity Retirements, Form 860, 2014 Early Release, Annual Electric Generator Report, Generator Y2014 File, "Operable" tab, http://www.eia.doe.gov/cneaf/electricity/page/eia860.html.
- EIA – Electric Power Monthly, March 2015, Table 1.1.A, "Net Generation from Renewable Sources: Total (All Sectors)," http://www.eia.gov/electricity/monthly/current_year/march2015.pdf.
- Oak Ridge National Laboratory – 2014 Hydropower Market Report, April 2015, http://www.energy.gov/sites/prod/files/2015/04/f22/2014%20Hydropower%20Market%20Report_20150424.pdf.

References

Marine and Hydrokinetic Power – Pages 86–88

- Ocean Energy Systems (OES), Annual Report 2014, http://report2014.ocean-energy-systems.org/.
- U.S. DOE EERE – Marine and Hydrokinetic Technology Database, http://en.openei.org/wiki/Marine_and_Hydrokinetic_Technology_Database.

Hydrogen and Fuel Cells – Pages 92–96

- U.S. DOE EERE – Alternative Fuels Data Center, Alternative Fueling Station Counts by State, http://www.afdc.energy.gov/afdc/fuels/stations_counts.html.
- U.S. DOE EERE – Alternative Fuels Data Center, Data Downloads, http://www.afdc.energy.gov/data_download.
- Fuel Cells 2000 – http://www.fuelcells.org/base.cgim?template=databases.

Renewable and Alternative Fuels and Fueling Stations – Pages 99–100

- U.S. DOE EERE – "Integrated Biorefineries," http://www.energy.gov/eere/bioenergy/integrated-biorefineries.
- U.S. DOE EERE – Alternative Fuels Data Center, Alternative Fueling Station Counts by State, http://www.afdc.energy.gov/afdc/fuels/stations_counts.html.
- U.S. DOE EERE – Alternative Fuels Data Center, Data Downloads, http://www.afdc.energy.gov/data_download.

Ethanol – Pages 101–103

- Renewable Fuels Association (RFA) – 2015 Ethanol Industry Outlook, http://www.ethanolrfa.org/resources/publications/outlook/.
- U.S. DOE EERE – Alternative Fuel Price Report, January 2015, Table 2, http://www.afdc.energy.gov/afdc/price_report.html.

References

Biodiesel – Pages 105–106

- U.S. DOE EERE – Alternative Fuel Price Report, January 2015, Table 2, http://www.afdc.energy.gov/afdc/price_report.html.
- National Biodiesel Board estimates according to U.S. EPA EMTS data.
- REN21 – 2015 Renewables Global Status Report, http://www.ren21.net/wp-content/uploads/2015/07/REN12-GSR2015_Onlinebook_low1.pdf.

U.S. and Global Investment – Pages 109–114

- Bloomberg New Energy Finance (BNEF) – Global Trends in Clean Energy Investment, January 2015, http://about.bnef.com/presentations/clean-energy-investment-q4-2014-fact-pack/content/uploads/sites/4/2015/01/Q4-investment-fact-pack.pdf.

Clean Energy Index Performance in 2014 – Page 115

- Public data; downloaded from the Yahoo! Finance website.

U.S. DEPARTMENT OF
ENERGY

Energy Efficiency &
Renewable Energy

For more information, visit:
eere.energy.gov

DOE/GO-102015-4724
November 2015

Prepared by the National Renewable Energy Laboratory (NREL)
NREL is a national laboratory of the U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
Operated by the Alliance for Sustainable Energy, LLC