2017

The SOLAR FOUNDATION™
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The Potential of State Solar Jobs

Workforce growth scenarios in 2021 for six U.S. states

A Solar Jobs Census Series Report

ACKNOWLEDGEMENTS

The Solar Foundation® is a national 501(c)(3) nonprofit organization whose mission is to accelerate adoption of the world's most abundant energy source. Through its leadership, research, and capacity building, The Solar Foundation creates transformative solutions to achieve a prosperous future in which solar technology is integrated into all aspects of our lives. In 2010, The Solar Foundation conducted its first National Solar Jobs Census, establishing the first comprehensive solar jobs baseline and verifying that the solar industry is having a positive impact on the U.S. economy. Using the same rigorous, peer-reviewed methodology, The Solar Foundation has conducted an annual Census in each of the last seven years to track changes and analyze trends.

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THE POTENTIAL OF STATE SOLAR JOBS

Workforce Growth Scenarios in 2021 for Six US States: Florida, Illinois, New York, Pennsylvania, South Carolina, Texas

Released in February 2016, the *National Solar Jobs Census 2016*[1] found that solar industry employment growth outpaced the overall U.S. economy by 17 times as it increased by over 51,000 jobs, for a total of 260,077 U.S. solar workers. The solar workforce grew by 25 percent over 2016, the largest annual growth percentage since The Solar Foundation's first *National Solar Jobs Census* was released in 2010. The number of solar jobs increased in 44 of the 50 states in 2016, showing that the solar industry is providing new employment opportunities across the country.

Annual solar jobs figures offer valuable understanding of the impact of the *current* solar workforce, however, there is increased interest in understanding the *future* potential of solar jobs. From the 3,888 full survey completions received from establishments involved in solar, solar employment is forecasted to grow by 10 percent in 2017. To go beyond a one-year projection, The Solar Foundation partnered with the Center for Regional Analysis at George Mason University. Those projections – referred to as "National Trends Projections" (NTP) and based on historic sector correlations, industry trends, and increased labor efficiencies – yield approximately 401,200 jobs by 2021 and 581,600 jobs by 2026. Those figures are similar in scale to several other expert estimates, including the Solar Energy Industries Association's 2016 projection of 360,000 jobs by 2020[2] and the less recent estimate by the US Department of Energy's 2012 SunShot Vision Study of 340,000 jobs by 2030[3].

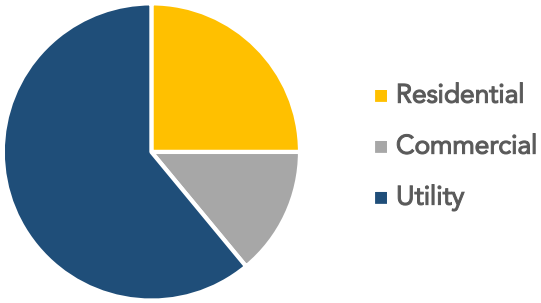
To add to the solar workforce conversation occurring in many states, The Solar Foundation looked at select pairings between subject states and model states. The purpose of the pairings was to project how much additional employment, if any, the subject state would experience if it installed as much solar, on a per capita basis, in 2021 as the model state had installed in 2016. The state pairings for this "State Per Capita Projection" (SPCP) were selected based on similarities in solar insolation, electric markets, and electricity rates, but not policy. The subject state might need to change policies to achieve the solar deployment of that of the model state, but the specifics of such changes were not evaluated. Nonetheless, the pairings were intended to demonstrate

[1] *National Solar Jobs Census 2016*, The Solar Foundation, available at: http://SolarJobsCensus.org

[2] Solar Industry Data, Solar Energy Industries Association, available at: http://www.seia.org/research-resources/solar-industry-data

[3] SunShot Vision Study, 2012, U.S. Department of Energy, available at: https://energy.gov/sites/prod/files/2014/01/f7/47927.pdf

National Solar Breakdown (Forecast) - 2021



challenging, but achievable goals for the subject states.

In addition to the watts per capita adjustment in the SPCP scenario, it was assumed that to secure significant additional solar capacity, the subject state would likely absorb growth in all market segments, including ones that policies and market conditions do not currently favor. The subject state's 2021 higher installed capacity under the SPCP scenario was allocated across solar sectors – residential, commercial, and utility-scale – in two ways and then averaged. Those solar sector capacity averages were combined with a GMU/TSF projected labor efficiency to derive the 2021 SPCP scenario jobs forecast.[4]

The subject states include Florida, Illinois, New York, Pennsylvania, South Carolina, and Texas. The high deployment resulting from the State Per Capita Projection scenarios (described below) are particularly poignant when compared with the National Trends Projections, as they illustrate how more equal solar deployments between states, on a watts per capita basis, can yield significant solar employment increases.

[4] GMU/TSF projects labor efficiency of 30 jobs/MW for residential, 20 jobs/MW for commercial, and 2.5 jobs/MW for utility-scale sectors.

STATE PAIRING AND RESULTS SUMMARY[5]

		National Trends Projection		State Per Capita Projection	Change: 2021 NTP to 2021 SPCP Scenario	
Subject States	2016 Jobs	2021 Rounded NTP	Percent Change 2016-2021	2021 Rounded Average SPCP	Amount	Percent
Florida	8,260	12,250	48%	20,800	8,550	70%
Illinois	3,718	5,300	43%	11,600	6,300	119%
New York	8,135	14,350	76%	21,400	7,050	49%
Pennsylvania	3,061	4,450	45%	10,000	5,550	125%
South Carolina	2,772	3,900	41%	5,050	1,150	29%
Texas	9,396	10,850	15%	24,000	13,150	121%

State Pairing for Watts Per Capita Projection (SPCP)	
Subject States	Model States
Florida	Arizona
Illinois	Minnesota
New York	Massachusetts
Pennsylvania	Maryland
South Carolina	Georgia
Texas	Arizona

[5] See Methodology section for an expanded results table.

FLORIDA

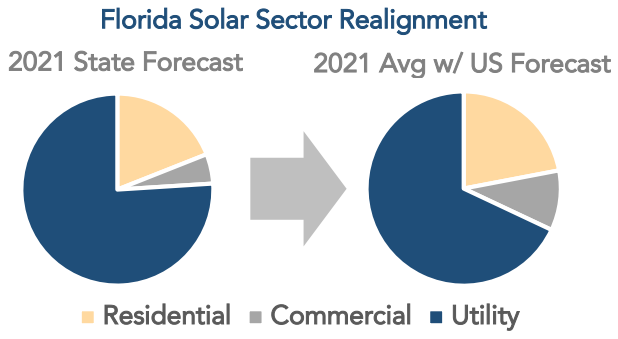
Scenario:

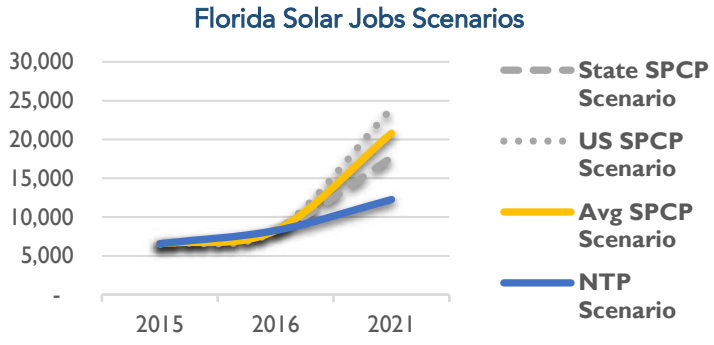
In 2016, Florida had 8,260 solar jobs. By 2021, national trends, under the NTP scenario, could boost Florida's solar workforce by nearly 50%, to reach 12,250 jobs. While that is certainly strong growth, and suggests a Compound Annual Growth Rate of at least 8%, a state as populous as Florida and with a strong solar resource, greater solar growth is possible. To anchor a SPCP Florida scenario, Arizona was identified as an appropriate corollary. Florida and Arizona share similarities in terms of their electricity markets: both states have several investor-owned utilities; both states have electricity prices that are slightly higher than the national median; and both states have average residential monthly electricity bills of approximately $130[6]. However, Arizona has far exceeded Florida in terms of installed solar capacity for the last several years. What would happen to Florida's solar labor force if, in the year 2021, Florida installed the same number of solar watts per capita as Arizona installed in 2016?

Workforce Impacts:

Arizona saw 657 MWs of solar installed in 2016. At more than 6.9 million in population, 2016 solar installations equate to 95 Watts per person. With approximately 20.6 million in population in Florida, a target of 95 Watts per person in 2021 would bring Florida to 1,958 Megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology.

In this scenario (Avg SPCP), the Florida solar market in 2021 could support 20,800 solar jobs. That is an increase of 8,550 (70%) solar jobs compared with the NTP 2021 scenario. While the Florida-specific policies to achieve such deployment and the related electricity market impacts are not clear, the Sunshine State's solar workforce would certainly outshine the Grand Canyon State under such a scenario.





[6] 2015 Average Monthly Bill- Residential, U.S. Energy Information Administration, available at: https://www.eia.gov/electricity/sales_revenue_price/pdf/table5_a.pdf

ILLINOIS

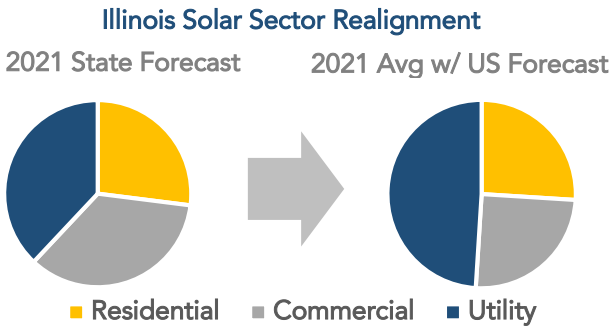
Scenario:

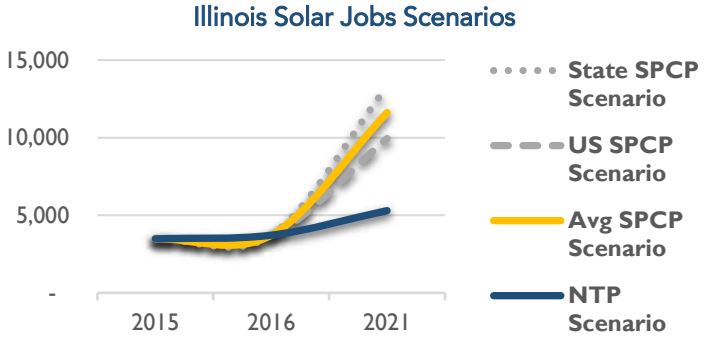
In 2016, Illinois had 3,718 solar jobs. By 2021, national trends, under the NTP scenario, could increase the solar workforce in Illinois by 43%, to reach 5,300 jobs. For a state as populous as Illinois, and a top ten state in energy production[7], greater solar growth is possible. To anchor a SPCP Illinois scenario, Minnesota was identified as an appropriate corollary. Illinois and Minnesota share similarities in terms of their electricity markets: both states have residential electricity prices close to the national average, and both states consume a similar amount of electricity per household. Despite not having a deregulated electricity market like Illinois, Minnesota has far exceeded Illinois in terms of installed solar capacity for the last several years. What would happen to Illinois's solar labor force if in the year 2021, Illinois had the same number of solar watts per capita as Minnesota installed in 2016?

Workforce Impacts:

Minnesota saw 340 MW of solar installed in 2016. At more than 5.5 million in population, 2016 solar installations equate to 62 watts per person. With approximately 12.8 million in population in Illinois, a target of 62 watts per person in 2021 would bring Illinois to 794 megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology.

In this scenario (Avg SPCP), the Illinois solar market in 2021 could support 11,600 solar jobs. That is an increase of 6,300 (119%) solar jobs compared with the NTP 2021 scenario. While it is not clear whether 2016's landmark energy bill[8] in Illinois will be sufficient to spur such high solar deployment, the potential for Illinois solar is dramatic under such a scenario.





[7] U.S. Energy Information Administration, "U.S. States, State Profiles and Energy Estimates" available at https://www.eia.gov/state/

[8] Midwest Energy News, "Illinois energy bill: After race to the finish, what does it all mean?" available at http://midwestenergynews.com/2016/12/08/illinois-energy-bill-after-race-to-the-finish-what-does-it-all-mean/

NEW YORK

Scenario:

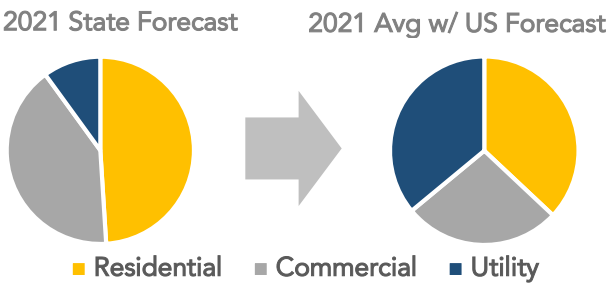
In 2016, New York had 8,135 solar jobs. By 2021, national trends, under the NTP scenario, could increase New York's solar workforce by nearly 76%, to reach 14,350 jobs. While that is certainly strong growth, and suggests a Compound Annual Growth Rate of at least 12%, a state as populous and prosperous as New York is likely capable of even greater growth. To anchor a high-deployment New York scenario, Massachusetts was identified as an appropriate corollary. While New York operates its own independent grid, New York and Massachusetts still share important similarities in terms of their electricity markets: both states have several investor-owned utilities; both states have electricity prices that are higher than the national median, with New Yorkers having monthly residential electricity bills almost as high as in Massachusetts (7% difference); and both states have or are developing distributed energy resource programs that support solar deployment. However, Massachusetts is further ahead in the latter regard and has far exceeded New York in terms of installed solar capacity for the last several years. What would happen to New York's solar labor force if in the year 2021, New York had the same number of solar watts per capita as Massachusetts installed in 2016?

Workforce Impacts:

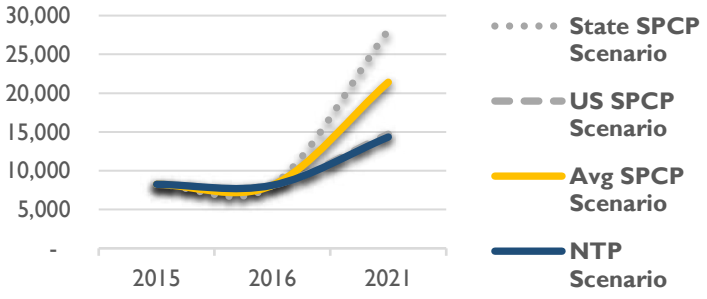
Massachusetts saw 406 MW of solar installed in 2016. At more than 6.8 million in population, 2016 solar installations equate to 60 watts per person. With approximately 19.7 million in population in New York, a target of 60 Watts per person in 2021 would bring New York to 1,185 megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology.[9]

In this scenario (Avg SPCP), the New York solar market in 2021 could support 21,400 solar jobs. That is an increase of 7,050 (49%) solar jobs compared with the NTP 2021 scenario. While it is not clear just how much additional solar will be deployed over the next several years from New York's ongoing Reforming the Energy Vision effort to reshape the electricity market, the potential for New York to support thousands more jobs through solar is clear.

New York Solar Sector Realignment



New York Solar Jobs Scenarios



[9] Moving to an average between the state's sector breakdown and the national breakdown represents a fairly significant shift from residential and commercial toward the less labor-intensive utility sector, which has not seen much development in the state.

PENNSYLVANIA

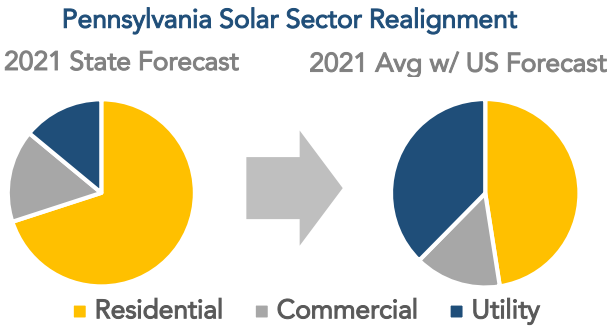
Scenario:

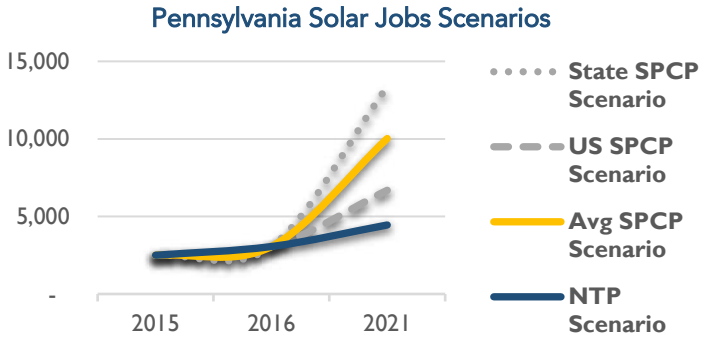
In 2016, Pennsylvania had 3,061 solar jobs. By 2021, national trends, under the NTP scenario, could boost Pennsylvania's solar workforce by 45%, to reach 4,450 jobs. For a state as large as Pennsylvania in terms of population, greater solar growth is possible. To anchor a high-deployment Pennsylvania scenario, Maryland was identified as an appropriate corollary. Although Maryland has a much higher solar carve-out in its renewable portfolio standard[10], Pennsylvania and Maryland share similarities in terms of their electricity markets: both Pennsylvania and Maryland have electricity rates that are higher than the national median, with Maryland's average residential rate only 13% higher than Pennsylvania, and both states have deregulated electricity markets that let users select their electricity provider. Maryland has far exceeded Pennsylvania in terms of installed solar capacity for the last several years. What would happen to Pennsylvania's solar labor force if in the year 2021, Pennsylvania had the same number of solar watts per capita as Maryland installed in 2016?

Workforce Impacts:

Maryland saw 248 MW of solar installed in 2016. At more than 6 million in population, 2016 solar installations equate to 41 watts per person. With approximately 12.7 million in population in Pennsylvania, a target of 41 Watts per person in 2021 would bring Pennsylvania to 524 megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology. Thus, Pennsylvania would shift from a residential dominated solar state to one where utility-scale and commercial help balance and diversify the state's solar industry.

In this scenario (Avg SPCP), the Pennsylvania solar market in 2021 could support 10,000 solar jobs. That is an increase of 5,550 (125%) solar jobs compared with the NTP 2021 scenario. While the Pennsylvania-specific policies – be they more aggressive renewable energy standards or reformation of the distributed energy market – to achieve such deployment and the likelihood of their implementation are unknown, the potential for Pennsylvania solar is dramatic under a Maryland-like scenario.





[10] 0.5% of 18% by 2021 for PA compared with 2.5% of 25% by 2020 for MD.

SOUTH CAROLINA

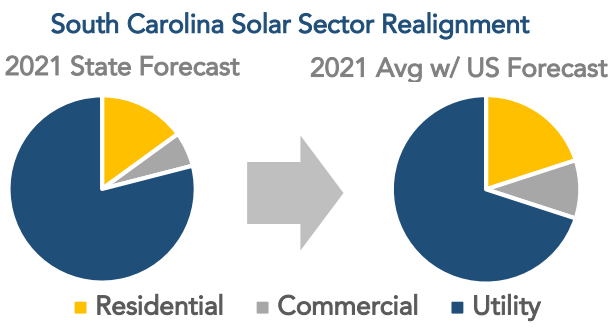
Scenario:

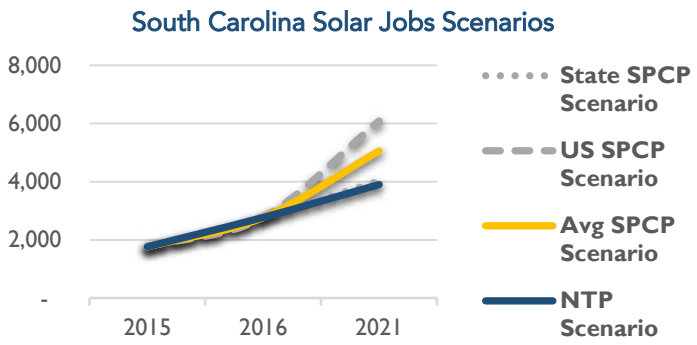
In 2016, South Carolina had 2,772 solar jobs. By 2021, national trends, under the NTP scenario, could increase South Carolina's solar workforce by 41%, to reach 3,900 jobs. For a state that appears to be at the beginning of strong solar growth curve, South Carolina has the potential to attain the solar prominence of its neighboring states. To anchor a high-deployment South Carolina scenario, Georgia was identified as an appropriate corollary. South Carolina and Georgia share many similarities in terms of their electricity markets: both states have electricity prices roughly approximate to the national average (although Georgia has slightly lower electricity rates than South Carolina, meaning solar could be slightly more competitive in the Palmetto State), and both states have large, regulated investor-owned and public power utilities. Georgia has far exceeded South Carolina in terms of installed solar capacity for the last several years. What would happen to South Carolina's solar labor force if in the year 2021, South Carolina had the same number of solar watts per capita as Georgia installed in 2016?

Workforce Impacts:

Georgia saw 1,023 MWs of solar installed in 2016. At more than 10 million in population, 2016 solar installations equate to 99 watts per person. With approximately 5 million in population in South Carolina, a target of 99 Watts per person in 2021 would bring South Carolina to 491 megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology. Thus, South Carolina would shift from a utility-scale dominated solar state to one where utility-scale is still the majority but residential and commercial have a 50% stronger presence.

In this scenario (Avg SPCP), the South Carolina solar market in 2021 could support 5,050 solar jobs. That is an increase of 1,150 (29%) solar jobs compared with the NTP 2021 scenario. While the long-term sustainability of the utility-driven solar deployment in South Carolina is unknown, as are the specific policies to drive greater sector diversity, the potential for South Carolina solar is dramatic under a Georgia-like scenario.





TEXAS

Scenario:

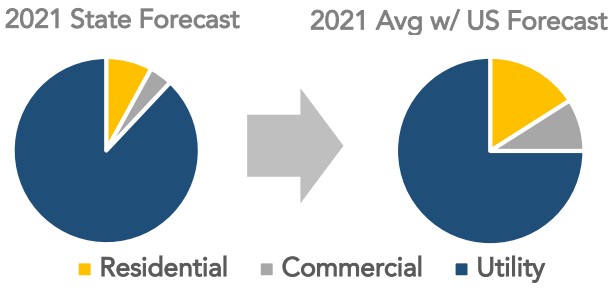
In 2016, Texas had 9,396 solar jobs. By 2021, national trends, under the NTP scenario, could increase the solar workforce in Texas by 15%, to reach 10,850 jobs. For the second-most populous state in the nation with a one of the strongest average levels of solar insolation, significantly greater solar growth is possible. To anchor a high-deployment Texas scenario, Arizona was identified as an appropriate corollary. Texas and Arizona share many similarities in terms of their electricity markets and siting opportunities: both states have electricity prices that are just below the national average; both states spend approximately $130 per month on their residential electric bills; and both states have an abundance of affordable land and relatively new rooftops.[11] Nevertheless, Arizona has far exceeded Texas in terms of installed solar capacity in watts per capita for the last several years. What would happen to Texas's solar labor force if in the year 2021, Texas had the same number of solar watts per capita as Arizona installed in 2016?

Workforce Impacts:

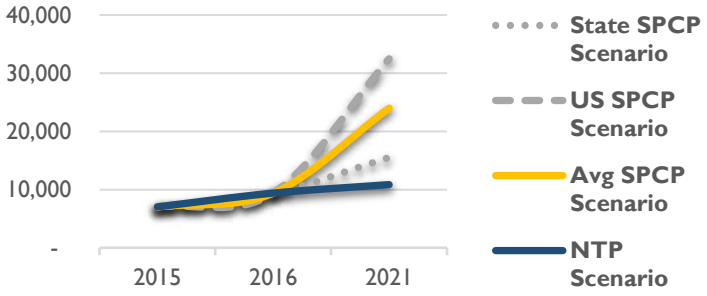
Arizona saw 657 MWs of solar installed in 2016. At nearly 7 million in population, 2016 solar installations equate to 95 watts per person. With approximately 27 million in population in Texas, a target of 95 Watts per person in 2021 would bring Texas to 2,610 Megawatts installed that year. Given the increase in deployment, a shift toward the national breakdown of projected 2021 solar sectors was assumed, per the rebalancing discussed in the methodology. Thus, Texas would shift from a utility-scale dominated solar state to one where utility-scale is still the majority but residential and commercial have a stronger presence.

In this scenario (Avg SPCP), the Texas solar market in 2021 could support 24,000 solar jobs. That is an increase of 13,150 (121%) solar jobs compared with the NTP 2021 scenario. While factors like Arizona's proximity to California, which provided a significant amount of demand for utility-scale solar projects in Arizona, may never be replicated in Texas, the Lone Star State may soon realize some mix of policy and market changes that could lead it to achieve Arizona levels of solar deployment, resulting in thousands of additional solar jobs over the next several years.

Texas Solar Sector Realignment



Texas Solar Jobs Scenarios



[11] National Association of Home Builders – Eye on Housing, "The Age of the Housing Stock by State" available at http://eyeonhousing.org/2014/02/the-age-of-the-housing-stock-by-state/

METHODOLOGY

The methodology for the 2021 jobs projections (NTP) were based on national projections for each of the five solar employment sectors tracked by The Solar Foundation: Installation, Manufacturing, Sales & Distribution, Project Development, and Other. The George Mason University Center for Regional Analysis identified correlations between each sector's job growth[12] and various measures of capacity growth[13]. Using the higher correlations, the jobs for four of the five sectors were forecast based on projected capacity growth and improvements in labor efficiency as measured on a jobs/MW basis.[14] Since the Other sector did not correlate with past capacity figures, the forecast for those jobs were based solely on exponential smoothing trend line forecasting techniques. The national 2026 jobs forecast was also based on exponential smoothing techniques.

State job forecasts were based on projected growth rates of US solar jobs by sector. The national sector growth rates were applied to state sector jobs as reported in the 2016 *National Solar Jobs Census*. Thus, the forecast explicitly assumes that the growth of sector jobs in each state mirrors the US growth of jobs of that sector. Consequently, the forecast excludes the impact of major policy changes that, if enacted, could dramatically alter the outlook for a state's growth.

For the paired state[15] comparison (SPCP), the model states had higher watt's per capita than that of the subject states, this adjustment generated higher installed capacity and thus, more jobs. To derive the higher jobs forecast, the sector-specific labor efficiency multipliers (jobs/MW) were applied to an average of the subject state's projected 2021 installed capacity for the residential, commercial, and utility sectors. The first such breakdown used to determine the average relied on the projected sector capacities for each state in 2021 from the SEIA/GTM Research "U.S. Solar Market Insight: 2016 Year in Review". The second breakdown relied on the projected sector capacities at the national level in 2021 from the SEIA/GTM Research "U.S. Solar Market Insight: 2016 Year in Review". For subject states that had previously favored residential development and saw a shift to utility-scale development in the sector rebalancing, job growth was less dramatic than in states that saw a shift to more residential and commercial sectors. Since these segments have higher job/MW counts than for utility-scale deployment, the rebalancing generated greater additional jobs. Lastly, the Manufacturing and Other sector forecasts from the NTP scenario were added to arrive at the final "Avg SPCP" forecasts (See table below).

[12] From *National Solar Jobs Census*, 2010-2016, The Solar Foundation.

[13] SEIA/GTM Research, a Wood Mackenzie Company, "Solar Market Insight" 2010-2016.

[14] The jobs/MW figures are broad measures of annual efficiency rather than precise measurements of work done per hour.

[15] Subject states selected represent the top five states by population after California, which was not considered as its solar workforce is already the U.S. leader. South Carolina was included as a sixth state for consideration to provide, geographic and demographic diversity, as well as electricity market diversity given it is the least deregulated state addressed here.

STATE PROJECTION SCENARIO BREAKDOWN

	National Trends Projection			State Per Capita Projection				Change: 2021 NTP to 2021 SPCP Scenario	
Subject States	2016 Jobs	2021 Rounded NTP	Percent Change 2016-2021	Model Watts Per Capita States	2021 SPCP Using 2021 State Sector Forecast	2021 SPCP Using 2021 National Sector Forecast	2021 Rounded Average SPCP	Amount	Percent
Florida	8,260	12,250	48%	AZ	17,650	23,953	20,800	8,550	70%
Illinois	3,718	5,300	43%	MN	13,283	9,948	11,600	6,300	119%
New York	8,135	14,350	76%	MA	28,113	14,709	21,400	7,050	49%
Pennsylvania	3,061	4,450	45%	MD	13,364	6,687	10,000	5,550	125%
South Carolina	2,772	3,900	41%	GA	4,023	6,085	5,050	1,150	29%
Texas	9,396	10,850	15%	AZ	15,521	32,472	24,000	13,150	121%

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