INTRODUCTION & OVERVIEW

The Solar Foundation's *State Solar Jobs Census 2015* provides current employment, trends, and projected growth in the solar industry. This year's *State Census* is comprised of individual reports for 14 states, an interactive district-level map at SolarStates.org, and this *Compendium*, which includes summaries of all states and regions based on the nine U.S. Census Divisions.

This work follows the January 2016 release of the *National Solar Jobs Census 2015*. The *National Census* found that as of November 2015, the U.S. solar industry employs nearly 209,000 solar workers, representing a growth rate of 20.2% since November 2014, and 123% since The Solar Foundation first started tracking solar workers in 2010. In 2015, the solar industry added workers[1] at a rate nearly 12 times faster than the overall economy, accounting for 1.2% of all jobs created in the U.S. Over the next 12 months, employers expect to see total employment in the solar industry increase by 14.7% – which is 13 times faster than the U.S. workforce as a whole is expected to grow[2] – to approximately 240,000 solar workers.[3] Nationally, solar power currently produces approximately 1% of U.S. electricity generation, but that too is expected to increase in coming years.[4]

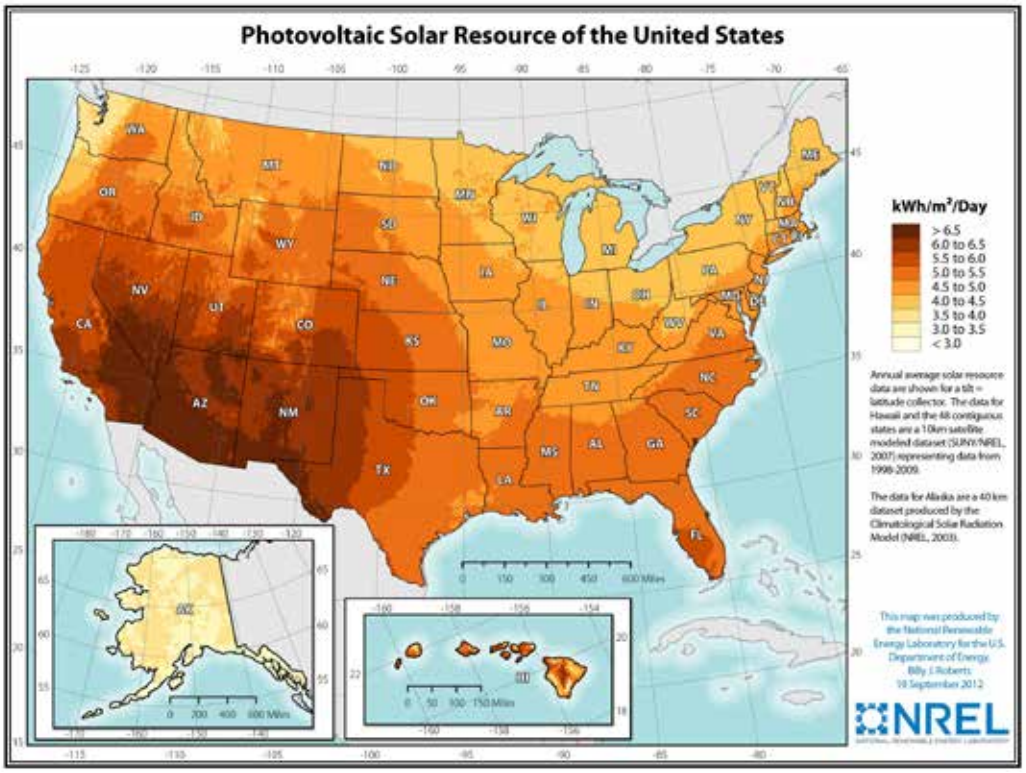
Factors that Differentiate Solar Power Among States

This section addresses key factors that help to differentiate solar power employment and development among the states. Such factors include:

- Customer demand
- Solar radiation/resource
- Grid access
- Installation costs
- Energy prices
- Local and state policies

More populated states generate greater residential, commercial, and industrial demand for electricity, including solar power. While California, the nation's most populated state, leads the country in solar power, the next four most populated states – Texas, Florida, New York, and Illinois – do not rank in the top five for installed solar capacity, and only New York joins California as a top five state for total solar jobs.

Some states receive far greater solar radiation in a given year than others, as seen in the National Renewable Energy Laboratory map below. The sunny, dry Southwest has the greatest natural solar resource, generating on average more electricity from photovoltaic cells per square meter than in other part of the country. Not surprisingly, the four states with the best solar resource – Arizona, California, Nevada, and New Mexico – rank in the top ten for solar jobs per capita. Nonetheless, regions that receive less solar radiation can also generate ample power. Germany's solar resource is less than that of any U.S. state except Alaska, yet Germany boasts 40 GW of installed solar capacity, more than all U.S. states combined.[5] Closer to home, even a system in Portland, Maine can produce over 90% of the



solar electricity, on an annual basis, as a comparable system operating in Miami, Florida.[6]

Solar power systems typically require access to the grid. Large, utility-scale solar generation, for example, must have access to the electric grid to sell bulk power to consumers. While it may be preferable to locate utility-scale solar projects in remote areas, such areas often lack transmission lines that allow access to the grid. This disconnect can limit the potential for high radiation regions with ample open space to support more populated regions. However, the growth of distributed solar power could decrease the need for additional bulk power generation and related transmission lines.[7]

The general decline in installation costs has been essential to solar market growth. Since 2010, U.S. average installed costs have declined 35% for residential, 58% for nonresidential, and 67% for utility-scale installations.[8] However, among the states, there is a considerable amount of variability in these costs. A 15-state study of smaller (<15 kW) PV systems found that installation costs ranged considerably among states.[9] Factors that influenced installation costs include (1) potential electric bill savings, (2) government incentives, (3) number of installers in the local market, (4) installer experience, (5) installation size, (6) installation ownership (customer of third party), (7) construction type (new construction or retrofits), (8) PV materials (thin film or crystalline silicon), and (9) source of materials.

Installation costs typically range from $2.00 to $4.00 per watt, with residential systems costing more, and varying more, on average than non-residential and utility-scale systems.[10]

The economic benefit of solar power tends to be greater in states with higher average electricity prices. Mainland U.S. electricity prices range from a high of 16.73 cents per kWh in New England, to a low of 8.48 cents per kWh in the West South Central Division of the U.S. Some of the highest prices for electricity can be found in populous states such as California, New York, and New Jersey, while prices are highest in Hawaii, at 26.81 cents per kWh. As of September, average electricity prices for 2015 were 10.51

Average Price of Electricity to Customers by State, Year-to-Date, Through Sept. 2015‡

Division & States	Price (cents per kWh)	State Rank: Highest to Lowest Price
Division 1	**16.73**	
Connecticut	17.99	2
Maine	13.08	11
Massachusetts	17.11	5
New Hampshire	16.17	6
Rhode Island	17.20	4
Vermont	14.33	9
Division 2	**13.22**	
New Jersey	14.14	10
New York	15.54	8
Pennsylvania	10.42	19
Division 3	**9.87**	
Illinois	9.30	35
Indiana	8.82	39
Michigan	10.89	16
Ohio	9.91	21
Wisconsin	11.01	15
Division 4	**9.43**	
Iowa	8.72	43
Kansas	10.11	20
Minnesota	9.75	24
Missouri	9.44	30
Nebraska	9.20	36
North Dakota	8.94	38
South Dakota	9.35	34
Division 5	**10.06**	
Delaware	11.21	14
District of Columbia	12.01	13
Florida	10.71	17
Georgia	9.75	24
Maryland	12.11	12
North Carolina	9.41	31
South Carolina	9.58	28
Virginia	9.39	32
West Virginia	8.06	46
Division 6	**9.13**	
Alabama	9.52	29
Kentucky	8.02	47
Mississippi	9.65	27
Tennessee	9.36	33
Division 7	**8.48**	
Arkansas	8.22	44
Louisiana	7.71	50
Oklahoma	7.94	49
Texas	8.77	41
Division 8	**9.65**	
Arizona	10.64	18
Colorado	9.86	23
Idaho	8.18	45
Montana	8.99	37
Nevada	9.74	26
New Mexico	9.89	22
Utah	8.74	42
Wyoming	7.97	48
Division 9 (cont.)	**12.95**	
California	15.63	7
Oregon	8.80	40
Washington	7.32	51
Division 9 (non-cont.)	**23.34**	
Alaska	17.96	3
Hawaii	26.81	1
US AVERAGE	**10.51**	

cents per kWh nationwide. Due to the increased economic benefits of solar in states with traditionally expensive electricity, nearly all of the high-rate states have seen significant solar development in recent years.

State and local policies and incentives can differentiate solar development among states. Chief among these are net metering and interconnection. A majority of states offer net metering, which allows owners of residential and commercial solar energy systems to sell excess power back to the utility. For most states, customers can sell the excess power back to the utility at the retail electricity rate. For other states, such as Hawaii and Nevada, excess power is credited at a lower wholesale rate, decreasing investment return on solar installations in those areas. States may also have aggregate system caps, meaning that utilities will only purchase a fixed amount of distributed power in a given year. Finally, there may be interconnection charges or fees for hooking distributed power up to the grid. Almost half (22) of all states received an "A" or "B" grade for net metering and interconnection as shown in the table on the next page.

There are numerous state incentives, such as rebates and tax credits, that encourage solar development. Such incentives are often influenced by broader goals for renewable portfolio standards (RPS) – in which case states commit to derive a specific percent of their power generation from renewable energy sources by a specified year. RPS designated renewable energy sources typically include hydro-electric, wind, solar (PV & thermal), biomass, and geothermal. States typically designate 15% to 30% of their electricity generation from renewable sources by a year in the relatively near future. Some states such as California, New York, Maine, and New Hampshire have set aggressive RPS goals that will help to drive solar development in those states for years to come.

There are policy developments related to technological changes that can differentiate solar power among states. Demand response tools, such as "automated load control, smart grid and smart metering, real-time pricing, and time-of-use tariffs," can provide flexibility for intermittent power sources, such as solar, to more efficiently meet demand.[11] Efficient battery storage could further leverage these demand response tools. Additionally, the growing use of electric vehicles will increase demand for electricity. States that are quick to accommodate electric vehicles will experience a correlated growth in electricity demand, which may serve as an additional driver for increased solar development.

Top Scoring States (A & B grades)				
	Policy Grades[12]		Renewable Portfolio Standards (RPS)[13]	
State	Net Metering	Interconnection	RPS Target	RPS Target Deadline
CA	A	A	50%	2030
CO	A	B	30%	2020
CT	A	B	23%	2020
DC	A	B	20%	2020
DE	A	B	25%	2026
IA	B	B	105 MW	N/A
IL	B	A	25%	2023
IN	B	B	10%	2025
MA	A	A	15%	2020
MD	A	B	20%	2022
ME	B	B	40%	2017
NH	A	B	24.8%	2025
NJ	A	B	20.38%	2021
NM	B	A	20%	2020
NY	A	B	50%	2030
OH	A	A	12.5%	2026
OR	A	A	25%	2025
PA	A	B	18%	2021
RI	B	B	14.5%	2019
UT	A	A	20%	2025
VT	A	B	75%	2032
WA	B	B	15%	2020

State Solar Employment

California leads the nation with over 75,000 solar jobs. It has five times the number of solar jobs as the second highest state of Massachusetts (15,095). California is expected to continue to lead the nation in solar jobs with a forecasted 19% growth in 2016. The third largest state by solar jobs, Nevada, has the most jobs per capita, followed by Massachusetts. However, given recent policy changes in Nevada, the state's solar workforce is no longer expected to grow in 2016 at the 18% rate projected. Nationally, solar jobs are expected to grow 14.7% in 2016.

California leads the nation in installation jobs, followed by Massachusetts and Nevada (though, as noted, this may no longer be true). The proportion of Nevada, New York, Tennessee, and Maryland's installation jobs is well above the national average of 57.4%. Of the top ten states for total installation jobs, Nevada has by far the greatest proportion of such positions, with installation firms employing nearly 95% of its solar workers. Thus, Nevada's solar economy is highly dependent on the residential rooftop solar business, where most installation jobs are typically found.

California leads the nation in solar manufacturing jobs, followed by Arizona and Massachusetts. Arizona and Oregon manufacturing firms employ over a third of their states' solar workers, which is well in excess of the national average of 14.5%.

California leads the nation in project development jobs, followed by Massachusetts and Florida. Massachusetts, Florida, and Louisiana employ a significantly greater proportion of project development workers than the national average of 10.8%. Notably, Nebraska project development firms employ an impressive 61.4% of the state's solar workers. While a high proportion of project development jobs may imply that utilities and large firms are actively pursuing solar power, it could also indicate a missed opportunity to develop more residential and small commercial rooftop solar.

Top 10 States in Installation Jobs

State	Installation	% of Solar Jobs
CA	40,597	53.7%
MA	8,741	57.9%
NV	8,285	94.5%
NY	5,829	70.7%
TX	4,547	64.7%
NJ	4,303	60.9%
FL	3,217	49.0%
TN	3,047	80.2%
MD	3,025	70.9%
CO	2,958	59.2%
National Average		57.4%

Top 10 States in Manufacturing Jobs

State	Manufacturing	% of Solar Jobs
CA	11,183	14.8%
AZ	2,400	34.7%
MA	2,098	13.9%
TX	1,424	20.3%
OR	1,149	38.3%
NC	1,144	19.2%
OH	834	17.3%
IL	822	23.6%
NY	800	9.7%
GA	751	23.6%
National Average		14.5%

Top 10 States in Solar Jobs					
State	2015 Jobs	National Rank	Jobs Per Capita Rank	2016 Projected Growth	Cumulative Q3 2015 Installed Capacity Rank
California	75,598	1	5	18.9%	1
Massachusetts	15,095	2	2	8.6%	6
Nevada	8,764	3	1	18.5%	5
New York	8,250	4	21	11.6%	7
New Jersey	7,071	5	12	10.3%	3
Texas	7,030	6	34	12.7%	10
Arizona	6,922	7	7	8.4%	2
Florida	6,560	8	28	7.8%	13
North Carolina	5,950	9	15	10.2%	4
Colorado	4,998	10	8	10.3%	9

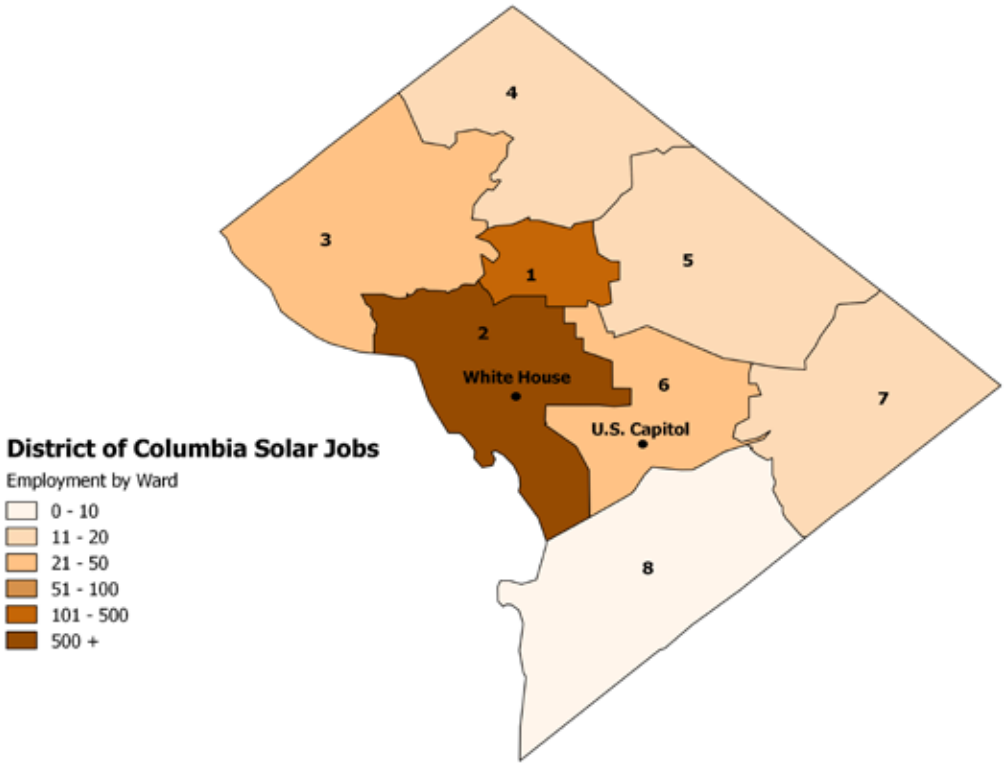
Methodology

The *State Solar Jobs Census 2015* demonstrates that the U.S. solar industry is having a positive and growing impact on the national economy, supporting jobs across every state in the nation. As with the previous *Census* studies, this report series includes information about all types of companies engaged in the analysis, research and development, production, sales, installation, and use of all solar technologies – ranging from solar photovoltaics (PV), to concentrating solar power (CSP), to solar water heating systems for the residential, commercial, industrial, and utility market segments.

The findings presented herein are based on rigorous survey efforts that include nearly 288,000 telephone calls and over 44,000 emails to known and potential solar establishments across the United States, resulting in a maximum margin of error for state employment of ±5% at a 95% confidence interval. Unlike economic impact models that generate employment estimates based on economic data or jobs-per megawatt (or jobs-per-dollar) assumptions, the *Solar Jobs Census* series provides statistically valid and current data, gathered from actual employers.

In contrast, The Solar Foundation's 2014 state estimates of solar employment (for all states except CA, AZ, NY, TX, MD, and GA) were produced using a carefully developed dual methodology – one for installation and construction jobs and another for non-installation jobs (covering industry sectors such as manufacturing, sales & distribution, project development, and "other" occupations that support the solar industry). Method one used labor intensity multipliers developed internally and cross-checked with leading studies on the subject, while method two was based not only on a direct count of solar workers, but also the average number of jobs per solar establishment and total number of establishments in the state.

This year's full methodology can be found in the Appendix of the *National Solar Jobs Census 2015* report: www.TSFcensus.org.
State-specific *Census* reports were completed for 14 states including: Arizona, California, Colorado, Florida, Massachusetts, Michigan, Minnesota, New Jersey, New Mexico, New York, North Carolina, Texas, Utah, and Vermont. These reports can be found at www.TSFcensus.org or on The Solar Foundation's new interactive SolarStates.org microsite.



DISTRICT OF COLUMBIA

Total Solar Jobs, 2015

1,000

Projected Solar Jobs Growth, 2016

93
(9.3%)

Solar Jobs Rank

#33

Solar Jobs Per Capita Rank

#6

Cumulative Installed Capacity thru Q3 2015 (MW)

15.4

Total Solar Companies**

130

District of Columbia

The District of Columbia saw substantial solar capacity growth in 2015. The District added 6.1 megawatts (MW) through Q3 of 2015, putting it on pace to nearly double its 2014 cumulative capacity (9.3 MW) in a single year. Washington D.C. ended 2015 with 1,000 solar workers, which is the highest solar jobs per capita in the region, and ranks 6th in the country in terms of solar jobs per capita.

The strong solar market in the nation's capital is largely driven by high average electricity prices (12.01 cents per kWh through September 2015)[234], as well as a consistently high Solar Renewable Energy Certificate pricing ($480) as a result of aggressive solar goals.[235] The majority of the solar capacity in D.C. is residential (59%).[236] Aside from economic drivers, the robust residential solar market is bolstered by active government and non-profit solar programs targeting D.C. residents, such as the DC Sustainable Energy Utility[237] and the Community Power Network.[238] The district also benefits from recently-adopted solar-friendly policies, such as a Solar Energy Property Tax Credit and an active Commercial Property Assessed Clean Energy financing program, among others.[239] Non-residential capacity constitutes the remaining 41% of D.C.'s solar installations.[240] The proportion of non-residential solar is likely to grow in 2016, especially in light of the District of Columbia's plans to construct the nation's largest municipal onsite solar project, installing 11.4 MW of solar on 34 District-owned roofs and parking lots.[241]

Sector	DC Solar Jobs	% DC Solar Jobs	% U.S. Solar Jobs
Installation	324	32.4%	57.4%
Manufacturing	89	8.9%	14.5%
Sales & Distribution	36	3.6%	11.7%
Project Development	220	22.0%	10.8%
Other	330	33.0%	5.7%

Demographic	% DC Solar Jobs	% DC Overall Jobs†	% U.S. Solar Jobs
Women	24.3%	50.3%	23.8%
African-American	7.2%	35.1%	5.1%
Asian or Pacific Islander	3.9%	4.3%	8.6%
Latino or Hispanic	5.7%	10.3%	11.3%
Older Workers (55+)	27.1%	16.1%	18.6%
Union Members	-	-	5.5%
Veterans of the U.S. Armed Forces	3.3%	4.0%	8.1%

While solar jobs are expected to continue to increase in the District of Columbia next year by 9.3%, the future of the area's solar marketplace remains uncertain due to the pending Exelon merger with Pepco, D.C.'s electric utility. While the merger currently contains provisions for Exelon to provide $3.5 million to a Renewable Energy Development Fund, as well as a commitment to develop 10 MW of solar in D.C., a deal has yet to be finalized.[242]