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National Solar Jobs Census 2013



The Annual Review of the U.S. Solar Workforce



Acknowledgements:

The Solar Foundation® (TSF) is a national 501(c)(3) nonprofit organization whose mission is to increase understanding of solar energy through strategic research that educates the public and transforms markets. In 2010, The Solar Foundation® released its first *National Solar Jobs Census* report. *Census 2010* established the first credible national solar jobs baseline and verified the positive impact the solar industry is having on the U.S. economy. Using the same rigorous, peer-reviewed methodology, TSF has conducted an annual *Census* in each of the last three years to track changes and analyze trends in the solar industry labor market.

TSF would like to acknowledge and thank its research partners and sponsors. Without their foresight and leadership, this report would not have been possible.

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We also want to thank all of the solar employers that participated in the survey. Your responses were critical in providing us with the high level of accurate and timely data needed to produce this report.

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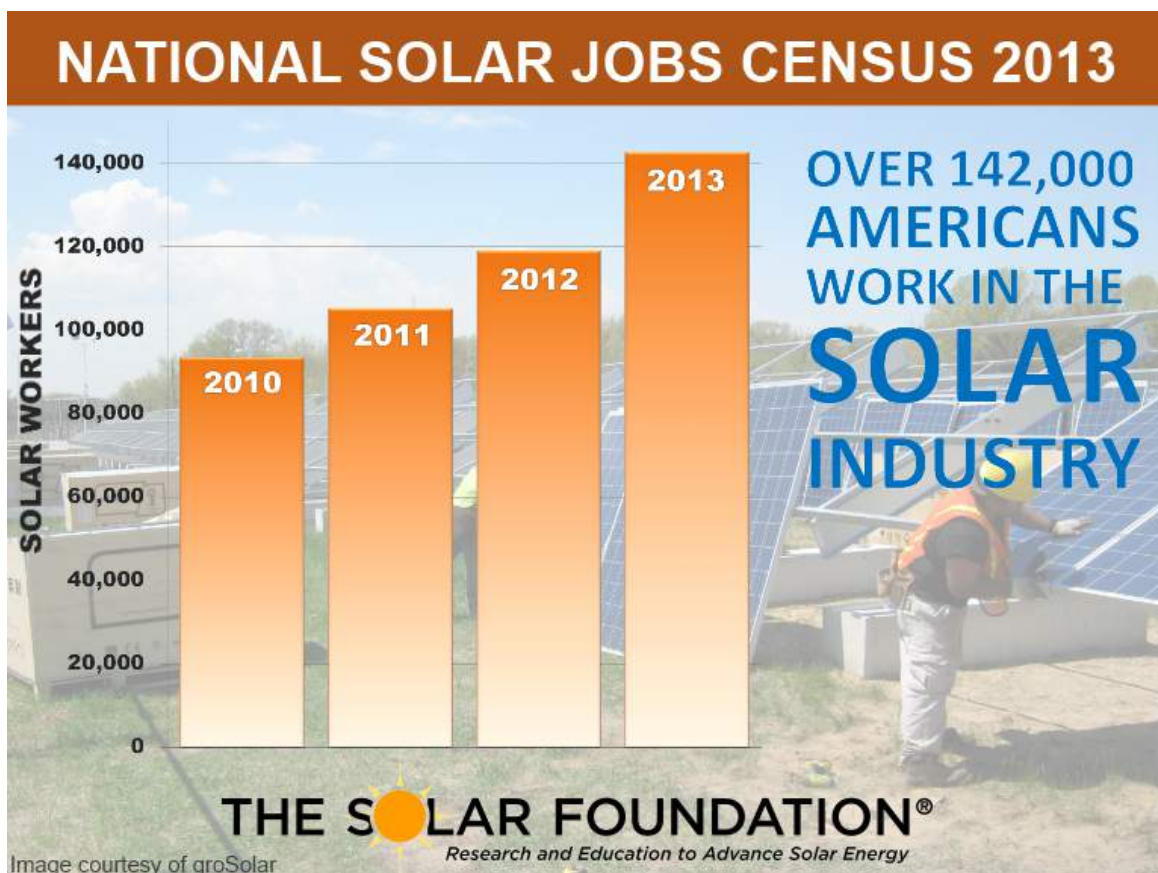
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1. Executive Summary

The *National Solar Jobs Census 2013* is the fourth annual update of current employment and projected growth in the United States solar industry. Data for *Census 2013* is derived from a statistically valid sampling and comprehensive survey of 15,437 employers throughout the nation, in industries ranging from manufacturing to construction and engineering to sales. The rapid pace of change in this industry has warranted annual updates that examine the size and scope of the solar labor force and employers' perspectives on job growth and opportunities.

Since The Solar Foundation® first started tracking solar jobs, it has found that the industry has experienced steady and impressive job growth. Our research shows that solar industry employment has grown by an astonishing 53% - or nearly 50,000 new solar jobs - since we first started tracking them in 2010. Leading this growth are businesses in the installation sector, in which solar employment has grown by nearly 60% over the four-year period covered by the *Census* series, representing more than 25,000 jobs created in the sector since 2010. With leading market analyses predicting continued growth in annual installed solar capacity, it is likely that the national solar workforce will continue to experience similar growth.



U.S. solar companies continue hiring faster than the overall economy, and remain optimistic about future growth. **As of November 2013, the solar industry has grown to 142,698 solar workers.**¹ This is an increase of almost 20% over our Census 2012 findings, and represents a growth rate that is ten times faster than what the overall U.S. economy experienced during that same time period. Over the next 12 months, nearly 45% of solar establishments expect to add jobs, while fewer than 1.9% expect to cut workers, **yielding an expected 15.6% growth in employment.** This finding is especially relevant given that employment in the overall U.S. economy is projected to grow by only 1.4% over the next 12 months.²

By comparing the job growth expectations from our multi-year research effort and from existing secondary sources, we can draw several important conclusions.

As of November 2013:

- **Solar jobs increased nearly 20% since the Fall of 2012, which is ten times the national average job growth rate.**³ There are 142,698 solar workers in the United States, up from 119,016 in 2012. Not only did the industry exceed growth expectations, but the pace of hiring has quickened, at a rate 50% higher than last year, suggesting that the trajectory for growth is even stronger than previously thought.
- **Solar is a major source of new U.S. jobs.** Seventy-seven percent of the nearly 24,000 new solar workers since September 2012 are new jobs (rather than existing positions that have added solar responsibilities), representing 18,211 new jobs created. Viewed a different way, one in every 142 new jobs in the U.S. were created by the solar industry, and each day the solar industry creates 56 new jobs across America.
- **The solar industry expects double digit job growth over the next 12 months.** Solar employment is expected to grow by 15.6% over the next year, representing the addition of approximately 22,240 new solar workers. Forty-five percent of all solar establishments expect to have added solar employees by November 2014.

¹ A “solar worker” is defined an employee who spends at least 50% of work time supporting solar-related activities. The research finds that approximately 91% of those who meet our definition of a “solar worker” actually spent 100% of their time working on solar.

² EMSI Complete Employment, 2013.4.

³ Bureau of Labor Statistics, “Current Employment Statistics, Total Nonfarm Payroll, Seasonally Adjusted (October 2012 – November 2013)”. Available at www.bls.gov

- **Two-thirds of new solar hires are living-wage installation jobs.** Installers added the most solar workers over the past year, growing by 22%, an increase of 12,500 workers. Installer jobs, which cannot be off-shored and earn an average of \$23.63 per hour, are expected to increase by nearly 15,000 next year. This represents a 21% year-over-year growth rate.
- **Solar workers are diverse.** Nineteen percent of all solar workers are women, representing 26,738 solar workers, and one in six solar workers is Latino or Hispanic. With 13,192 U.S. veterans working at solar establishments across the United States, the solar industry is also an important source of employment for returning veterans, exceeding the percentage of veterans in the broader U.S. workforce.
- **Solar jobs have increased over 50% since 2010.** Since the first *National Solar Jobs Census* was conducted in 2010 by The Solar Foundation®, solar industry employment has grown by 53%, which translates to nearly 50,000 new jobs.
- **The solar industry supports hundreds of thousands of indirect and induced jobs.** *Census* data include most of the direct jobs and many of the indirect jobs in the solar industry, with the exception of some indirect jobs in the component and materials supply chain. Those jobs, combined with induced impacts of the industry, support an additional 435,000 jobs, bringing the total employment impact for the U.S. solar industry to nearly 600,000.⁴

The results continue to illustrate that the solar industry is a strong and growing part of the U.S. economy and responsible for thousands of jobs across every state in the nation. Continued growth in installed capacity clearly corresponds with strong job creation.

This report includes up-to-date information on the solar industry, quantifying employment growth since last year's study and trends since *Census 2010*. The research findings also provide stakeholders with fresh information on the potential for further growth and the factors that are likely to impact the industry over the coming year. As with the previous *Census* studies, this report includes information about all types of companies engaged in the analysis, research and development, production, sale, installation, and use of all solar technologies - ranging from photovoltaics (PV), to concentrating solar power (CSP), to solar water heating systems for the residential, commercial, industrial, and utility market segments.

⁴ For more information on economic impacts, please see Appendix 5.

These findings are based on rigorous survey efforts that include 73,796 telephone calls and over 11,000 emails to potential solar establishments across the United States, resulting in a maximum margin of error for employment related questions of +/-1.3%. Unlike economic impact models that generate employment estimates based on economic data (such as company revenue) or jobs-per-megawatt (or jobs-per-dollar) assumptions, the *National Solar Jobs Census* series provides statistically valid and current data gathered from actual employers.



Photo Courtesy OneRoof Energy

About The Solar Foundation®

The Solar Foundation® (TSF) is an independent national 501(c)(3) nonprofit whose mission is to increase understanding of solar energy through strategic research that educates the public and transforms markets. TSF is considered the premier research organization on the solar labor force, employer trends, and economic impacts of solar. It has provided leading-edge industry insight to the National Academies, the Inter-American Development Bank, the U.S. Department of Energy, and other organizations during a time of dynamic industry growth and policy and economic uncertainty.

While TSF recognizes that solar energy is a key part of our energy future, it is committed to excellence in its aim to help people fairly and objectively gauge the value of the solar industry worldwide.

About BW Research Partnership

BW Research is widely regarded as the national leader in labor market analysis for emerging industries and clean energy technologies. In addition to the *Census* series, BW Research has conducted rigorous solar installation and wind industry labor market analysis for the National Renewable Energy Laboratory, wind energy and energy retrofit studies for the Natural Resources Defense Council, a series of comprehensive clean energy workforce studies for the Commonwealth of Massachusetts, Illinois, and Vermont, and numerous skills and gap analyses for community colleges, workforce investment boards, state agencies, and nonprofit organizations.

BW Research provides high quality data and keen insight into economic and workforce issues related to renewable energy, energy efficiency, transportation, recycling, water, waste, and wastewater management, and other environmental fields. The principals of the firm are committed to providing research and analysis for data-driven decision-making.

About The George Washington University Solar Institute

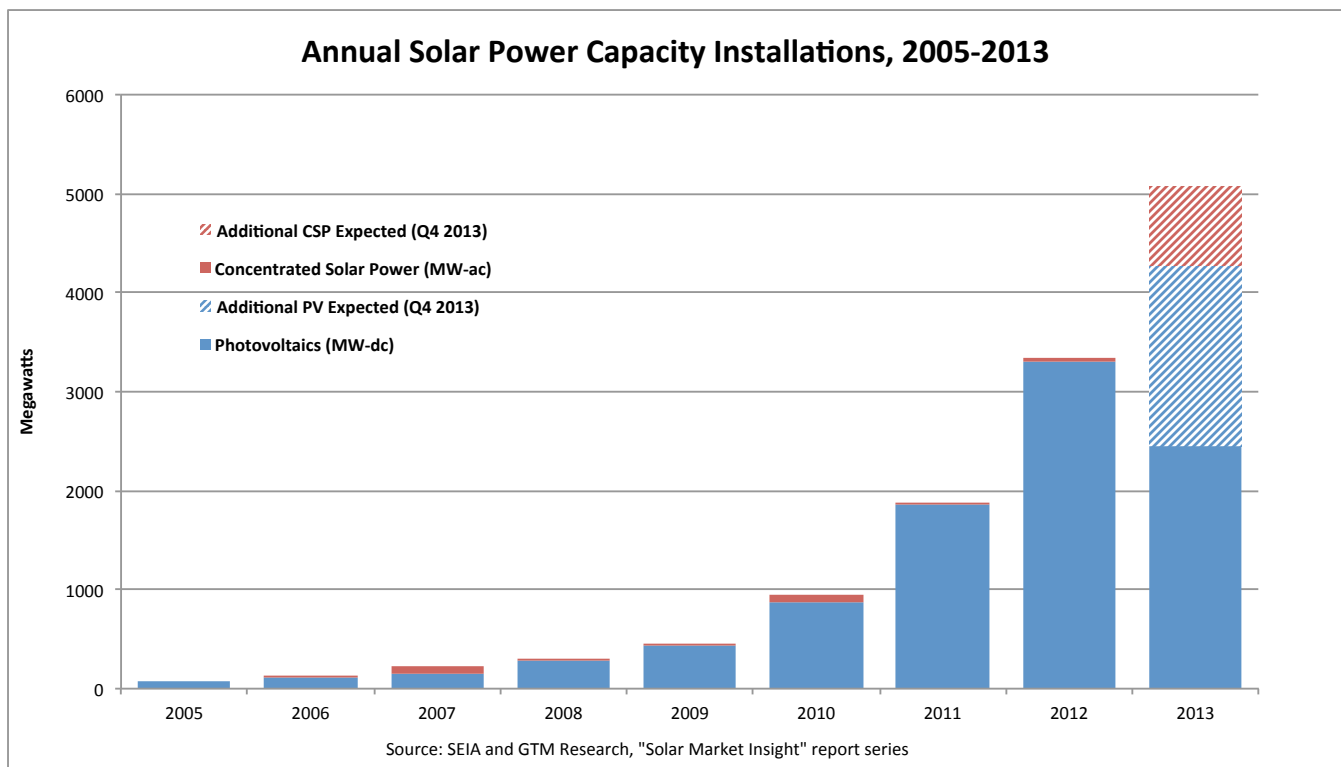
The George Washington University Solar Institute (GW Solar Institute) is a unique research and information center focused on identifying, developing, and sharing pragmatic and politically attuned solutions to the policy barriers preventing the adoption and scale of solar energy. Toward these ends, the GW Solar Institute pursues research projects in a wide range of disciplines, typically in partnership with other university faculty, industry experts, and GW students. In addition, the GW Solar Institute also leverages its intricate knowledge of the policymaking process and location in Washington, DC to convene stakeholders and provide decision-makers with unbiased new ideas on solar related policies, regulatory approaches, and government investments.

2. Introduction

Throughout 2013, the U.S. solar industry continued to demonstrate dramatic growth and success, increasingly showing signs of a maturing industry that has overcome some growing pains and is now surpassing significant industry milestones. While solar is still a relatively small part of the U.S. energy mix, it is expected to become one of the primary sources of new electricity generation. Cumulative solar capacity in the U.S. already exceeds 10,000 megawatts (MW).

In their most recent *Solar Market Insight* report, SEIA and GTM Research estimate that nearly 4,300 MW of new PV capacity were installed during 2013, nearly 30% more than was added in the previous year. In addition, 800 MW of new concentrating solar power (CSP) came online, over four times as much as was installed in the entire decade prior.⁵ Some analysts are now predicting that annual photovoltaic (PV) additions in the U.S. will for the first time surpass new capacity installed in Germany, the current global leader.

Figure 1: Annual U.S. Solar Capacity Additions

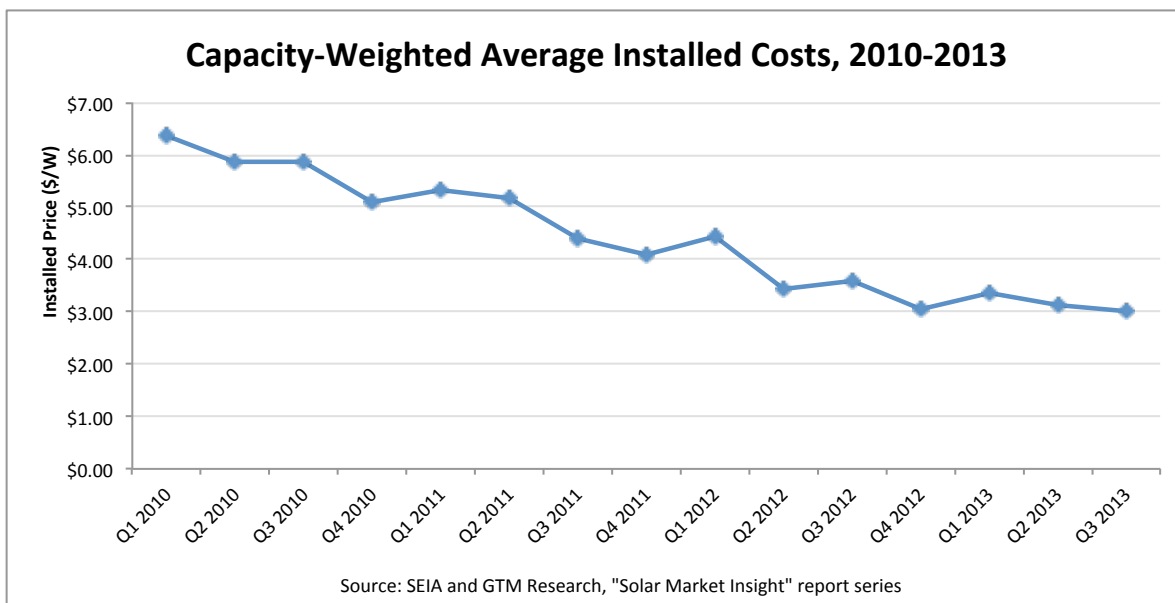


⁵ SEIA/GTM Research, "U.S. Solar Market Insight: 3rd Quarter 2013". Available at <http://www.seia.org/research-resources/solar-market-insight-2013-q3>.

This *Census* and other expert analysis continues to affirm that the primary driver of industry growth is the falling cost of solar equipment and installations, along with increased use of innovative new financing models and supportive government policies. While a global glut in solar panel production capacity has contributed significantly to components being produced and sold at a fraction of the cost from just a few years ago (previous *Solar Market Insight* analyses demonstrated the 44% decline from the second quarter of 2011 to the second quarter of 2012), module prices appear to have stabilized and are expected to continue to gradually decline even with increased global demand.

These PV component price trends, combined with the scaling up of the solar industry, are reflected in decreases in total average installed system costs, which have declined by more than 50% since the beginning of 2010. Though these price reductions continue to impact certain industry sectors in different and sometimes disruptive ways, they continue to be widely and consistently cited as the leading driver of solar capacity growth.⁶

Figure 2: Average Installed Costs, 2010-2013



One value of an annual census is the ability to track metrics over time. In years past, a major focus of our study was workers' skills and deficiencies. For 2013, however, respondents were asked to provide their feedback regarding their customers' motivations to go solar, how

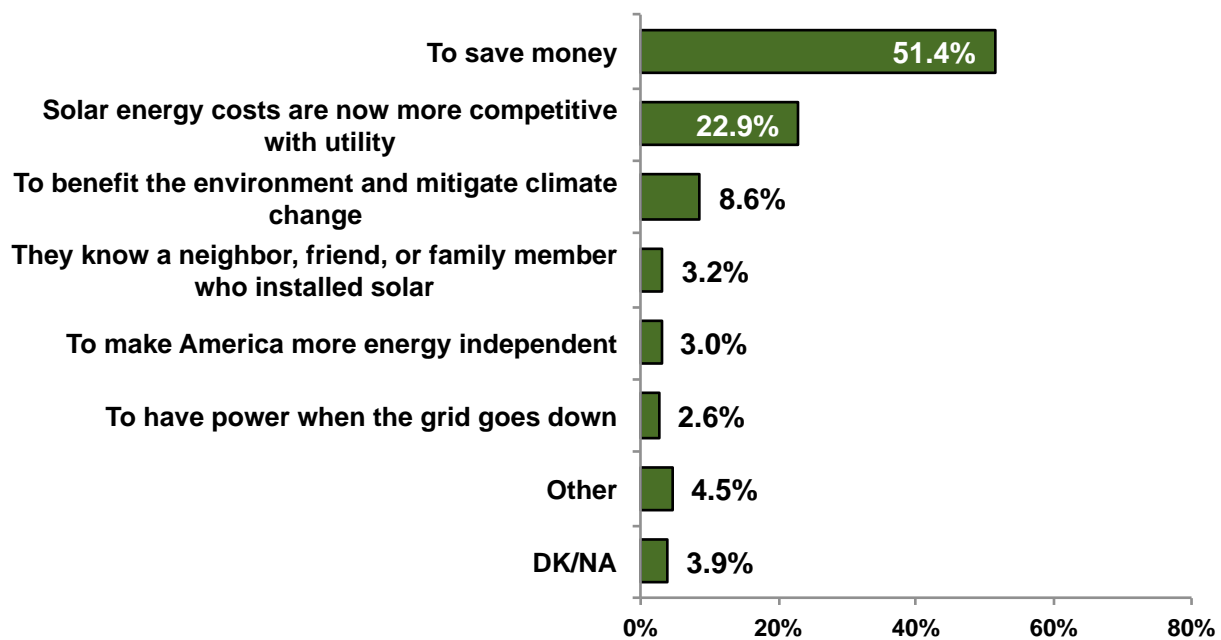
⁶ David R. Baker, D. (2014, January 19). Explosive Growth for State's Surviving Solar Firms. The San Francisco Chronicle. Available at: <http://www.sfgate.com/news/article/Explosive-growth-for-state-s-surviving-solar-firms-5158184.php#page-1>; Washington Post Editorial Board (2013, August 12). U.S. Tariffs on Chinese Solar Panels Boomerang. Available at: www.washingtonpost.com/opinions/us-tariffs-on-chinese-solar-panels-boomerang/2013/08/12/fef555e6-f577-11e2-a2f1-a7acf9bd5d3a_story.html.

their customers learned about solar, and who they feel are most knowledgeable about the benefits of solar.

In an effort to better understand the psychology bridging the producer and consumer, companies were asked to provide their perspective on the most typical reasons customers, in general, cite for installing solar energy. As illustrated in Figure 3 below, saving money was the most oft-cited reason consumers adopt solar, followed by solar becoming more cost competitive. These results seem to indicate that falling panel prices and innovative consumer financing options are key drivers behind increasing consumer demand for solar. However, the results also suggest that solar does not necessarily need to be less expensive than—but rather merely competitive with—current utility rates to drive adoption.

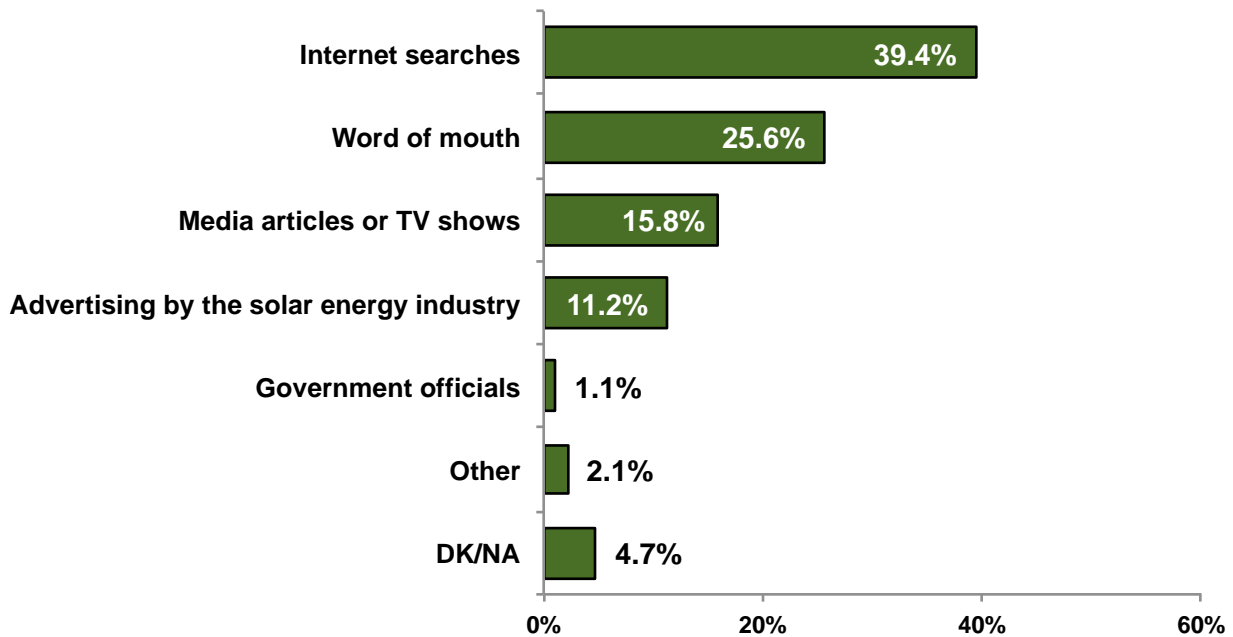
It is also notable that respondents did not feel that the many other commonly cited benefits of solar (including reducing pollution, energy independence, and being a source of backup power) stood out as major drivers of consumer demand.

Figure 3: Factors Driving Consumer Demand



Respondents also provided valuable information about how customers find information about their companies and services offered in particular and on solar power in general. As a sign of the digital age, internet searches came in first, followed by word of mouth, with traditional media and advertising as the third most often cited information source. These findings should prove informative to solar installers continuing to face high customer acquisition costs and increased competition in certain regional markets.

Figure 4: How Consumers Learn About Solar



In order to better understand the consumer motivations for installing solar, respondents were asked questions on whether various stakeholders understand the benefits of solar power. Over half of those surveyed felt that both the local utility company and their friends and neighbors (57% and 56%, respectively) “understood the benefits of solar power.” Approximately two out of five respondents agreed that government officials (44%) and local business leaders (38%) appreciate solar’s benefits. About two-thirds of respondents (62.4%) felt their members of Congress could do a better job of recognizing the importance of solar energy. Finally, one out of ten respondents felt that none of these groups understood the benefits of solar.

This report includes accurate, up-to-date information on the various sectors comprising the solar industry and quantifies employment growth and trends since *Census 2010*. As in years past, this report includes information about all types of companies, from component manufacturers to installation subcontractors, engaged in the production, sale, installation, and use of all solar technologies, ranging from PV to CSP to solar water heating systems across the residential, commercial, and utility market segments.

In addition to our *Census* jobs tracking approach, some analysts find jobs-per-megawatt analyses to be useful. However, not only are they less reliable, they are complicated because regional, system size, system type, and other factors play a major role in the labor efficiency of an installation. Nonetheless, when reviewing the installation workforce data against installed capacity figures, it is clear that the U.S. solar installation sector is becoming more efficient, which in turn will ultimately make it more profitable and stable.

Census 2013 estimates 81,827 workers are employed by the installation and project development sectors, compared to 65,165 in 2012, a growth rate of 25.6%. The combined sectors installed 3,343 MW of solar (PV and CSP) in 2012 and 5,100 MW in 2013, for growth of just under 53%. These data suggest that the sectors were 21.5% more efficient in 2013, raising their productivity from 51.3 kW per worker to 62.3 kW. When taken as a whole, each solar worker throughout the entire value chain represents 35.7 kW of the installed capacity in 2013.

Unlike economic impact models that generate employment estimates based on economic data (such as company revenue) or jobs-per-megawatt (or jobs-per-dollar) assumptions, the *National Solar Jobs Census* series provides statistically valid and current data gathered from actual employers. The primary data contained in this report are drawn from a mixed-method survey administered directly to employers. Data collection occurred during October and November 2013 in two stages: (1) through a survey of so-called “known universe” establishments, and; (2) via a random sampling of businesses within various construction, sales and distribution, and manufacturing industries.

Nearly 74,000 telephone calls were attempted and over 11,000 emails were sent to potential solar establishments across the United States. This mixed approach, which the Bureau of Labor Statistics recognizes as the emerging standard given its own limitations in calculating solar employment, allows us to accurately update previous years’ efforts and draw broad conclusions about the solar industry with a high degree of confidence. Although the maximum margin of error for employment questions is well below other national industry studies at +/-1.3%, the figures included in this report are conservative estimates, meaning that there may well be more solar workers than reported herein. It is also important to mention that there are limits to the survey approach. Because the research findings are based on survey responses, the employment growth figures cited in the following sections represent employers’ best estimates of how many jobs they will add over the coming year. As seen in prior *Census* reports, actual growth may vary.

3. Labor Market Analysis: Overview of the Industry

Overall, the data gathered by our survey of solar employers indicate that there are currently more than 18,000 solar establishments employing 142,698 solar workers in the United States. These figures represent the addition of 23,682 new solar jobs since September 2012.

The *Census 2013* effort is the most comprehensive to date, including new sector categories for academic, nonprofit, and government workers. The survey was distributed to a broad range of companies across various industry segments to ascertain the scope and depth of the industry throughout the entire value chain. Responses were gathered from 15,437 businesses, including solar and non-solar related establishments. Full surveys were completed by 2,098 establishments.

This year's *Census* found a significant uptick in the number of solar establishments (from 15,000 to 18,000), as more establishments see the potential of a dramatically expanding solar landscape and greater opportunities across the country. While employment remains concentrated in states that have supportive market conditions and regulatory policies, *Census 2013* found that employment opportunities seem to correlate closely with the continued growth in solar installations in each state.

In addition to the direct jobs reported by employers for this *Census*, the economic activity generated by the solar industry supports many other jobs across the U.S. Specifically, the additional indirect and induced jobs supported by the solar industry exceed 435,000, bringing the total number of jobs connected to the industry to nearly 600,000.⁷

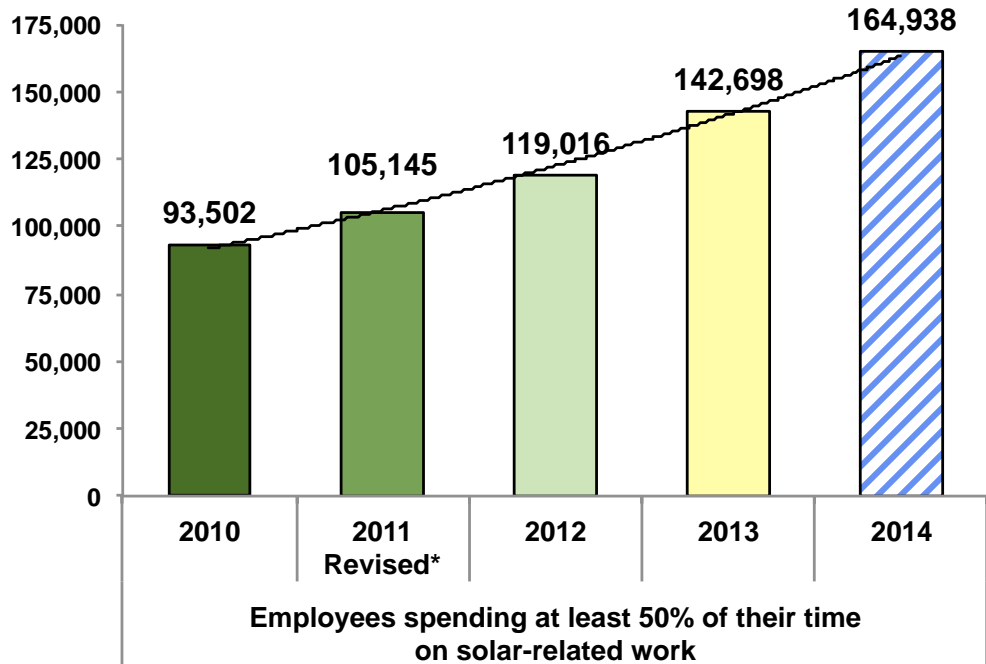
Employment in the solar industry grew ten times faster than the national average employment growth rate of 1.9%,⁸ considerably faster than the growth rates seen in some conventional energy generation sectors that grew much more slowly or experienced employment declines. For example, over the same period covered by this *Census*, the fossil fuel electric generation sector shrank by more than 8,500 jobs (a decline of 8.7%) and jobs in coal mining grew by just 0.25%.⁹ Solar employment, on the other hand, is likely to continue its robust growth, with respondents predicting the number of solar workers in the U.S. will increase by more than 15.6% in the next 12 months, representing the addition of approximately 22,000 new solar workers (Figure 5).

⁷ Economic Modeling Specialists, Inc. 2013.4, I/O model based on BEA analysis and similar NAICS industries. See Appendix 5.1 and 5.2 for additional details on the methodology for the economic impact analysis.

⁸ Bureau of Labor Statistics, "Current Employment Statistics, Total Nonfarm Payroll, Seasonally Adjusted (October 2012 – November 2013)". Available at www.bls.gov

⁹ *Id.*

Figure 5: Solar Employment Growth; 2010-2014 (2014 Projected)



Solar employers are optimistic regarding their future hiring, with 44.5% of surveyed establishments reporting an expectation to add solar employees over the next 12 months. By contrast, only 1.9% expect to cut solar workers over the same period. Despite similar levels of optimism to years past, employers anticipated growing a bit more slowly through November 2014, at 15.6% (compared to over 17% last year). While one year alone does not make a trend, it will be important to monitor several key states, especially those where employers have been forced to significantly scale back their operations. Lowered growth projections may be influenced by increased global competition and/or changes or uncertainty regarding state incentives, renewable energy targets, and regulatory policies. Overall, findings show an industry that is growing at a significantly faster pace than the economy as a whole, which is expected to grow by only 1.4% over the course of 2014.¹⁰

In order to ensure that the sample included only establishments that work in solar, employers were asked several preliminary screener questions. For this portion of the *Census*, survey respondents were asked to select the appropriate sector to which their firm belongs, choosing from installation, manufacturing, sales and distribution, project development, academic, nonprofit, government, or - for those that did not fit neatly into a category - "other," such as establishments that provide ancillary support to the solar industry (e.g., research and development, financial or legal services). Many establishments reported that their work spanned

¹⁰ EMSI Complete Employment, 2013.4.

several sectors. However, the number of such responses continues to decrease over time, suggesting that establishments are beginning to specialize.

Figure 6: Percentage of Respondents, by Sector

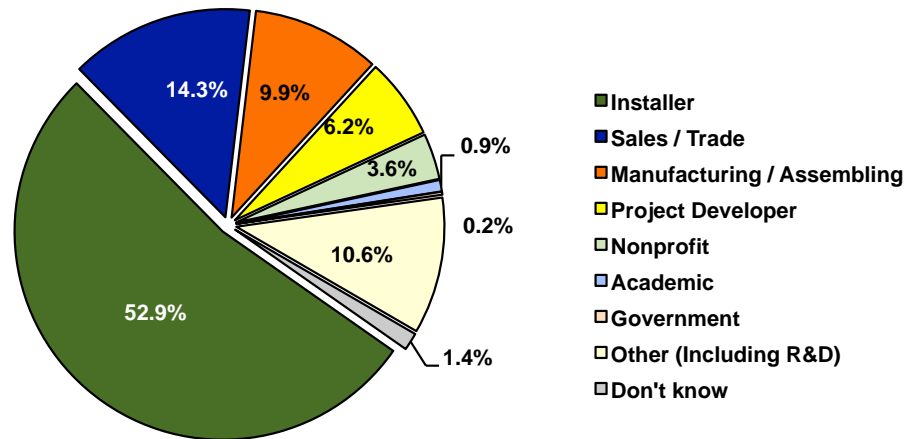


Table 1: Data by Sector—Number of Solar Workers

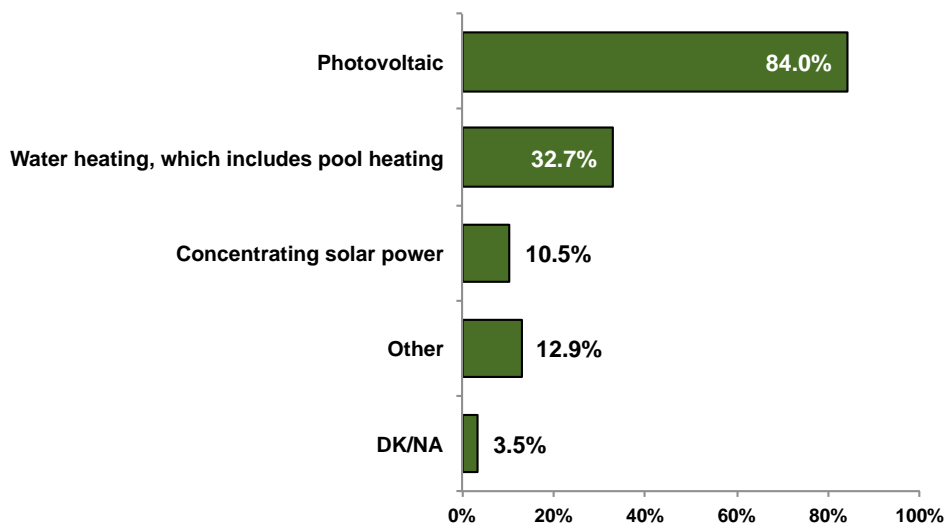
<i>Sector</i>	<i>2010 Jobs</i>	<i>2011 Jobs</i>	<i>2012 Jobs</i>	<i>2013 Jobs</i>	<i>2012 - 2013 Growth Rate</i>	<i>2014 Projected Employment</i>	<i>2013 - 2014 Expected Growth Rate</i>
Installation	43,934	48,656	57,177	69,658	21.8%	84,331	21.1%
Manufacturing	24,916	37,941	29,742	29,851	0.4%	32,429	8.6%
Sales and Distribution	11,744	13,000	16,005	19,771	23.5%	22,585	14.2%
Project Development	N/A	N/A	7,988	12,169	52.3%	12,529	3.0%
Other*	12,908	5,548	8,105	11,248	38.8%	13,064	16.1%
Total	93,502	105,145	119,016	142,698	19.9%	164,938	15.6%

*2013 employment in "Other" includes 625 solar workers at nonprofits, 588 in government, and 241 in academia. Changes in the number of jobs in the "Other" category over the years are not necessarily a reflection of actual increases or decreases in employment, but may instead be due to changes in the types of jobs included in this category.

In previous years, some questioned whether defining solar workers as those that spend at least 50% of their time on solar activities was a reasonable metric for calculating industry jobs. In order to understand this better, *Census 2012* introduced additional questions to address these concerns, which were again included in *Census 2013*. The 2013 research found that a similar percentage (90.7%) of all solar workers spend 100% of their time on solar activities, representing almost 130,000 workers. This finding suggests that the solar worker definition is a reasonable proxy for full time equivalency and an accurate assessment of real solar employment.¹¹

Overall, the solar industry is largely made up of companies focused on PV, with 84% of establishments reporting working with the technology. One-third of respondents also reported business related to solar water heating. Figure 7 illustrates the breakdown of establishments across the value chain by technology. Note, due to many establishments working with more than one technology, the sum is greater than 100%.

Figure 7: Solar Establishments by Technology Area

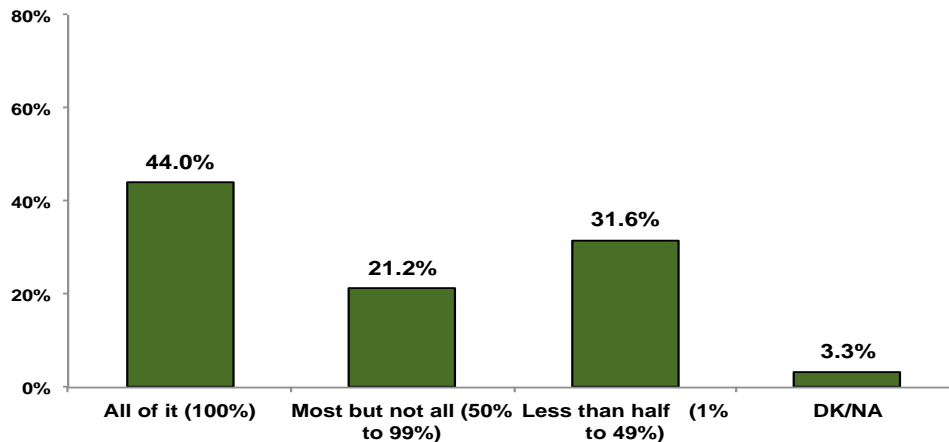


Solar establishments were also asked to report the proportion of their revenues that are attributed to solar-related activities. Forty-four percent of all establishments surveyed receive all of their revenues from solar goods and services, and almost two-thirds of companies receive at least half of their revenues from solar activities (Figure 8). These figures are lower than in 2012 (52.9% and 75.2% respectively), but still higher than *Census* data from 2010 and 2011. Our analysis shows that while employers are now less likely to span multiple sectors within the industry (e.g. installation *and* manufacturing), the revenues trend appears to suggest that companies may be choosing to diversify their products and services outside of solar in order to

¹¹ For more information about this report's methodology, please see Appendix 5.

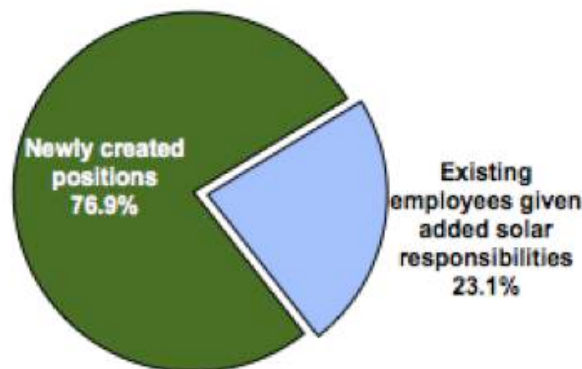
create greater operational stability and be able to offer their customers with more services within the same sales package.

Figure 8: Company Revenues Attributable to Solar



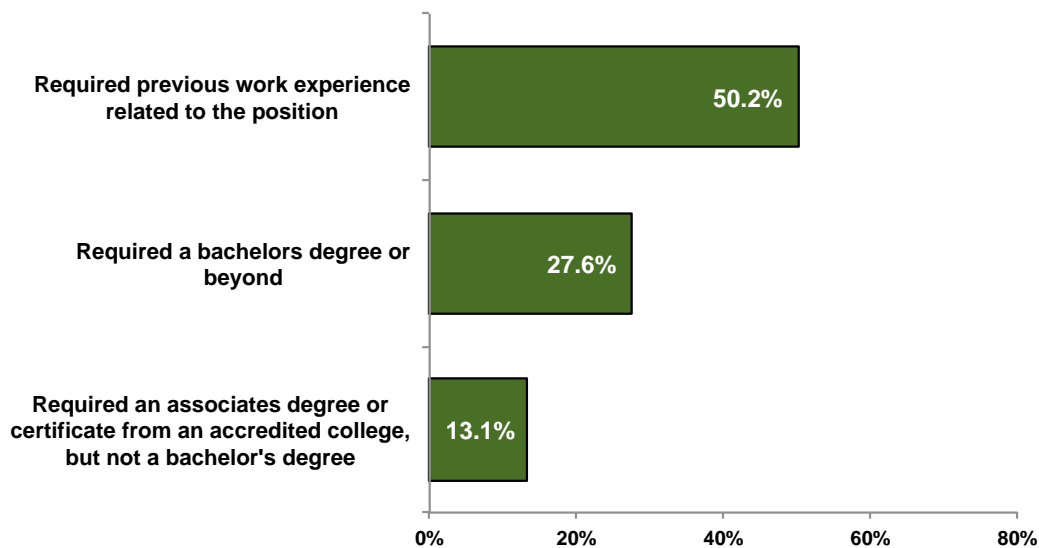
In an effort to develop profiles of the types of positions being filled, employers were asked several questions about the new workers they hired over the past year. First, respondents were asked whether increases in reported employment were driven by new hires or by existing employees taking on solar-related responsibilities. Survey results show that 76.9% of the increase in solar employment in 2013 (18,211 jobs) can be attributed to newly created positions presumably due to a demand for more solar products or services, as seen in Figure 9.

Figure 9: New Positions at Solar Establishments



Next, employers were asked questions about the education and experience of the 23,682 new solar workers. Employers reported that their new solar workers are generally not entry-level. The majority of the new hires require at least some work experience related to the position, and a large number require a college degree or certificate (Figure 10), though this number is down slightly since 2012, especially for those positions requiring a bachelor’s degree (40.7% in 2012).

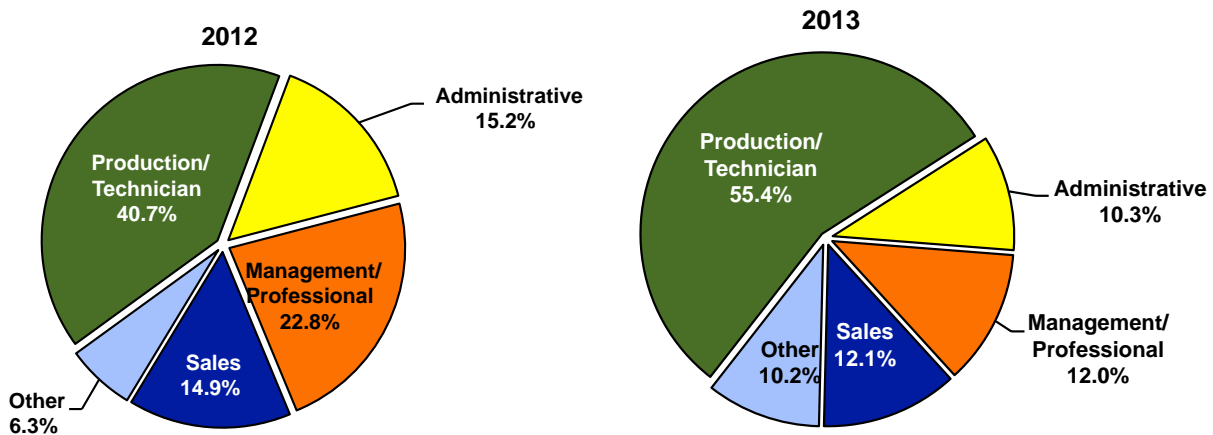
Figure 10: Background of Newly Hired Solar Worker - Percent of Workers



As a supplement to the usual worker profile questions on experience and education, we asked employers about the importance of credentials offered by third parties, such as the Interstate Renewable Energy Council (IREC). IREC credentials are designed to ensure that the solar installation workforce is highly skilled and trained to meet employer needs. A training program which has received such accreditation has demonstrated that they not only meet IREC’s instructional standards, but they also teach the job skills which have been defined through industry-validated job task analyses. Since this credentialing program is relatively new, the results to this question will serve as a baseline for future years.

The new solar positions for 2013 are well distributed across a range of skill-sets. Similar to last year, the largest category of new solar workers includes technical or production-related positions, followed by management, administrative, and sales jobs. Figure 11 illustrates changes over last year. Notable is the dramatic pace of production/technician hires – which went from 40.7% to 55.4%.

Figure 11: New Positions by Occupational Category - 2012 v. 2013



Another new and important inclusion in this year's *Census* were questions about wages. While the education requirements remain high for solar jobs (See Figure 10), wages were found to be competitive. The typical solar installer is reported to earn between \$20.00 (median) and \$23.63 (mean) per hour, which is commensurate with wages paid to skilled electricians and plumbers and significantly higher than roofers, carpenters, and other construction laborers.¹²

Production and assembly workers earn slightly less than installers, averaging \$15.00 (median) to \$18.23 (mean). These wages are slightly higher than the national average for electrical and electronic equipment assemblers of \$13.85-14.89 per hour.¹³

This year, firms were also asked for the first time to provide a demographic profile of their workforce, with a particular focus on women, racial and ethnic minorities, and U.S. veterans. Because of the sensitive nature of these questions, the survey was careful to avoid social obligation bias, however, as documented by survey experts, some bias in such questions is inevitable. As a result, it is likely that the figures reported below are inflated by some 10 to 15%. It is also important to recognize that national comparisons are challenging because the solar industry is not equally representative across the country and therefore regional distribution of firms and regional demographics play a large role in the figures. Despite this uncertainty, the demographic data do provide a general understanding of the demographic makeup of the industry and a baseline from which to track progress in future *Census* reports.

As Figure 12 illustrates, the solar industry is generally diverse, but women and racial and ethnic minorities make up a smaller share of the solar workforce than in the overall U.S.

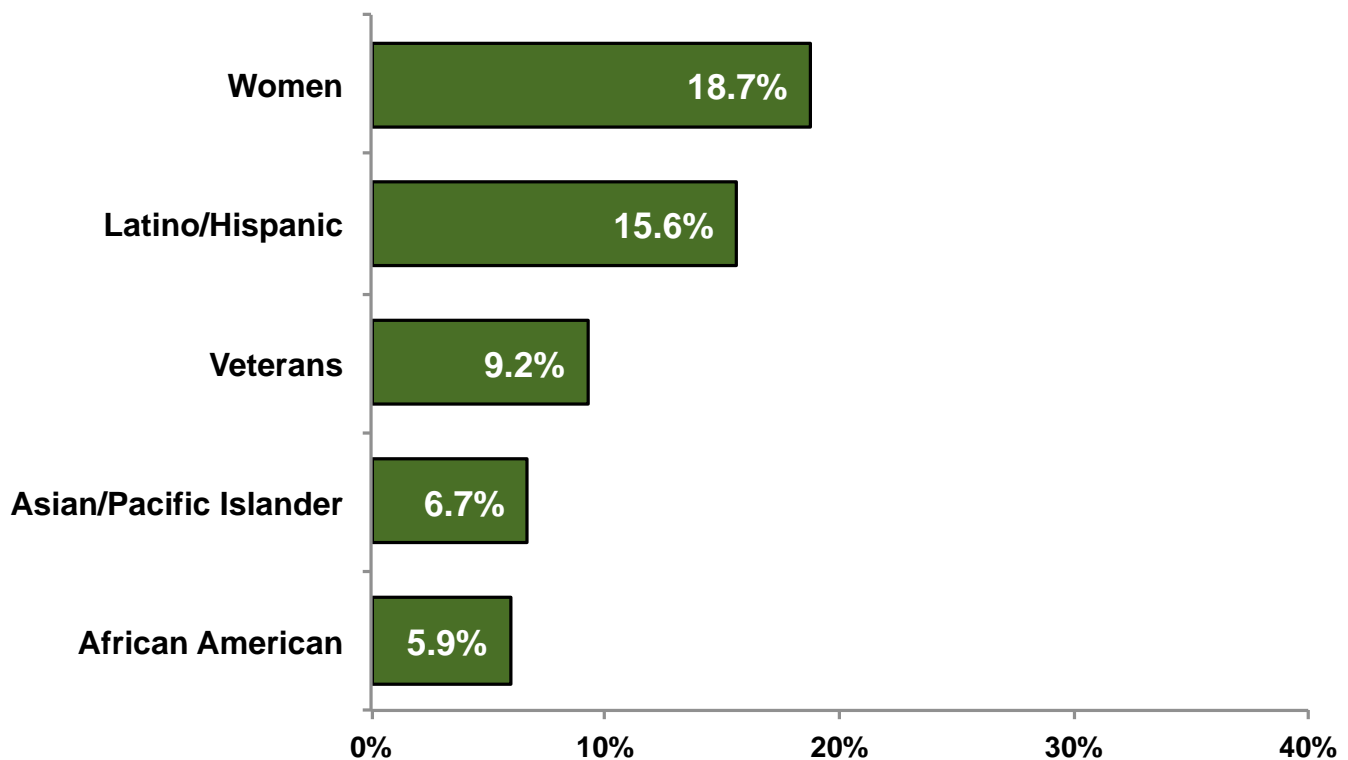
¹² Bureau of Labor Statistics, QCEW, available at www.bls.gov.

¹³ *Id.*

economy, though Latino/Hispanics and Asian/Pacific Islanders are about as representative as the overall U.S. workforce. One particularly bright spot for the industry is its employment of veterans of the U.S. Armed Services, with about one in ten (13,192) former service members employed in the industry. This is especially relevant given that veterans returning from recent combat missions continue to face extraordinarily high unemployment rates.¹⁴

At 18.7%, women are better represented in the solar industry than they are nationally in construction (12%) and “Mining, Quarrying, and Oil and Gas Extraction” (16%), but less so than manufacturing (28%).¹⁵ While women are still largely underrepresented, their role in all aspects of the value chain cannot be underestimated. A recent #Women4Solar survey¹⁶ found that women represent the largest block of residential solar purchasing decision makers, suggesting that women are not only paying attention to industry trends but are driving adoption rates.

Figure 12: Demographic Breakdown - Overall



¹⁴ Figures from the Bureau of Labor Statistics for December 2013 show that 15.6% of veterans aged 18 to 24 years were unemployed.

¹⁵ EMSI Complete Employment, 2013.1

¹⁶ Russo, R. (2013, November 5). First Ever Women-Oriented Solar Survey Highlights Unveiled at SPI, Part I. Renewable Energy World. Available at www.renewableenergyworld.com/rea/blog/post/2013/11/first-ever-women-oriented-solar-survey-highlights-unveiled-at-spi-part-1.

Table 2: Demographics¹⁷

Demographic	Percentage of Workforce	Solar Workers	Employed U.S. Population	Point Difference	Predominant Solar Sector
Women	18.74%	26,738	46.97%	-28.23%	Manuf.
African American	5.93%	8,458	11.13%	-5.2%	Manuf.
Latino/Hispanic	15.60%	22,264	15.36%	0.24%	Installer
Asian/Pacific Islander	6.68%	9,537	5.76%	0.92%	Manuf.
Veterans	9.24%	13,192	7.57%	1.67%	Manuf.



Photo Courtesy SunPower

¹⁷ U.S. demographic information collected from: U.S. Bureau of Labor Statistics. 2013. "Labor Force Statistics from the Current Population Survey." Available at www.bls.gov/cps/cpsaat18.htm; U.S. Bureau of Labor Statistics. 2014. "Table A-5. Employment status of the civilian population 18 years and over by veteran status, period of service, and sex, not seasonally adjusted." Available at www.bls.gov/news.release/empst.t05.htm.

3.1 Detailed Labor Market Analysis: Installation

The expanded 2013 research effort collected responses from thousands of firms in the construction, installation, and maintenance sector. Based on the responses, our *Census* found 10,392 establishments deriving at least some of their revenue from installation services and related goods, though the vast majority of these—approximately 8,000—are quite small, employing only one or two solar workers.

Installation companies in the U.S. employ 69,658 solar workers, making the installation sector the largest single segment of the solar industry. Installers added more new solar workers (nearly 12,500) over the past year than any other sector. While small firms dominate the installation sector, employment is growing most dramatically at known, larger firms. This is one indication that the installation sector continues to consolidate. However, data on trends in the percentage of company revenue attributed to solar-related activities may suggest otherwise. While it may seem contradictory, there can be consolidation and diversification at the same time. The larger firms are growing faster (and acquiring other firms) than the industry as a whole, but not so fast as to eliminate opportunities for new entrants.

Forty-four percent of solar installation firms expect to add workers over the next 12 months, representing 14,673 new solar workers (a 21.1% employment growth rate) (Figure 13). It is important to note that while this growth projection is on par with previous *Census* results, declining percentages over time may signal increasing labor productivity, which can be viewed as a good sign for the industry

Figure 13: 12-Month Hiring Expectations—Installation Establishments

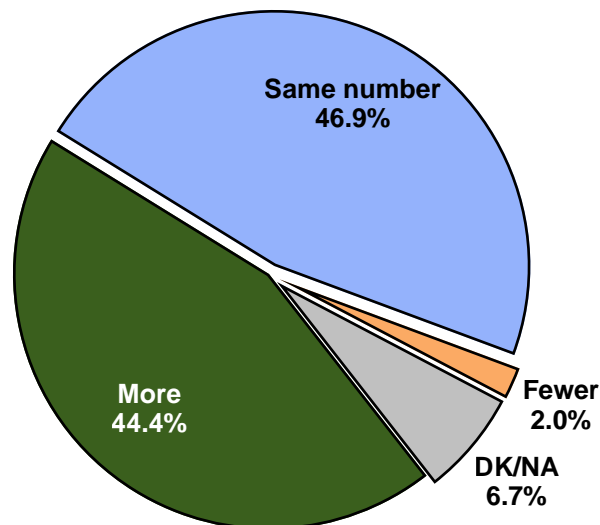
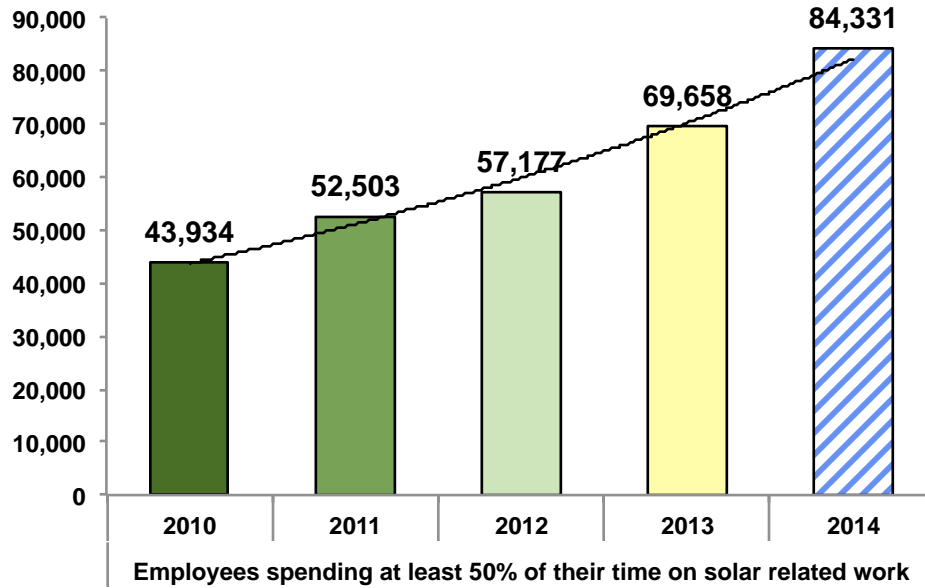
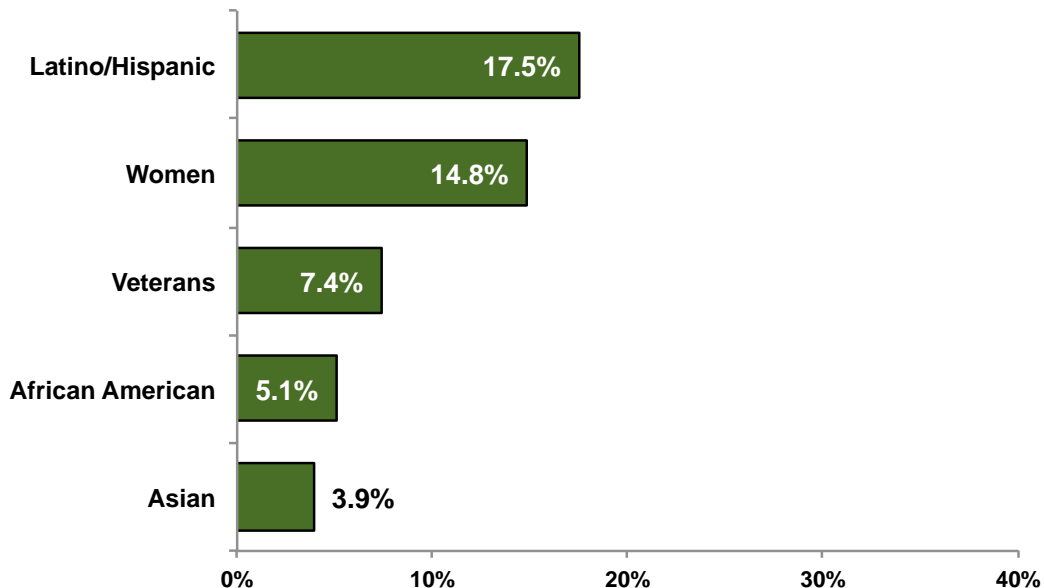


Figure 14: Solar Employment Growth 2010-2014 (2014 projected)—Installation



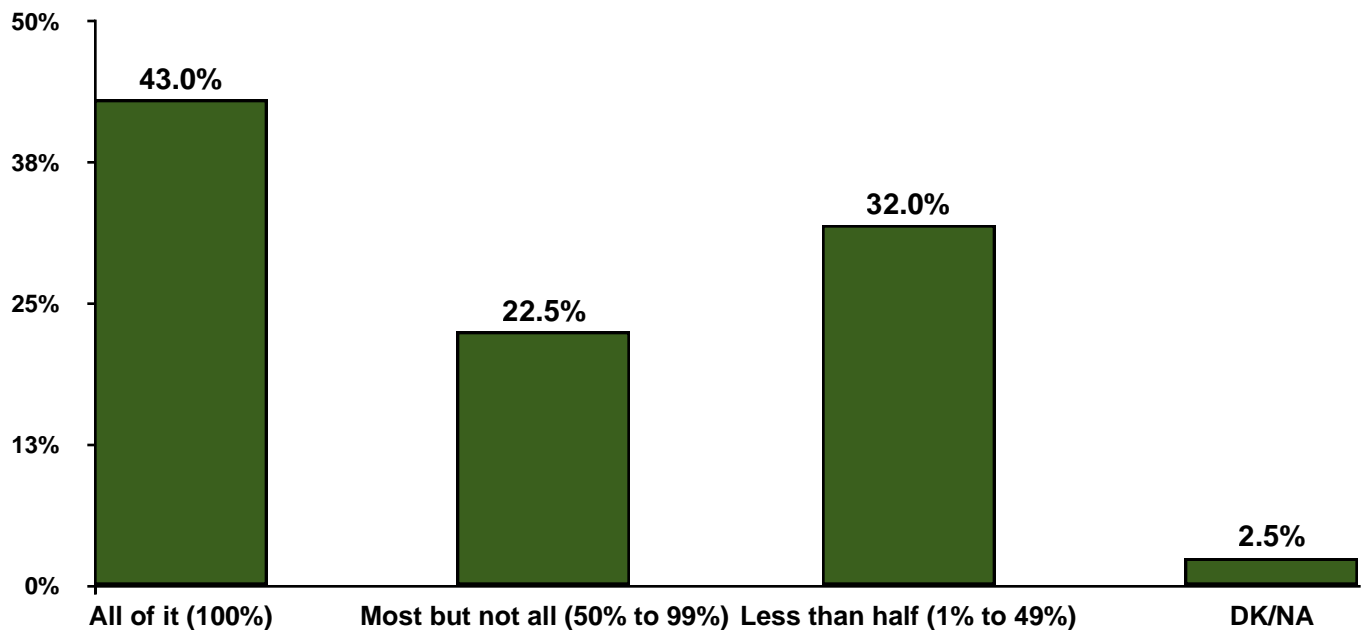
The installation workforce is somewhat diverse, employing a larger proportion of Latino/Hispanic workers than either the solar industry as a whole or are represented in the national workforce. In addition, veterans are about as well represented in this sector as they are in the entire employed U.S. population. (Figure 15).

Figure 15: Installation Sector Diversity



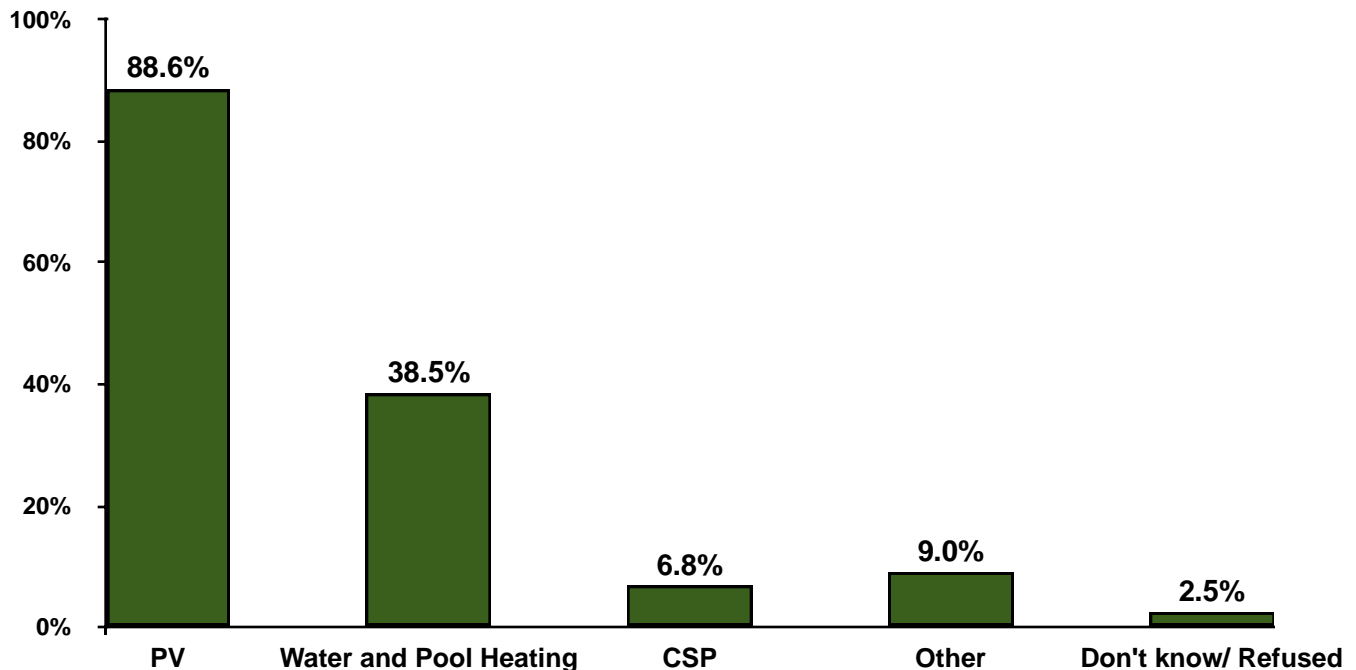
Interestingly, this *Census* finds that fewer establishments are deriving all of their revenue from solar activities, which seems counterintuitive given the trend of consolidation that has occurred over the previous several years (43% in 2013, down from 51% in 2012, though still up from 39% in 2011) (Figure 16). About two-thirds of solar establishments derive a majority of their revenues from solar.

Figure 16: Percentage of Revenue Related to Solar Products—Installation



As shown in Figure 17 below, many establishments work with more than one type of technology. Eighty-nine percent of establishments install PV systems while just under 40% install solar hot water (and pool heating) systems. However, the average employment at solar hot water firms is significantly smaller than at PV firms, and there were virtually no large firms (greater than 25 solar workers) predominantly installing hot water systems.

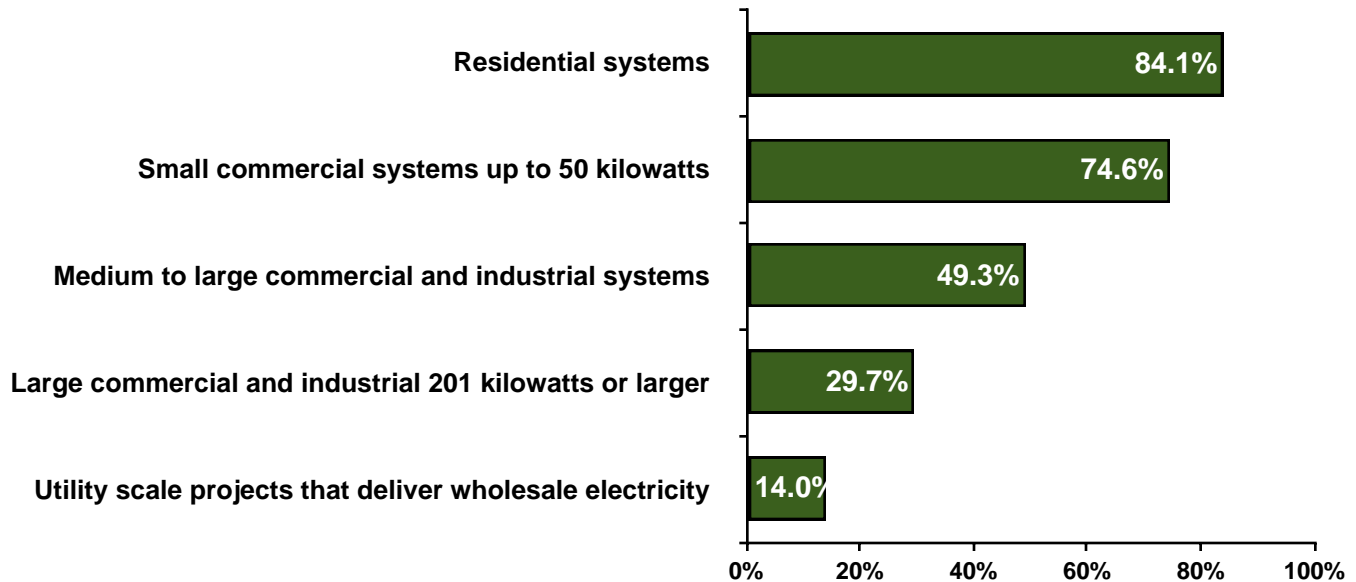
Figure 17: Establishments by Technology—Installation



Due to the number of establishments working across multiple technologies, it is still not possible to provide reliable estimates of the number of employees within each specific solar technology. Also, establishment percentages provided in Figure 17 include overlap (i.e., establishments working with multiple technologies are counted in each technology group), so the sum of the percentages will exceed 100%.

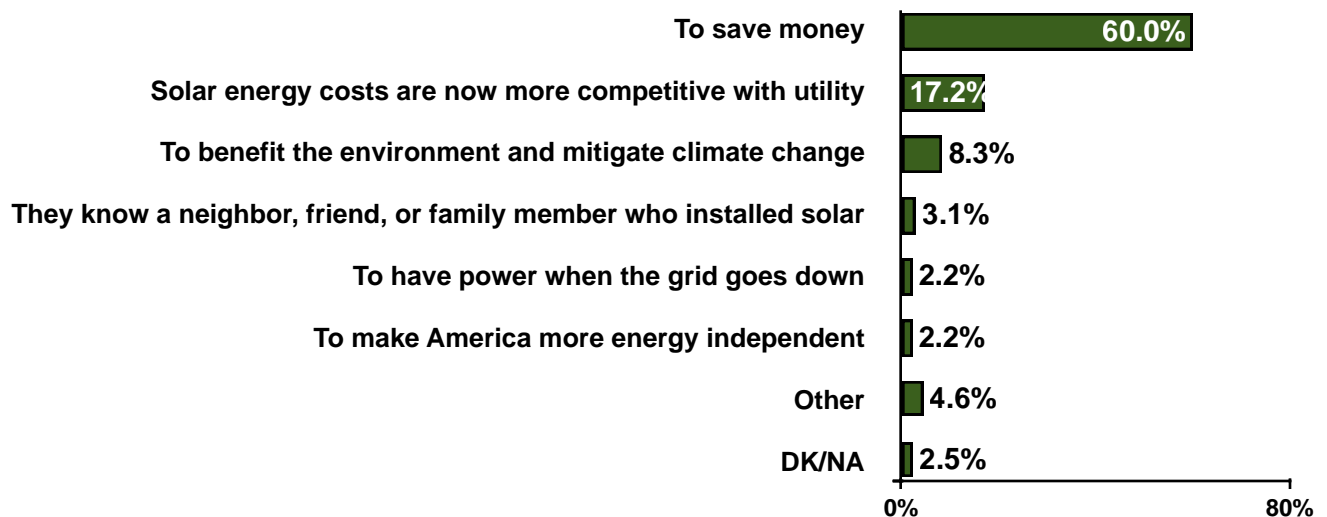
U.S. installation companies also report working on systems of varying sizes. As would be expected, the majority of installation firms are working on smaller systems—mainly residential and commercial installations up to 50 kilowatts (Figure 18). In general, the figures for 2013 look similar to those from 2012; however, there is a significant uptick in utility scale projects. The 14% reported for these types of projects in 2013 is up from 3.7% in the previous year, though the increase in this *Census* appears to be driven primarily by smaller subcontractors working on a specialized part of the installation. This means that while the number of establishments working on utility scale solar projects increased, it is unlikely that the number of *workers* increased at the same rate.

Figure 18: Percentage of Establishments Working on Systems, by Size—Installation



The research findings illustrate a healthy industry segment, with strong growth and continued employment gains. Respondents are optimistic about the future of their businesses, and working on larger systems than in previous years. In addition, the research reveals a sector that is highly focused on consumer demand. Seventy-seven percent of respondents in this sector attribute consumer demand to solar’s increased competitiveness with incumbent electricity providers, as seen in Figure 19 below.

Figure 19: Consumer Demand Drivers — Installers



In *Census 2012*, employers reported that declining module prices were the number one reason for their growth. Installers, in particular, reported that these price declines, led by lower-cost panels manufactured overseas, were making solar power more cost-competitive and thus a significant driver of business growth and success. When asked how they felt about lower cost panels and their impact on the U.S. solar industry, installers were split evenly.

Figure 20: International Manufacturing Impacts - Installers

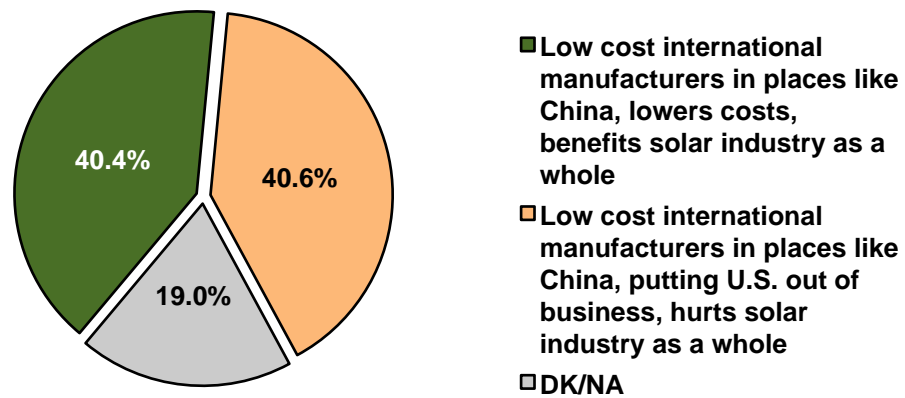


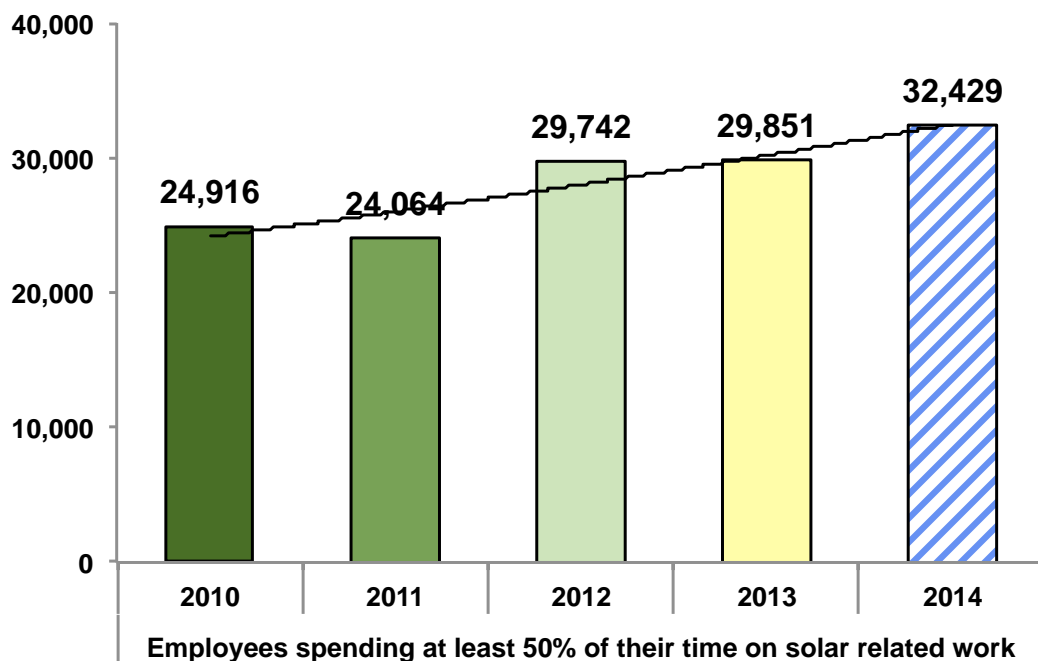
Photo Courtesy NREL

3.2 Detailed Labor Market Analysis: Manufacturing

Solar manufacturing has held firm in 2013. Despite losses between 2011 and 2012 (-8,199), a global glut in PV panel manufacturing capacity, and continued pressure to lower production costs, employment in solar manufacturing remained essentially flat between 2012 and 2013 at 0.37% growth. Compared with manufacturing in the overall U.S. economy during the same period (0.74%), the solar industry is not an anomaly.¹⁸

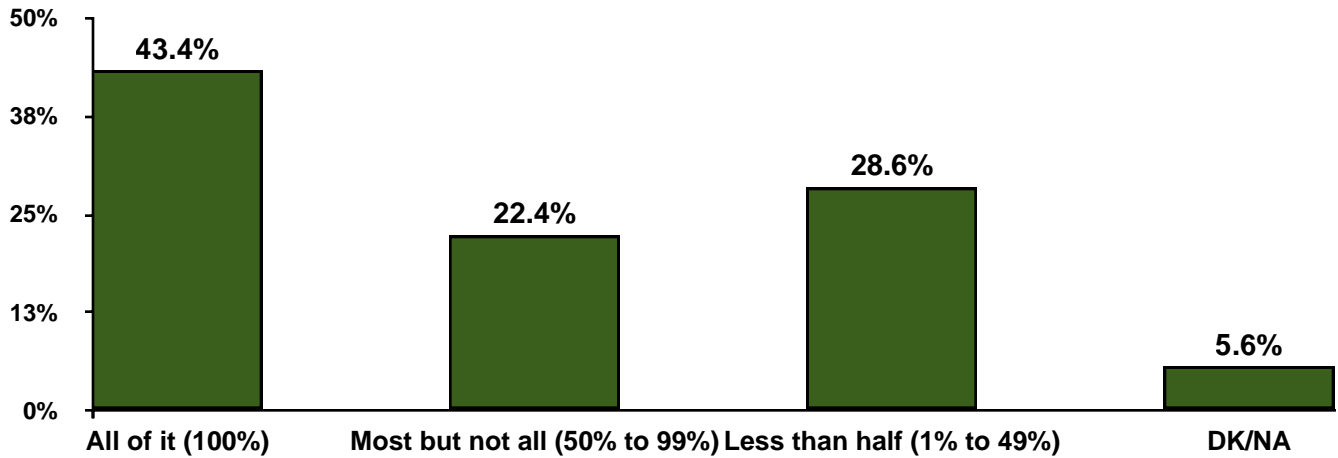
This *Census* finds 1,484 solar manufacturing establishments in the United States (26% of which serve as U.S. headquarters for manufacturing that is conducted abroad), employing 29,851 solar workers (Figure 21). The employment figures are also taken in the context that fewer firms derive 100% of their revenues from solar (43% this year, down from 59% in 2012), suggesting that companies may be diversifying into other, non-solar products or suggesting that some less competitive, non-diversified companies counted in 2012 are now out of business. Our research indicates that firms specializing in solar have survived, as have companies that supply more generic parts of the value chain, such as encapsulants, wiring, and fasteners.

Figure 21: Solar Employment Growth; 2010-2014 (2014 Projected) — Manufacturing



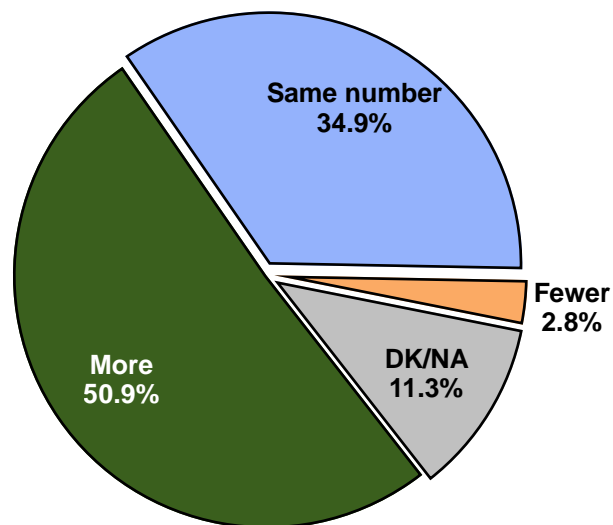
¹⁸ Bureau of Labor Statistics, Comparison of All Employees, Seasonally Adjusted: <http://www.bls.gov/webapps/legacy/cesbtab1.htm>.

Figure 22: Percentage of Revenue Related to Solar Products — Manufacturing



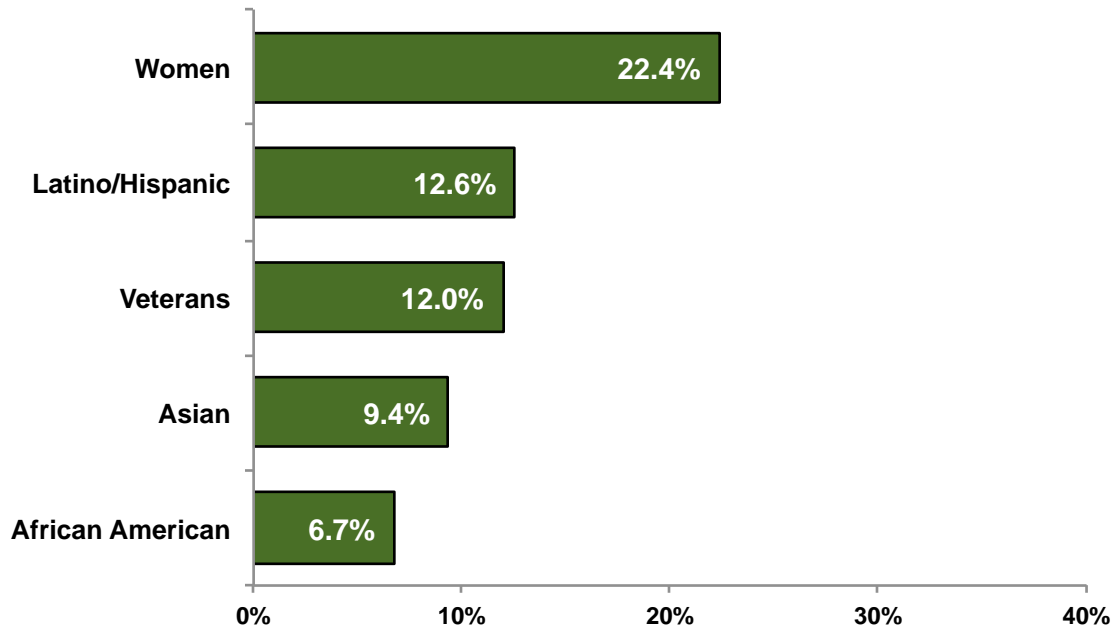
Manufacturers remain optimistic about future employment growth, with over 50% of firms expecting an almost 9% increase in employment over the coming 12 months (Figure 23).

Figure 23: Growth Projections, 12-Month — Manufacturing



Nationally, manufacturers are the most diverse of all sectors. Firms in this category are an important employer of U.S. veterans and Latino/Hispanic workers. Additionally, manufacturers on the whole have the largest proportion of workers who are women of all of the solar industry sectors. (Figure 24).

Figure 24: Sector Diversity — Manufacturing



The impact of international trade disputes on overall solar employment requires additional study. In October 2011, seven U.S. crystalline silicon photovoltaic cell and module manufacturers filed antidumping and countervailing duty petitions with the U.S. International Trade Commission (ITC) and the U.S. Department of Commerce (DOC) alleging unfair trade practices by Chinese solar cell and module manufacturers. These proceedings led U.S. trade regulators to impose antidumping and countervailing duties on solar cells and modules from China.

Following the U.S. investigations, the Chinese solar industry successfully petitioned China's Ministry of Commerce to initiate antidumping and countervailing duty investigations on imported polysilicon from Europe, South Korea, and the United States. These investigations resulted in the recent imposition of prohibitive antidumping and countervailing duties against U.S. polysilicon, a key raw material used in solar panels and significant source of America's positive solar trade balance with China.¹⁹

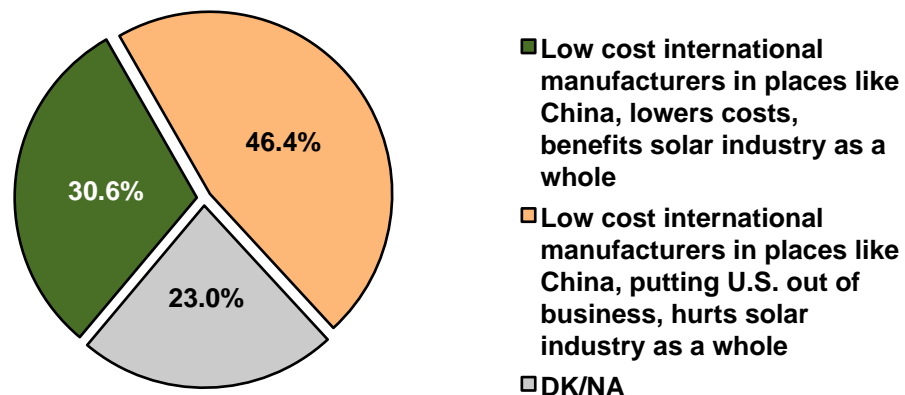
¹⁹ Jordan, Philip *Solar Energy Markets, An Analysis of the Global Solar Industry*, El Sevier, 2013, Ch. 9.

On December 31, 2013, one of the original U.S. petitioners filed additional antidumping and countervailing duty petitions against solar products from China and an antidumping duty petition against solar products from Taiwan. The petitioner is seeking to extend antidumping and countervailing duties to solar modules assembled in China with third-country cells and solar cells and modules from Taiwan.

It is not clear how these trade disputes, or attempts to find a mutually agreeable trade resolution with the help of a third-party, will affect employment in solar manufacturing in the coming year. As seen in Figure 25, respondents were equally divided on whether lower-cost international manufacturers benefit or hurt the solar industry as a whole.

Some research indicates that the U.S. imposed trade tariffs increased the price of Chinese solar modules in the U.S. by 11%, which may have depressed demand.²⁰ However, price differences of this magnitude may only be affecting demand and associated solar employment at the margins, given increasing cost efficiencies in other areas. A comprehensive study of the broader U.S.-China solar trade conflict is needed to provide a deeper understanding of the conflict's impact or potential impact on employment in both upstream and downstream labor markets (e.g., polysilicon manufacturing and installations, respectively).

Figure 25: International Manufacturing Impacts — Manufacturing

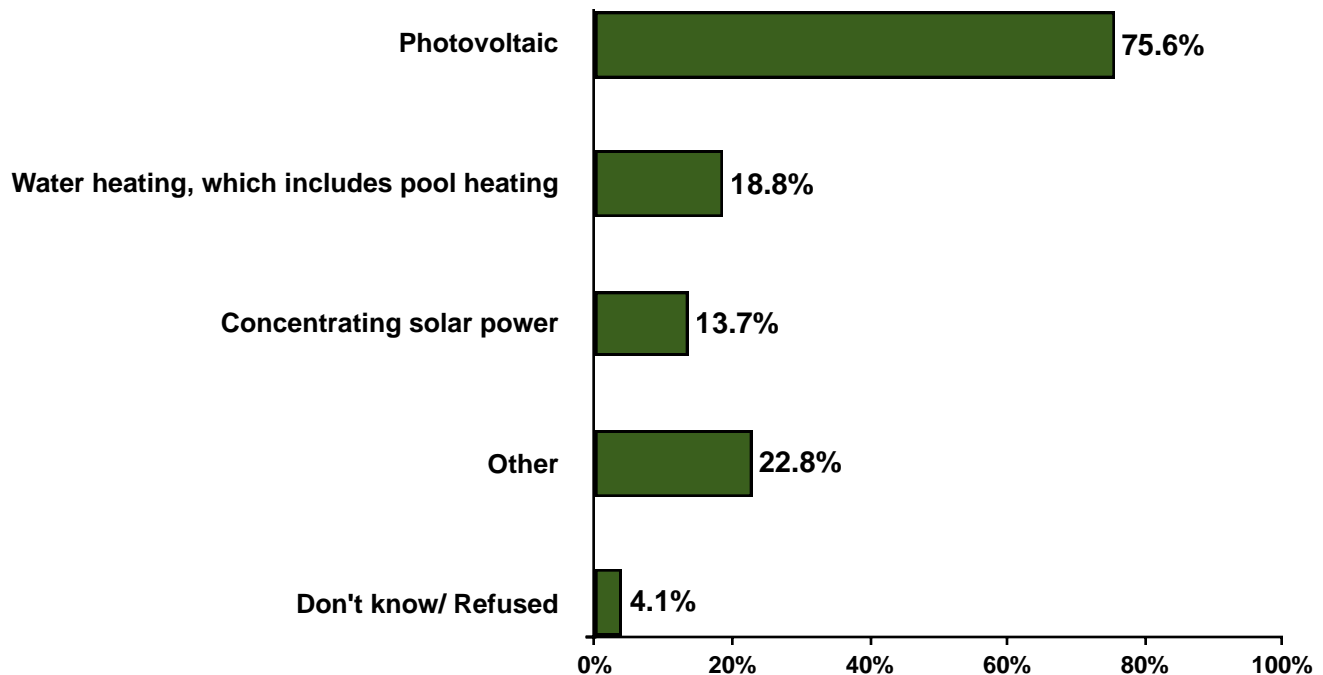


Manufacturers are predominantly producing components for photovoltaics, with over 3/4 of establishments engaged in PV, compared with just under 20% in water heating and 14% in CSP

²⁰ GTM Research, "US Solar Module Industry Leery of SEIA's China Trade Settlement Plan". Available at <http://www.greentechmedia.com/articles/read/U.S.-Solar-Module-Industry-Leery-of-SEIAs-China-Trade-Settlement-Plan>.

(Figure 26). In 2013, several state agencies and industry organizations produced policy guides to support and streamline solar water heating and cooling applications.²¹ While these efforts could lead to increased demand for solar heating and cooling products, corresponding increases in demand for photovoltaics will likely not change the technology proportions in 2014. Employment in CSP is less certain as many CSP projects will reach completion in the next few years. These projects have long lead times and new projects may find it challenging to obtain contracts or financing in time to ensure the project will be able to begin commercial operation before the scheduled expiration of the 30% federal investment tax credit (ITC) at the end of 2016. Also of note is the fact that several large CSP projects switched to PV due to PV price declines.²²

Figure 26: Establishments by Technology Type — Manufacturing



²¹ For examples, see Minnesota Department of Commerce: https://mn.gov/commerce/energy/images/MNValue_SolarThermal.pdf; Massachusetts Department of Energy Resources: <http://www.mass.gov/eea/docs/doer/renewables/renewable-thermal-study.pdf>.

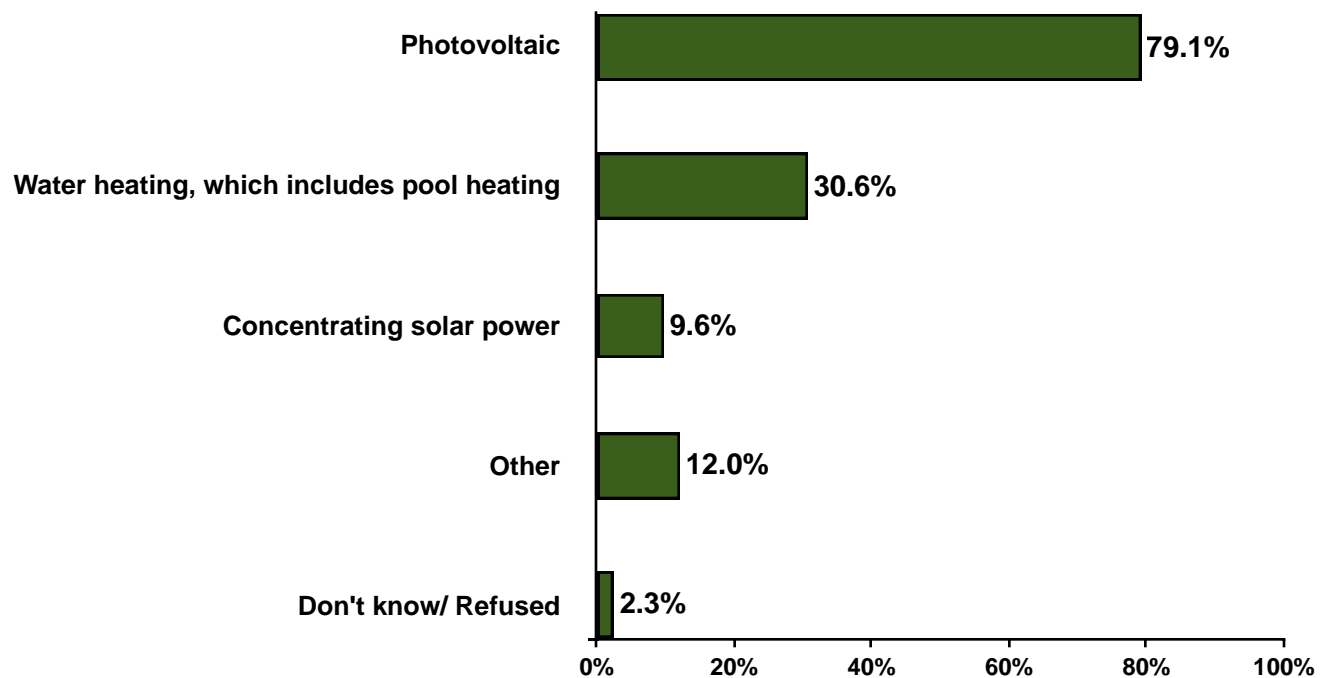
²² California Energy Commission, “Blythe Solar Power Project”. Available at http://www.energy.ca.gov/sitingcases/blythe_solar/; DOE/NREL, “Utility-Scale Concentrating Solar Power and Photovoltaics Projects: A Technology and Market Overview”. Available at <http://www.nrel.gov/docs/fy12osti/51137.pdf>.

3.3 Detailed Labor Market Analysis: Sales and Distribution

Employers in the solar sales and distribution sector sell all types of systems and play a pivotal role in the solar supply chain. These establishments work in wholesale and retail trade of components and finished products.

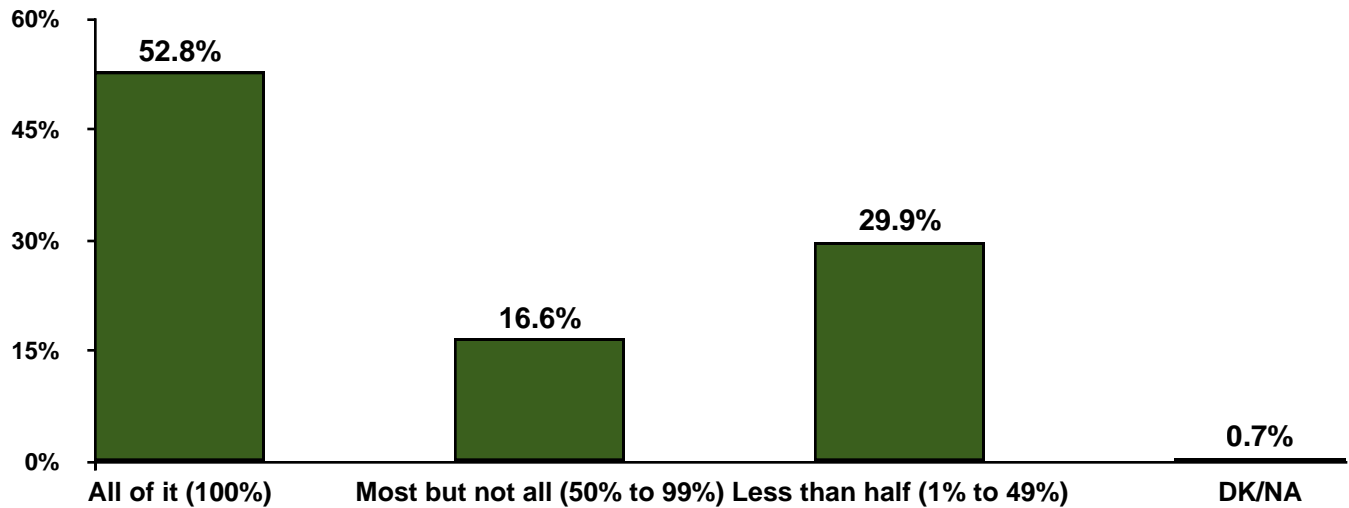
The majority of sales and distribution companies deal in PV systems, with 30.6% providing solar water heating equipment (Figure 27).

Figure 27: Percentage of Establishments by Product Sales—Sales and Distribution



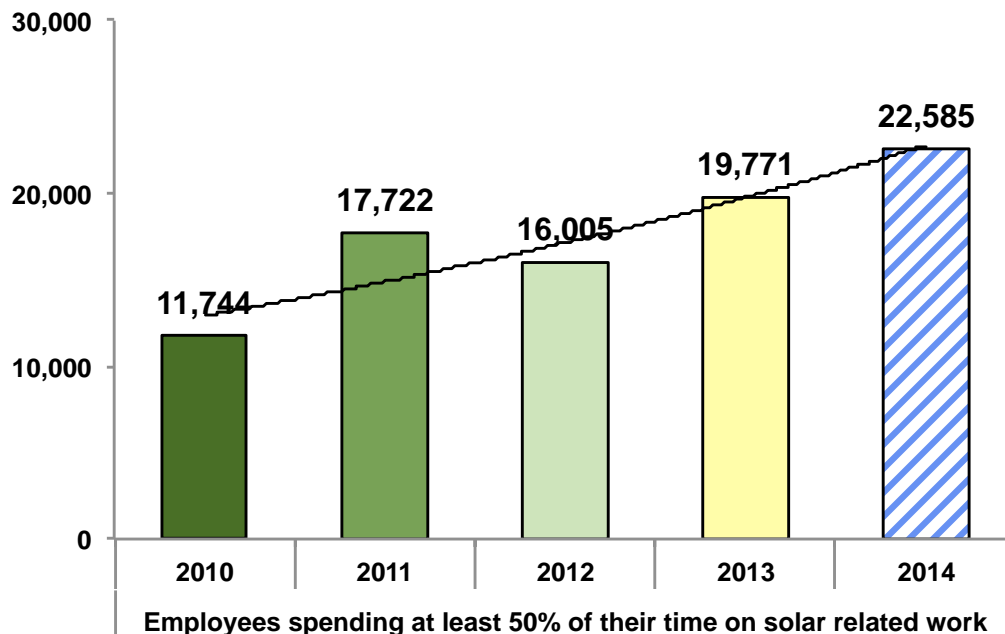
Unlike other sectors, which seem to be trending towards other product lines in addition to solar, sales and distribution establishments remain mostly engaged in solar work (Figure 28). A majority (53%) attribute 100% of their revenues to solar goods, which is up from only 31% in 2011 and consistent with 2012 figures.

Figure 28: Percentage of Revenue Related to Solar Products—Sales and Distribution



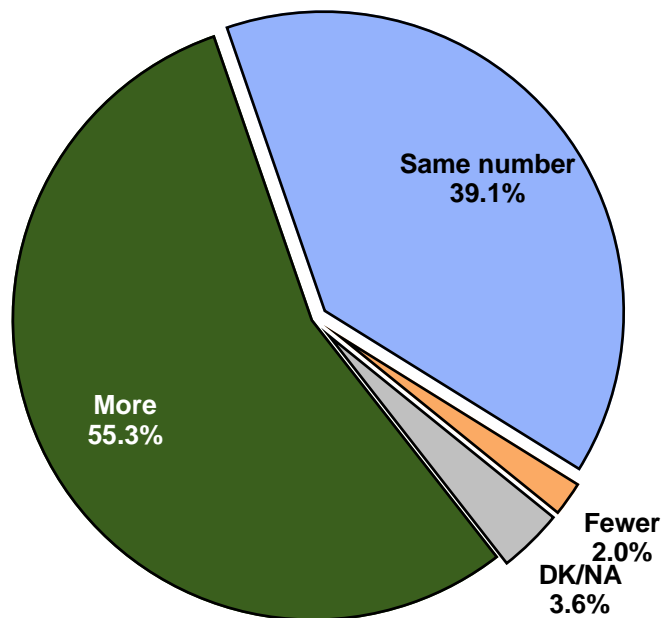
Solar sales and distribution showed strong growth in 2013, expanding to 19,771 workers from just over 16,000 in 2012 (Figure 29). In fact, solar sales and distribution positions for this *Census* exceeded the 2013 projections in *Census 2012* (19,549). These numbers are not surprising given the increase in residential and commercial solar installations.

Figure 29: Solar Employment Growth; 2010-2014 (2014 Projected)—Sales and Distribution



More than half of solar sales and distribution establishments surveyed expect to add jobs, resulting in the projected addition of 2,800 new jobs by October 2014. Only 2% of these establishments expect to cut solar workers (Figure 30). Again, these numbers are not surprising given various industry projections showing continued solar installation growth in 2014.²³

Figure 30: 12 Month Hiring Expectations—Sales and Distribution



²³ IHS Inc, "IHS News Flash: Solar Market Predictions for 2014". Available at <http://press.ihs.com/press-release/design-supply-chain/ihs-news-flash-solar-market-predictions-2014>; PV-Tech, "ROTH Capital raises 2014 global solar market demand outlook". Available at: <http://www.pv-tech.org/news/roth-capital-raises-2014-global-solar-market-demand-outlook>.

Figure 31 below illustrates the diversity in the sales and distribution sector, which appears to be particularly strong for women as compared to some other sectors.

Figure 31: Sales and Distribution Sector Diversity

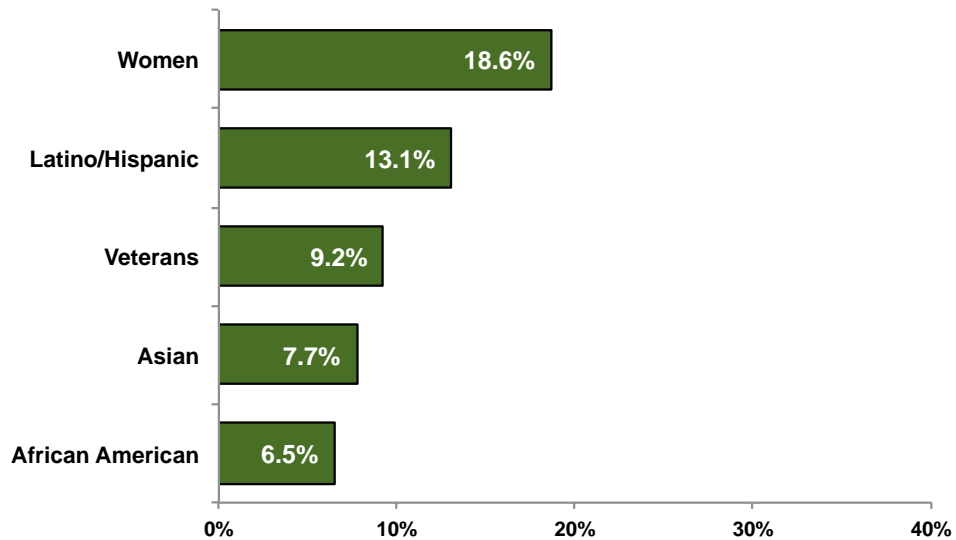


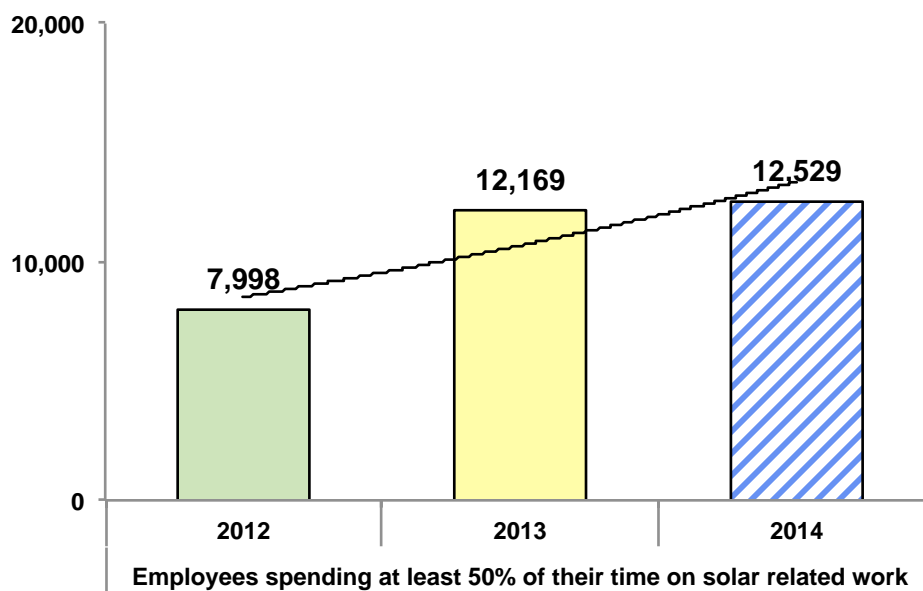
Photo Courtesy NREL

3.4 Detailed Labor Market Analysis: Project Developers

Since 2012, the *Census* has included specific information about project developers, which, until that point, were distributed throughout other categories (most often in installation or in “other” jobs). This company classification encompasses establishments that plan, construct, and maintain large utility-scale solar projects.

Solar project developers have proven important to solar growth, expanding by an astounding 52% since 2012. Despite these rapid gains, project developers are the least bullish overall regarding future employment, expecting to add only 360 jobs over the coming 12 months (representing approximately 3% growth), as seen in Figure 32.

Figure 32: Solar Employment Growth; 2010-2014 (2014 Projected)—Project Development

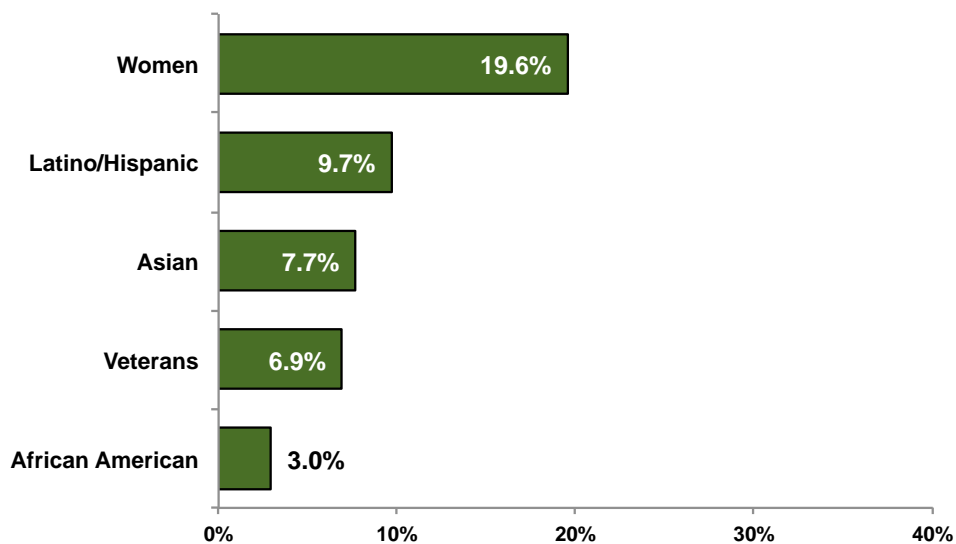


The projected slowdown in hiring in this sector may be the result of two major factors. First, the large amount of utility-scale capacity expected over the next several years meets many utilities’ anticipated needs for such projects. While this spike in new capacity may have contributed to the observed recent increase in project development employment, firms in this sector may have little need for additional workers moving forward. The second factor likely influencing the expected slow growth of this sector is the expected sunset of the 30% ITC in 2016. Though 36 months remain before this incentive is reduced to only 10%, this may not be enough time for utility projects with longer timelines to take advantage of the incentive. Due to

this uncertainty, some banks are becoming more reluctant to finance such projects, which, in turn, signifies that fewer are being planned.

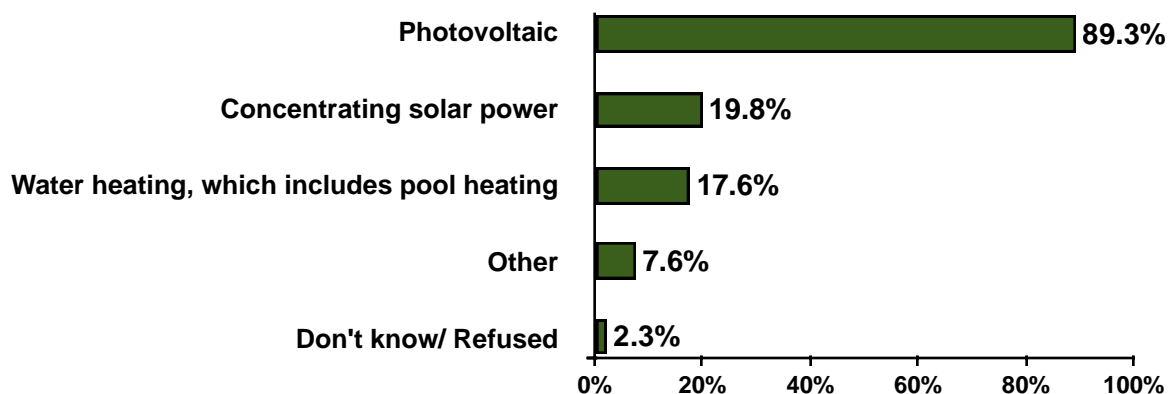
Figure 33 illustrates the diversity in the project development sector. Project developers are about as diverse as their counterparts in other sectors.

Figure 33: Project Development Sector Diversity



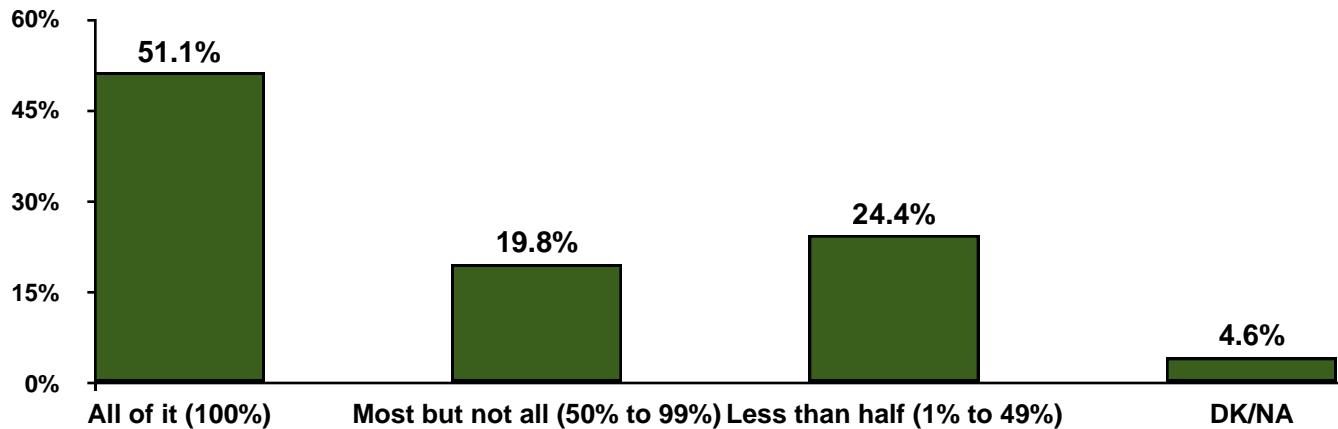
The overwhelming majority of developers work with PV (Figure 34), as one would expect based on the large proportion of total installed solar capacity the technology represents. The 20% working with CSP is double what was reported in 2012, which may be driven in part by both the nearly 2,000 MW worth of projects currently with signed power purchase agreements and the over 1,600 MW of projects still under development. The same proportion of project developers report working with solar water heating (18%) as was reported in *Census 2012*.

Figure 34: Percentage of Establishments by Technology—Project Development



Project developers are slightly more “solar focused” than workers in other sectors, though still only half report that all of their revenue is derived from solar projects, as illustrated in Figure 35.

Figure 35: Percentage of Revenue Related to Solar—Project Development



While other sectors are focused on serving consumers in the residential and commercial markets, the “consumers” for many project developers are electric utilities. Thus, firms in this category are less concerned with online or traditional marketing, as they are driven primarily by price and policy. These consumer motivations are reflected in the *Census* results, which show that project developers believe their consumers are driven by cost more than any other factor. This may explain why the majority of project developers see lower cost, internationally manufactured panels as a benefit to the industry (Figure 36).

Figure 36: Consumer Drivers — Project Development

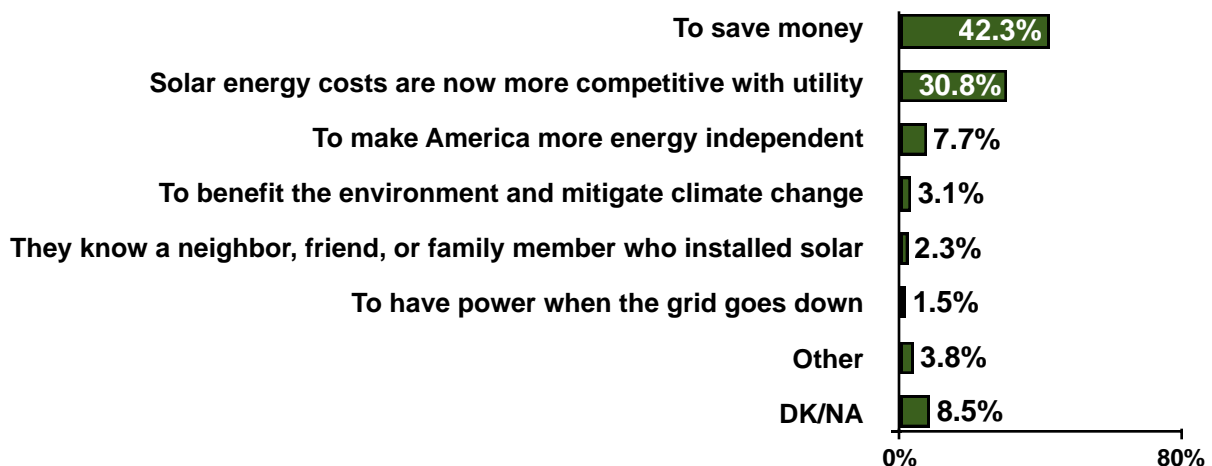


Figure 37: International Competition and Impact — Project Development

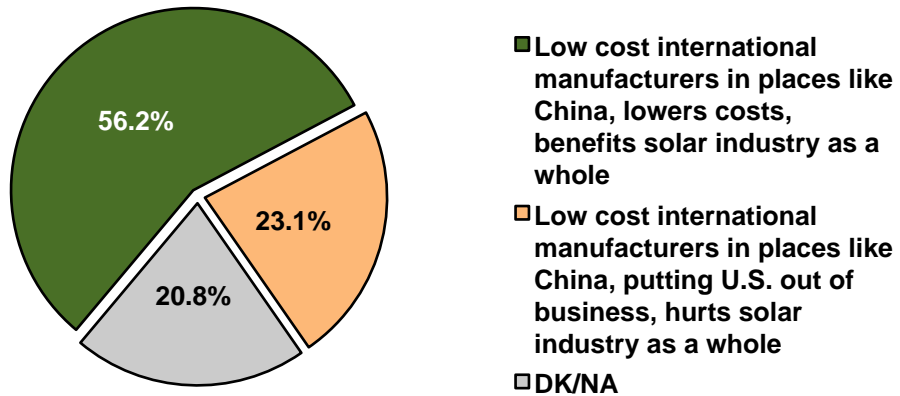


Photo Courtesy groSolar

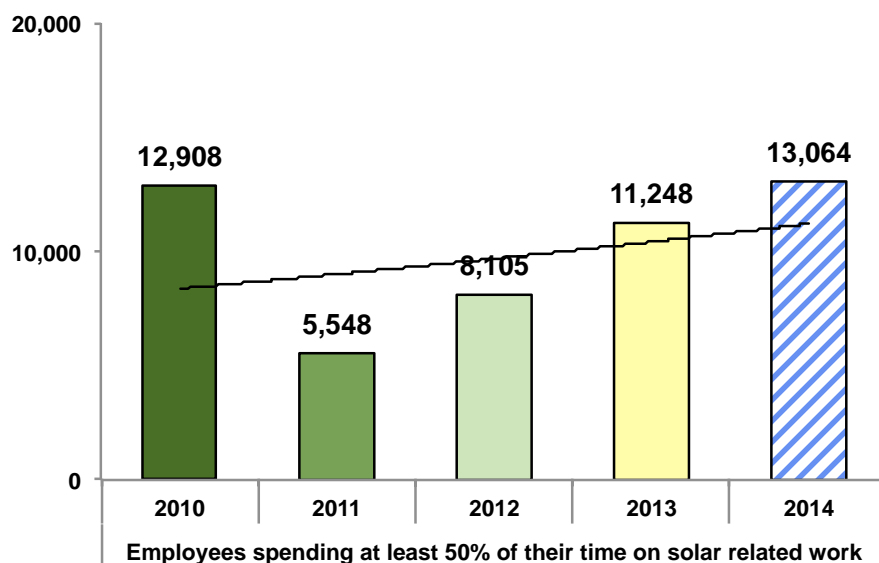
3.5 Detailed Labor Market Analysis: Other

As in previous years, a significant number of the solar establishments participating in this study did not identify with any of the specific sectors already described in this report.²⁴ These establishments, which have been grouped into an “other” category, include those engaged in research and development, finance and accounting, legal work, or other ancillary services that support the solar industry.

Though none of these additional solar sectors were large enough from an employment perspective to warrant a dedicated category, the establishments classified as “other” collectively employ more than 11,200 workers. In 2013, this “other” category was expanded to include nonprofits (which employ 625 solar workers), government agencies (588 solar workers), and academic institutions, (with 241 workers). While some of these workers were likely counted in previous editions of the *Census* as providing “ancillary services”, a significant proportion of them are thought to have been included here for the first time. Given this, we estimate that approximately 25% of the apparent increase in employment in this category can be attributed to the addition of nonprofit, academic, and government workers.

The “other” establishments have indicated that they anticipate strong growth over the coming 12 months – adding more than 1,800 new jobs. Thirty-one percent of survey respondents in this category expect to add solar workers by October 2014 (Figure 38).

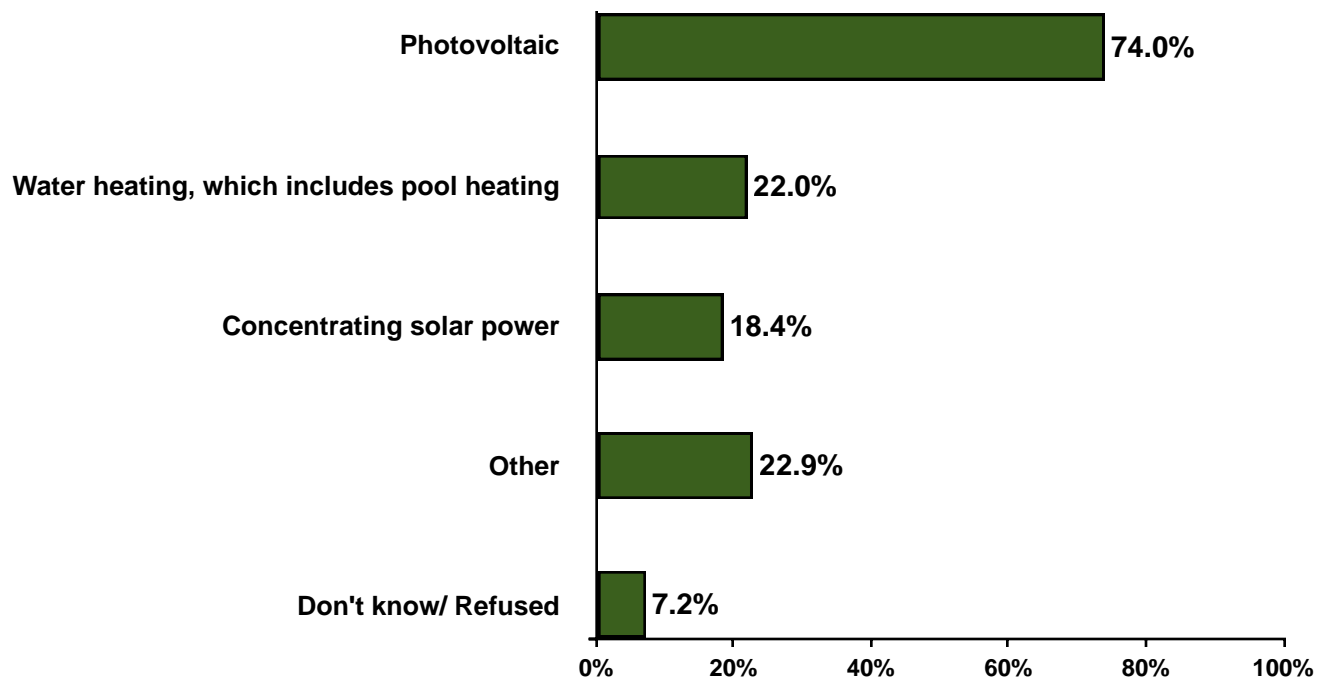
Figure 38: Solar Employment Growth; 2010-2014 (2014 Projected)—Other



²⁴ Nor were they specifically targeted.

Establishments in this category reported working predominantly with photovoltaic panels. Year-over-year, fewer establishments indicate involvement with solar water heating technologies. Only 22.0% of establishments in 2013 were connected with solar water heating, down from 28.1% in 2012, and 43.3% in 2011. As with the other sectors, our survey found that many establishments work with more than one technology (Figure 39).

Figure 39: Percentage of Establishments by Technology—Other



Though about one-third of the employers in this category described their firm as being a 100% solar-related business, this category has the highest percentage of establishments (39%) that obtain less than half their revenue from solar work (Figure 40). Such a finding will come as no surprise when one considers that many of the types of firms in this catchall category provide services to clients or constituents across a wide variety of industries and sectors.

Figure 40: Percentage of Revenue Related to Solar Products—Other

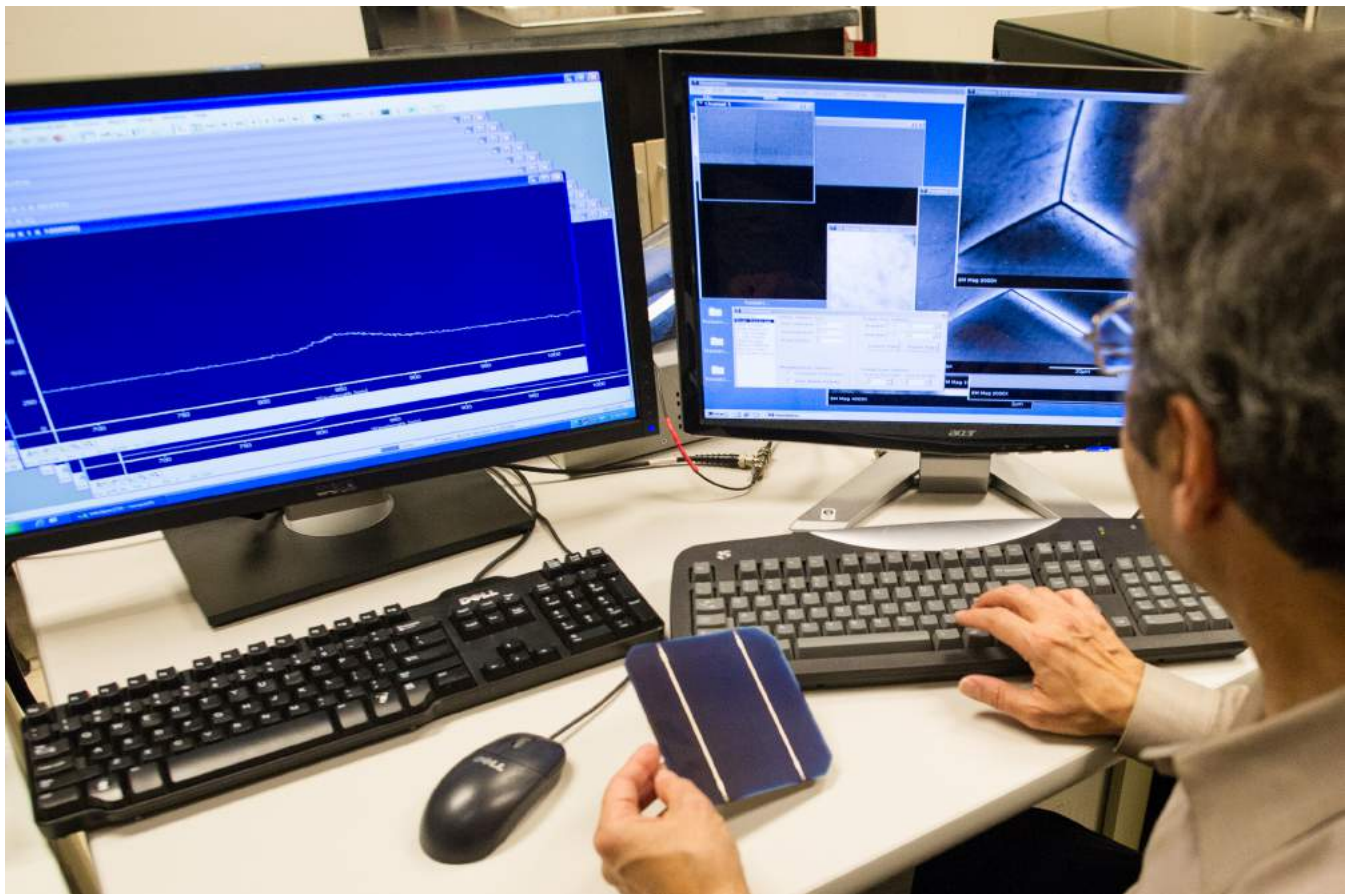
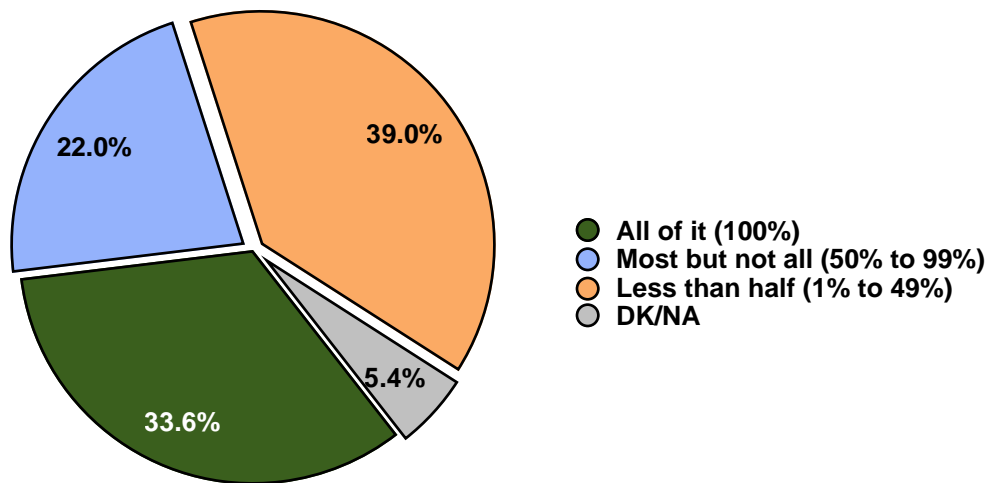


Photo Courtesy NREL

4. *Conclusions and Recommendations*

This fourth annual *Census* confirms that the industry continues to play an important role in America's overall economic recovery by providing good-paying, high-skilled jobs opportunities to more than 142,000 workers at 18,000 locations in all 50 states. Its 20% growth rate over the last year, (more than ten times the overall national employment growth rate during the same period), makes the U.S. solar industry one of the fastest growing industries in the U.S. Not only did the solar industry exceed its growth expectations, but the pace of hiring in 2013 was more than 50% higher than in 2012. These data suggest that the trajectory for industry growth is even more pronounced than previously anticipated, with no sign of slowing down.

It is well documented in our *Census* series that competitive pricing is the key driver behind the growth of the solar industry. Market forces and supportive federal and state policies have driven declining costs and price competitiveness. Though the price of solar components and installed costs have generally leveled off over the last year after steady and steep declines, the cost of solar power is lower than ever. At \$0.70/watt in Q3 2013, module prices are less than a third of the cost at the beginning of 2010. Similarly, national average installed costs have fallen by approximately 53% over the same period (\$3.00/watt in Q3 2012 vs. \$6.37/watt in Q1 2010).²⁵ Successful efforts to further reduce these costs – primarily through addressing the many non-hardware costs of solar – can be expected to continue to drive growth in both installed solar capacity and new solar employment.

Nowhere is the competitive price of installed solar power more prominently displayed than in the installation and project development sectors. In addition to their combined employment growth since 2012, workers in these sectors have dramatically improved their productivity, installing just over 25% more solar power per worker in 2013 as compared to 2012. These productivity gains may help ensure a more profitable and stable industry for the foreseeable future.

While the last few years have seen much uncertainty and turmoil for some state-level policies (including attempts to weaken net metering and roll back state renewable portfolio standards) and secondary federal policies (such as the U.S. Department of Energy's Loan Guarantee Program and the 1603 Treasury Program), the 30% ITC has continued to serve as the foundational policy for the solar industry in the United States. Continued policy support is critical to ensure sustained competitive pricing and resulting expansion of installed capacity of solar power.

Some of the same global market forces that have made consumer electronics more affordable in the U.S., upsetting overall U.S. manufacturing numbers, are also affecting the solar

²⁵ See references to SEIA/GTM *Solar Market Insight* reports herein.

industry. After a relatively steep decline between 2011 and 2012, employment in solar manufacturing grew by 0.37% between September 2012 and November 2013 (manufacturing employment in the overall economy increasing by only 0.74% over the same period). Such fluctuations in manufacturing employment may lead some to speculate as to the impact the resurgent U.S.-China solar trade conflict is having on jobs in this sector. Some research indicates that the U.S. imposed trade tariffs have increased the price of Chinese solar modules in the U.S. by 11%, which may have depressed demand. However, price differences of this magnitude may only be affecting demand and associated solar employment at the margins, given increasing cost efficiencies in other areas. A comprehensive study of the broader U.S.-China solar trade conflict is needed to provide a deeper and more conclusive understanding of the conflict's impact on jobs.

Last, while we find that groups such as Veterans of the U.S. Armed Services and members of the Latino/Hispanic and Asian/Pacific Islander ethnic groups are strongly represented in the solar industry, other key demographics, such as women and African Americans, are significantly underrepresented. Developing a better understanding of the factors accounting for the observed demographic characteristics of the solar workforce may help expand employment opportunities to a larger portion of the population while making companies stronger and more diverse. It is our hope that the demographic figures provided herein can serve as a baseline from which to track progress toward this goal.

Given these industry dynamics, there are a few key actions that certain stakeholders are in a good position to execute in order to foster continued solar industry employment growth.

Recommendations for Policymakers

Support strong, transparent, and stable demand-side policies

As is commonly understood in the solar industry – and was reflected in results from over 900 survey respondents in *Census 2012* – a major driver of solar's success and employment growth can be attributed to strong and consistent federal and state policy support. Results from last year's *Census* showed that employers felt that state-level policies such as renewable portfolio standards and authorization of third-party system ownership, as well as federal consumer tax incentives for solar investment to be two of the top three drivers of industry and employment growth. Given the importance of such policies to the industry, it is not unreasonable to expect that demand-side incentives will continue to have a strong, positive impact on job creation and competitiveness. However, such incentives will have little impact if they are only short-term in nature. Supporting economic growth and new investment requires a long-term commitment to incentives and policies that attract and drive development.

Invest in solar workforce development

Previous *Census* reports found the majority of employers have some trouble finding qualified applicants to fill their positions. Lack of technical experience is most often to blame for these difficulties, followed by deficiencies in communication, problem solving and analytical skills, and education. These results are not surprising given reports of a continued lack of professionals with sufficient training in various regions across the U.S., particularly in the face of reduced public funding for workforce development.

While solar energy creates jobs across a wide variety of occupations and technologies and benefits families in all 50 states, the majority of these jobs are for highly-skilled and highly-trained workers. Although some entry-level jobs exist, the solar industry should not be viewed as a quick “pathway out of poverty”, and expectations in creating job opportunities for lower-skilled workers must be reasonably managed. As our data show, just over 50% of solar jobs require workers with previous experience, over one in four requires at least a bachelor’s degree, and just over 13% require an associate’s degree or other certification from an accredited college. Given this, programs that stand to make the greatest impact on solar workforce development are: (1) those that provide high-skilled workers with new or updated skills or experience, and; (2) comprehensive entry-level programs (typically offered through technical high schools, community-based organizations, and community colleges) that prepare lower-skilled workers to move into more highly-skilled occupations. While policymakers have generally done well in supporting policies promoting investment in solar energy capital assets, they have been less consistent in their commitment to human capital investments.

Recommendations for Workforce Training Providers

Know the market

In order to be effective, workforce training programs must have a solid understanding of the labor force they seek to serve, which includes recognizing the gap between the skills trainees already possess and those they need to be marketable to employers, as well as understanding the available opportunities for advancement and how these pathways should be navigated. Of equal importance is understanding local labor demand. Connecting with local employers, understanding their labor needs, and providing training according to these needs are vital components of a successful workforce training program.

Furthermore, many markets are starting to trend toward quality solar workforce training, backed by credentials involving defensible, balanced, and transparent assessments according to well-developed sets of criteria, requirements, and standards. Nevertheless, some establishments will likely continue to prefer training new employees in-house.

Train for the highest growth occupations, integrate solar into existing trade and professional programs, and focus on skill transferability

New solar positions added in 2013 required a diverse range of skill sets. As in 2012, production and technician positions represented the largest occupational category of new solar jobs. However, *Census 2013* found that a larger number of new solar workers fell into this category than in 2012 (55.4% of new solar workers in 2013 vs. 40.7% in the previous year). Sales positions were the second largest category of new jobs (12.1%), followed by management and professional jobs (12.0%), administrative positions (10.3%), and other jobs (10.2%). Workforce development professionals can draw on these results when deciding which professional areas deserve the greatest focus in training programs.

Additionally, program designers should look for ways to integrate solar curricula into more traditional or mainstream coursework. By cultivating a workforce with a set of solar skills that enhance a more broadly applicable set of core trade (e.g., roofing or electrical) or professional (e.g., legal or finance) skills, rather than creating solar-only workers, training providers will help ensure that program graduates are diverse enough to be successful, despite fluctuations in demand for some of their skills. For example, a roofer trained in solar can remain gainfully employed during a lull in the housing market by focusing on solar, while still able to transition back to their primary skill set when demand picks back up.

And finally, a greater emphasis should be placed on understanding and developing skill transfer programs designed to facilitate worker transitions into solar. Our finding regarding veteran employment in solar provides an illustration of this need. As a percentage of workers, veterans are more strongly represented in the solar workforce than in the total employed U.S. population. This strong representation may be driven in part by a high degree of skill transferability between military occupations and solar jobs, which has been supported anecdotally in preliminary interviews that The Solar Foundation® has conducted with select solar employers. Despite this potential skills overlap, some groups of veterans – especially those in the 18 to 24 year age group – continue to grapple with extremely high unemployment. Given this, we feel a deeper understanding of skills developed in military occupations and which of these translate well into the various types of solar positions can help these former service members transition into jobs in the solar industry. The Solar Foundation®, in partnership with the Truman National Security Project, plans to make this research effort, and the subsequent development of a standardized skill translation protocol, a major focus in 2014.

Recommendations for Employers

Support high-quality training

Not only is there a direct connection between installed capacity and number of solar jobs, but there is also a direct connection between training and quality. Shoddy workmanship often results in high call-back frequency, which can narrow profit margins for companies. The workforce training programs that have supported the solar industry thus far (some high-quality, some not) have primarily been sustained through public funding. These funds, however, have been largely exhausted, and new monies are unlikely to be forthcoming. Moving forward, it will be very likely up to the private sector to pay for any and all workforce training, but, in order to maintain consumer confidence, the training should be designed in accordance with the highest standards.

Support education and advocacy organizations

By virtue of not being associated with any one company, solar education and advocacy organizations (usually nonprofit) are able to provide policymakers and the general public with more objective information on the industry. By providing third-party insight into market trends and serving as an impartial messenger of the industry's successes, these entities provide significant benefits to all solar companies and the individuals these firms employ.

If you find this *Census* to be useful, please don't hesitate to make a tax-deductible donation to The Solar Foundation®. Each donation, no matter the size, helps us provide credible research that deepens our understanding of the industry and drives the market.

More information at www.TheSolarFoundation.org

5. Appendices

5.1 Data Sources

EMSI Data Sources and Calculations

Industry Data

In order to capture a complete picture of industry employment, EMSI basically combines covered employment data from Quarterly Census of Employment and Wages (QCEW) produced by the Department of Labor with total employment data in Regional Economic Information System (REIS) published by the Bureau of Economic Analysis (BEA), augmented with County Business Patterns (CBP) and Nonemployer Statistics (NES) published by the U.S. Census Bureau. Projections are based on the latest available EMSI industry data, 15-year past local trends in each industry, growth rates in statewide and (where available) sub-state area industry projections published by individual state agencies, and (in part) growth rates in national projections from the Bureau of Labor Statistics.

State Data Sources

This report uses state data from the following agencies: Alabama Department of Industrial Relations; Alaska Department of Labor and Workforce Development; Arizona Department of Commerce, Research Administration; Arkansas Department of Workforce Services; California Labor Market Information Department; Colorado Department of Labor and Employment; Connecticut did not provide us with a data source; Delaware Office of Occupational and Labor Market Information, Delaware Wages 2004; District of Columbia did not provide us with a data source; Florida Agency for Workforce Innovation; Georgia Department of Labor, Workforce Information and Analysis, Occupational Information Services Unit; Hawaii Department of Labor and Industrial Relations, Research and Statistics Office; Idaho Department of Labor; Illinois Department of Employment Security, Employment Projections; Indiana Department of Workforce Development; Iowa Workforce Development; Kansas Department of Labor, Labor Market Information Services, Kansas Wage Survey; Kentucky Office of Employment and Training; Louisiana Department of Labor; Maine did not provide us with a data source; Maryland Department of Labor, Licensing and Regulation, Office of Labor Market Analysis and Information; Massachusetts did not provide us with a data source; Michigan Department of Labor and Economic Growth, Bureau of Labor Market Information and Strategic Initiatives; Minnesota Department of Employment and Economic Development; Mississippi Department of Employment Security; Missouri Department of Economic Development; Montana Department of Labor and Industry, Research and Analysis Bureau; Nebraska Workforce Development; Nevada Department of Employment, Training and Rehabilitation, Information Development and Processing Division, Research and Analysis Bureau; New Hampshire Department of Employment Security; New Jersey Department of Labor and Workforce Development; New Mexico Department of Labor, Bureau of Economic Research and Analysis; New York Department of Labor, Division of Research and Statistics; North Carolina Employment Security Commission, Labor Market Information Division; North Dakota Job Service, Labor Market Information Center; Ohio Department of Job and Family

Services, Labor Market Information Division; Oklahoma Employment Security Commission; Oregon Employment Department, Oregon Labor Market Information System; Pennsylvania Department of Labor and Industry, Center for Workforce Information and Analysis; Rhode Island did not provide us with a data source; South Carolina Employment Security Commission, Labor Market Information Department; South Dakota Department of Labor, Labor Market Information Division; Tennessee Department of Labor and Workforce Development, Research and Statistics Division; Texas Workforce Commission; Utah Department of Workforce Services; Vermont did not provide us with a data source; Virginia Employment Commission, Economic Information Services; Washington State Employment Security Department, Labor Market and Economic Analysis Branch; West Virginia Bureau of Employment Programs, Research Information & Analysis Division; Wisconsin Department of Workforce Development, Bureau of Workforce Information; Wyoming Department of Employment, Research and Planning.

Input-Output Data

The input-output model in this report is EMSI's gravitational flows multi-regional social account matrix model (MR-SAM). It is based on data from the Census Bureau's Current Population Survey and American Community Survey; as well as the Bureau of Economic Analysis' National Income and Product Accounts, Input-Output Make and Use Tables, and Gross State Product data. In addition, several EMSI in-house data sets are used, as well as data from Oak Ridge National Labs on the cost of transportation between counties.

This report uses data release EMSI Complete Employment 2013.4

5.2 Data Limitations and Methodology

The *National Solar Jobs Census* methodology is the most closely aligned with the Bureau of Labor Statistics' methodology for its Quarterly Census of Employment and Wages (QCEW) and Current Employment Statistics (CES). Like BLS, this study uses survey questionnaires and employer-reported data, though ours are administered by phone and email, as opposed to mail.

Also like BLS, we develop a hierarchy of various categories that represent solar value chain activities (within their broader NAICS framework), develop representative sample frames, and use statistical analysis and extrapolation in a very similar manner to BLS. We also constrain our universe of establishments by relying on the most recent data from the BLS or the state departments of labor, depending on which is collected most recently. We believe that the categories that we have developed could be readily adopted by BLS should it choose to begin to quantify solar employment in its QCEW and CES series.

The survey was administered to a known universe of solar employers that includes 14,172 establishments and is derived from SEIA's *National Solar Database* as well as other public and private sources. Of these establishments, 2,839 provided information about their solar activities (or lack thereof), and 1,286 completed full or substantially completed surveys.

The survey was also administered to a stratified, clustered, random sampling from various industries that are potentially solar-related that include a total of 248,205 establishments nationwide. After an extensive cleaning and de-duplication process, a sampling plan was developed that gathered information on the level of solar activity (including none) from 18,943 establishments. Of these, 862 establishments qualified for and completed full surveys. This level of sampling rigor provides a margin of error for establishment counts at +/-0.72% and employment at +/-1.3% at a 95% confidence interval.

The indirect and induced job figures were gathered using averaged figures from EMSI's input output model (see Data Sources, above). The industries selected for installation were electrical contractors and power and communication line construction; for manufacturers, semiconductor equipment manufacturing and other electronic and electrical assembly; for sales and distribution, wholesale trade of electronic appliances and wholesale trade of heating and hot water apparatus; and for project development, heavy civil construction and engineering and power and communication line construction.

The following three-phased methodology describes the survey process used to gather employer information from both self-identified or known solar employers, those establishments that are connected to solar industry associations and can be found on solar employer databases, and unknown solar employers that are found in industry classifications that are more likely to have solar employers. This methodology describes the process that was followed for all of the solar employer surveys except for those completed by utilities in earlier editions of the *Census*.

Phase 1: Develop, classify and analyze a database of self-identified or known solar employers.

The first phase created a comprehensive database of all known or self-identified solar employers across the country. This database was developed by SEIA and its partners. The comprehensive database was developed from all of the partners' contact information of employers. Duplicates were identified and removed following a stringent evaluation of firm phone numbers, locations, and firm names.

The database of employers did not include variables that consistently identified which sector (manufacturing, installation, sales and distribution, project development, ...) each employer was involved in, the size of the employer, or whether the employer had a single location or represented multiple locations.

Phase 2: Survey of self-identified or known solar employers.

The second phase of the survey research was a census, using online and telephone surveys of all solar employers from the database developed in phase one. Employers were asked which sector they were involved in (installation, manufacturing, wholesale trade, research & development and other) and based on their response they were forwarded to the appropriate survey instrument. All employers in the database with email information were sent multiple online invitations and for those that did not complete an online survey, they were called up to three times. The employers without email information were called up to five times and asked to participate in the survey by completing a brief phone survey. These results represent the solar employer community that is connected to regional and national solar trade associations.

It is important to note that surveys were completed for each employment location and not necessarily for each firm. So if a solar employer was asked to participate in a survey, s/he would be asked about the employment profile of a given location and not of the entire firm.

Margin of error: Survey of self-identified or known solar employers.

The overall margin of error for the known universe of the solar employer survey, at the 95% level of confidence, is between +/- 1.74% and +/- 3.5% (depending on the distribution of each question) for questions answered by all 2,098 employers from the universe of 6,132 solar employment locations estimated in the known universe. This also represents a response rate of 10-33% from the database of known solar employers, which includes employers in manufacturing, installation, sales and distribution, project development, and other related solar industries.

It is important to note that questions asked of smaller sub-groups of respondents will have a margin of error greater than +/- 3.5%, with the exact margin of error dependent on the number of respondents within each sub-group as well as the distribution of responses.

Phase 3: A random sampling of employers in industry classifications that are most likely to have unknown solar employers.

The final phase of the survey research was a sampling of employers in specific industries within wholesale trade, manufacturing, and the construction (installation) industries. The survey was completed over the phone and the sample was stratified by industry, region, and firm size (4 or

fewer employees or 5 or more employees). These results represent the solar employers that make up the wholesale trade, manufacturing, and construction industry employers within the industry classifications noted below.

It is important to note that the percentage of overlap between the known and unknown universe of solar employers was calculated based on a thorough search of the known firm database to the unknown universe file or establishments that indicated they had already completed a similar survey. The resulting calculation of overlapping establishments was taken out of the total estimate of establishments in the unknown universe of solar employers.

Wholesale trade: Provides the cleanest opportunity to interview establishments that were not in the known universe list because there are two NAICS (North American Industry Classification System) codes that are very specific to solar distributors/ wholesalers:

42372031 – Solar energy system supplier, and parts wholesaler;

42372032 - Solar energy equipment wholesaler.

According to Dun & Bradstreet, there are 2,111 establishments that indicated one of these two wholesale trade designations as their primary industry classification. All establishments that identified one of these two NAICS codes as their primary were called and asked whether they were in the solar industry and if they would participate in the survey.

Manufacturing: Industry classifications for manufacturing related to solar were not as specifically identified with solar work. Three NAICS codes were identified with the highest expected concentration of establishments that manufacture solar products and components. These NAICS codes were:

333611 – Turbine and turbine generator set unit manufacturing;

334413 – Semiconductor and related device manufacturing;

334414 – Manufacturing of Heating Equipment;

335911 – Storage battery manufacturing.

According to InfoUSA, there are 3,473 establishments that indicated one of these three manufacturing designations as their primary industry classification. All establishments that were identified in one of these three NAICS codes as their primary industry classification were called and asked whether they were in the solar industry and if they would participate in the survey.

Construction: Industry classifications for the construction industry related to solar were not specifically identified with solar work. Five NAICS codes were identified with the highest expected concentration of establishments that provide solar installation services. These NAICS codes were:

236118 Residential remodelers;

238160	Roofing contractors;
238210	Electrical contractors;
238220	Plumbing & HVAC contractors;
238990	All other specialty trade contractors.

According to InfoUSA, there are 332,005 establishments that indicated one of these five construction designations as their primary industry classification. A total of 10,000 establishments stratified by employer size and region within the country were called and asked whether they were in the solar industry and if they would participate in the survey.

Margin of Error: Survey of unknown solar employers in specific industries.

The overall margin of error for the unknown or random universe of solar employer in wholesale trade, manufacturing, and the construction industry, at the 95% level of confidence, is between +/- 0.76% and +/- 1.3% (depending on the distribution of each question) for questions answered by all employers that completed a survey or passed a screener question from the universe of all potential solar employment locations estimated of unknown employers in sales and distribution , manufacturing and construction.

Full survey completions were achieved from a total of 2,081 establishments in the known and unknown. An additional 12,205 responses from the unknown universe were used to calculate incidence rates. The overall margin of error, in consideration of all full survey completions and partial completions from the random sample is +/- 0.72% at a 95% confidence interval.

It is of further importance to note that the figures provided in this report are estimates based on surveys administered only to employers in installation, manufacturing, sales and distribution, project development and "other" establishments in research and development, legal services, finance and accounting, academia, government agencies, nonprofit organizations, and other ancillary employers that do solar work. Data for the "other" category do not capture all jobs or establishments in the category. Although some "other" establishments are included in the Known Universe (see section 5.2, "Data Limitations and Methodology"), accounting, legal, finance, and other ancillary establishments spend only a very small portion of their time on solar activities. Thus, full inclusion would lead to inflated employment counts.

5.3 Frequently Asked Questions

1. Are these "Direct Jobs" only?

Direct, indirect, and induced are terms intended to explain the various levels of economic activity that result from changes to an economy. These figures, generated by economic modeling exercises, are best applied to specific projects rather than entire industries. For example, a utility scale solar project would have a certain number of people working on the construction of the plant (direct), the workers who manufacture and deliver the goods (indirect), and support the local economy by increasing the spending on goods and services, such as restaurants, gas stations, and retail establishments (induced). *Census* data includes most of the direct and indirect jobs in the solar industry, with the exception of some indirect jobs in the component and materials supply chain. Those jobs, combined with induced impacts of the industry support an additional 435,000 jobs.

2. How does your methodology compare with the Bureau of Labor Statistics?

The *National Solar Jobs Census* methodology is the most closely aligned with the Bureau of Labor Statistics' methodology for its Quarterly Census of Employment and Wages (QCEW) and Current Employment Statistics (CES). Like BLS, this study uses survey questionnaires and employer-reported data, though ours are administered by phone and email, as opposed to mail.

Also like BLS, we develop a hierarchy of various categories that represent solar value chain activities (within their broader NAICS framework), develop representative sample frames, and use statistical analysis and extrapolation in a very similar manner to BLS. We also constrain our universe of establishments by relying on the most recent data from the BLS or the state departments of labor, depending on which is collected most recently. We believe that the categories that we have developed could be readily adopted by BLS should it choose to begin to quantify solar employment in its QCEW and CES series.

3. How is a solar worker defined?

A "solar worker" is defined as those workers who spend at least 50% of their time supporting solar-related activities. This definition helps to avoid the over-counting that is inherent in methods that count every single job in terms of FTEs or job hours. For example, although the Bureau of Labor Statistics (BLS) does not yet quantify solar jobs, they count other types of occupations by counting every single job separately regardless of hours or fraction of time actually spent on the job. As a result, according to the BLS, someone with three part-time jobs yields three jobs. Although the BLS and others consider our methodology to be the emerging standard for tracking jobs they do not yet track, critics of our methodology claim a 50% definition causes jobs to be over counted. However, the reality is that over 90% of those who meet our definition of a solar worker in 2013 actually spend 100% of their time supporting solar-related activities. Because the *Census* covers sectors directly related to new installed solar capacity and the sectors that support these efforts, jobs figures are best thought of as covering direct and indirect jobs.

4. Why doesn't the *Census* break-out the industry by technology?

Because so many establishments work across multiple technologies (PV, CSP, and solar water heating), it is impossible to provide reliable estimates of the number of employees working with a single technology. We do, however, provide figures on the number and relative percentage of solar establishments by technology. However, these figures reflect this technology overlap and are therefore not useful for ascribing employment to a single technology. BW Research estimates that 85% of installation firms and 80% of manufacturing establishments work exclusively with PV (and approximately 84% overall).

5. What methodology is used for the *Census*?

Each installment of the *National Solar Jobs Census* series applies the following three-phase methodology.

Phase I involved the development, classification, and analysis of a national database of self-identified solar employers. The Solar Foundation® and BW Research Partnership worked with national solar industry associations and other industry partners to develop this database from our partners' existing lists of employer contact information.

Phase II was the census phase, in which we conducted web-based and telephone surveys of the employers in our database. Employers were asked to identify which industry sector label (installation, manufacturing, sales and distribution, project development, and "other") best described their business and how many solar workers they employed.

Phase III focused on random sampling of employers in industry classifications that are most likely to have unknown solar employers. These employers were surveyed by telephone to determine if they employed solar workers, along with how many and in which sector. Final figures for this "unknown universe" were adjusted for overlap with known employers. Finally, raw data from both the known and unknown universe were used to extrapolate final national numbers. The focus of *Census 2011* and *2012* was on conducting additional sampling in both the known and unknown universes. Additional data were collected for the known universe and new rounds of random sampling of the unknown universe were conducted on a national basis to determine growth and contraction of solar establishments over the previous year.

In 2013, 73,796 telephone calls were made and over 11,000 emails were sent to potential solar firms across the United States. This mixed approach, which the Bureau of Labor Statistics recognizes as the emerging standard, allows us to accurately update previous years' efforts and draw broad conclusions about the solar industry with a high degree of confidence. The 2013 report, derived from data collected from more than 2,081 solar firms, measured employment growth in the solar industry between September 2012 and November 2013. The margin of error of this data set is +/-1.3%, significantly lower than any similar national industry study.

6. How does the *Census* methodology compare with other jobs studies?

The methods employed in the *National Solar Jobs Census* differ significantly from those used to produce other jobs studies. The fundamental methodological difference between the *Census* and the Bureau of Labor Statistics (BLS) report on *Green Goods and Services* is that organization's over-reliance on industry or occupational codes to identify solar employers. Currently, unique code identifiers do not exist for the full spectrum of clean energy jobs in the U.S., making it difficult for BLS to fully quantify workers in these industries. Further complicating matters, some solar installers work as trained electricians or roofers some of the time, who also install solar panels as part of their work. Currently, BLS has no means by which to count these misclassified or "some time" solar workers. Similar issues exist with quantifying workers in manufacturing, sales, and research and development. Finally, recent green studies by BLS focus on revenue. This is problematic because revenues for green goods often have wildly different labor intensities, and the assumption that revenue allocations are the same as labor allocations is inherently flawed.

Though similar to the *Census* in some ways, we view the Brookings Institution's *Sizing the Green Economy* report as applying a less comprehensive methodology than our own. While both studies used databases of known solar employers as the basis for their analysis, the *Census* goes one step further, conducting random sampling of the unknown universe (businesses likely to have unknown or unclassified solar workers). In addition, Brookings relies on overall employment estimates from Dun and Bradstreet, which is imprecise. In the case of the Brookings solar numbers, we believe they underestimated solar jobs by 300-400%.

7. How has the *Census* been used?

The topline figure from *Census 2012* (that the U.S. solar industry employs nearly 120,000 solar workers) has been extensively cited by lawmakers, the solar industry, the U.S. Department of Energy and the national labs, and national media outlets. *Census 2010* won the Interstate Renewable Energy Council's (IREC) Innovation Award and our previous *Census* reports have been the subject of hundreds of media citations and dozens of in-depth articles from high profile media outlets including CNN, Forbes, Bloomberg, NPR, LA Times, NY Times, and US News and World Report.

8. What is the minimum education necessary to enter the solar job field?

While there exist entry-level positions for individuals interested in entering certain solar job fields there is not always an immediate pathway into these jobs. Of the employers who participated in *Census 2013*, 50% indicated that they look for previous related experience in the solar workers they hire. In addition, 13% noted they require at least an associate's degree or certificate from an accredited college and 28% seek workers with a bachelor's degree or beyond. Those interested in beginning a career in the solar industry can learn more about the education, experience, and skills required for these jobs by visiting the U.S. Department of Energy's [Solar Career Map](http://www1.eere.energy.gov/solar/careermap) at <http://www1.eere.energy.gov/solar/careermap>.

9. What is the prognosis for the solar workforce in 2014? What does the data from the *National Solar Jobs Census* tell us about where the solar industry headed?

Over the next 12 months, nearly half (44.5%) of solar employers expect to add new jobs, while fewer than 2% anticipate losing workers. *Census 2013* estimates that overall solar employment will increase by 15.6% during this period, a figure which represents the addition of over 22,000 solar workers. The installation sector is expected to lead this growth with a 21% projected growth rate, followed by “other” jobs and sales and distribution firms (16.1% and 14.2% growth, respectively), manufacturing (8.6%), and project development (3.0%). Although in years prior employers tended to overestimate their growth projections, 2013 marked the first time employers not only met, but exceeded the growth projections in the previous year’s *Census*.

10. How does the *Census* calculate growth figures?

Growth figures and projections are based on our definition of a “solar worker” (see Question 3). These numbers increase or decrease based on changes in the number of solar companies, changes in new positions at these firms, and existing workers starting/ceasing to perform tasks that support solar. For example, a roofing company may employ ten workers, two of whom are “solar workers”. In the following year, solar-related work increases, but demand for general roofing work falls. As a result, the company still employs ten workers, but now four of them work on solar. While total employment has stayed flat, two workers have been repurposed to support solar, giving the company two new “solar workers” for that year.

11. What are the primary drivers of growth for solar businesses?

According to our survey results from *Census 2012*, the most oft-cited reason for continued growth has been the steady decline in component prices, with nearly one-in-three (31%) of respondents selecting this as their response. Other leading drivers of growth were: the passage of state legislation mandating the development of renewable portfolio standards or allowing third-party ownership (17%); federal tax incentives (16%), and; greater consumer awareness of solar products and services (13%). While this question was not asked in *Census 2013*, employers were asked to provide their perspective on the most typical reasons customers cite for installing solar energy systems. Saving money was found to be the biggest reason that consumers adopt solar, followed by solar becoming more cost competitive with utilities.

6. State Solar Employment

Due to the immense investment of time and funding required to do so accurately with a survey-based methodology, the *Census* report series does not directly provide estimates of solar employment in each of the 50 states. In early 2013, The Solar Foundation® published its first-ever *State Solar Jobs Map* (www.solarstates.org), an interactive, web-based tool presenting the most credible estimates of state-level jobs currently known. These figures were internally generated by The Solar Foundation® with technical assistance from the Solar Energy Industries Association's Research Department using thousands of data points from a combination of high-quality sources, including survey results from *National Solar Jobs Census 2012* and the Solar Energy Industries Association's "National Solar Database".

These state employment figures were produced using a carefully developed dual methodology – one for installation and construction jobs and another for distributed generation and non-installation jobs. In brief, method one employed 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 each state. The final state totals provided are the rounded average of our high and low estimates.

We anticipate revising these state-level employment estimates to incorporate data from *Census 2013* and reflect an updated and expanded "National Solar Database". **These updated figures will be made available through the *State Solar Jobs Map* website (www.solarstates.org) as part of our state employment releases on February 11th, 2014. Another key part of this state-level release on February 11th will be the publication of three new state-specific *Census* reports, which will provide solar employment numbers at the district level in California, Arizona, and Minnesota using the rigorous survey-based *Census* methodology.**

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