

OCTOBER 2011

# National Solar Jobs Census 2011



A Review of the U.S. Solar Workforce



Cornell University  
ILR School



## ***Acknowledgements:***

The Solar Foundation™ and BW Research Partnership wish to thank all industry survey respondents. Your assistance was critical in providing us with accurate and timely information. The Solar Foundation™ would also like to acknowledge the following institutions for their assistance in bringing this project to fruition:

**Cornell University's New York State School of Industrial and Labor Relations**

**California Community Colleges Centers of Excellence**

**Interstate Renewable Energy Council**

**Energy Foundation**

**Solar Electric Power Association®**

**Solar Energy Industries Association®**

For questions or comments about this report, please contact either:

Andrea Luecke, Executive Director  
The Solar Foundation™  
575 7th Street, NW - Suite 400  
Washington, DC 20004  
202-469-3750  
info@solarfound.org  
www.TheSolarFoundation.org

or

Philip Jordan, Chief Business Officer and President, Green LMI Division  
BW Research Partnership, Inc.  
50 Mill Pond Dr.  
Wrentham, MA 02093  
617-395-8898  
pjordan@bwresearch.com  
http://BWResearch.com

Please cite this publication when referencing this material: "National Solar Jobs Census 2011, The Solar Foundation (Oct. 2011), available at <http://thesolarfoundation.org/research/national-solar-jobs-census-2011>." Photos courtesy of H&H Energy Services, Convergence Energy, Oregon DOT, and Duke Energy.

## ***Table of Contents***

|                                                    |              |
|----------------------------------------------------|--------------|
| <b>1. Executive Summary.....</b>                   | <b>p. 4</b>  |
| <b>2. Introduction .....</b>                       | <b>p. 7</b>  |
| <b>3. Labor Market Analysis: Primary Data.....</b> | <b>p. 11</b> |
| 3.1 Installation.....                              | p. 14        |
| 3.2 Manufacturing .....                            | p. 25        |
| 3.3 Sales And Distribution .....                   | p. 35        |
| 3.4 Utilities .....                                | p. 42        |
| 3.5 Other.....                                     | p. 49        |
| <b>4. Conclusion .....</b>                         | <b>p. 52</b> |
| <b>5. Appendices .....</b>                         | <b>p. 55</b> |
| 5.1 Methodology and Limitations.....               | p. 55        |
| 5.2 Data Sources .....                             | p. 59        |
| 5.3 State Data .....                               | p. 61        |

## 1. *Executive Summary*

The *National Solar Jobs Census 2011* updates last year's census of employment and annual projected growth in the United States solar industry with new data from a statistically valid sampling of employers throughout the nation. The rapid pace of change in the industry has warranted annual updates that examine the size and scope of the industry.

The Solar Foundation™, a 501(c)(3) nonprofit, non-lobbying organization promoting solar through research and education, recognized this gap and worked with BW Research Partnership's Green LMI Division, Cornell University, and others to bring this important information to the foreground. This report represents an unprecedented effort to understand the solar industry's labor market conditions and potential for growth.

U.S. solar companies added jobs over the last 12 months at a pace much faster than the general economy and remain highly optimistic regarding their overall revenue growth in the near term. **Specifically, as of August 2011, the U.S. solar industry employs an estimated 100,237 solar workers**—defined as those workers who spend at least 50% of their time supporting solar-related activities—**up 6.8%** since August 2010. **Over the next 12 months, almost 50% of solar firms expect to add jobs while only 2.6% expect to cut workers.** This finding is especially relevant given that the overall expected 12-month growth rate for the entire U.S. economy is only about 1.4%.

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 August 2011:

- **There are 100,237 solar workers in the United States, up from 93,000 last year. This represents an overall growth rate of 6.8% over the past year, nearly 10 times higher than the national average employment growth rate of 0.7%**
- **Solar job growth over the next 12 months is anticipated to be almost 24%, representing approximately 24,000 additional new jobs. Nearly half of all solar firms expect to add solar employees over the next 12 months.**
- **Employers from all of the studied solar subsectors expect significant employment growth over the next 12 months.**
- **Nearly half of installation firms expect to be hiring in the next year, and these firms expect to add 13,068 jobs over the next year (25% growth rate).**

- **Almost 44% of manufacturing firms expect to add jobs over the next year, with 3,473 jobs expected to be created during that time (14% growth rate).**
- **More than 45% of sales and distribution firms expect to add jobs over the next year, creating 6,188 jobs (35% growth rate).**
- **A quarter of utility respondents surveyed in 2010 were expecting to hire additional renewable energy workers through 2012, with employment growth projections ranging from 10 to 19 percent.**

These findings clearly illustrate that the solar industry is a strong and growing cluster that is responsible for thousands of jobs across every state in the nation. The unprecedented growth of the industry is providing much needed job creation despite an historic economic and workforce downturn. The optimism of solar employers in the midst of these conditions suggests that job growth will continue for years to come.





### ***About The Solar Foundation***

The Solar Foundation is a national 501(c)(3) nonprofit working to demonstrate the global benefits of solar energy through research and education. Founded in 1977 and based in Washington, DC, The Solar Foundation is increasing the widespread adoption of solar energy and transforming the marketplace through coordinated public education and outreach efforts, high-level data collection, and innovative research.

The Solar Foundation's objective is to be on the front-lines, catalyzing solar markets, and helping people recognize the value of solar as a clean, renewable energy source that promotes greater use of domestic energy resources. The Solar Foundation believes that solar energy is a key part of our energy future and is unique even among other renewable energies as a source of wealth creation for individuals, communities, homeowners, and entrepreneurs in all 50 states and across the world.

For over 30 years, The Solar Foundation has worked to promote and expand the use of solar energy as a clean, sustainable, and secure way to meet global energy demand. The Solar Foundation has a proven track record of producing high-impact policy studies that have not only helped to directly advance the use of solar energy in the U.S., but have also provided valuable lessons for other emerging solar markets worldwide.

### ***About BW Research Partnership***

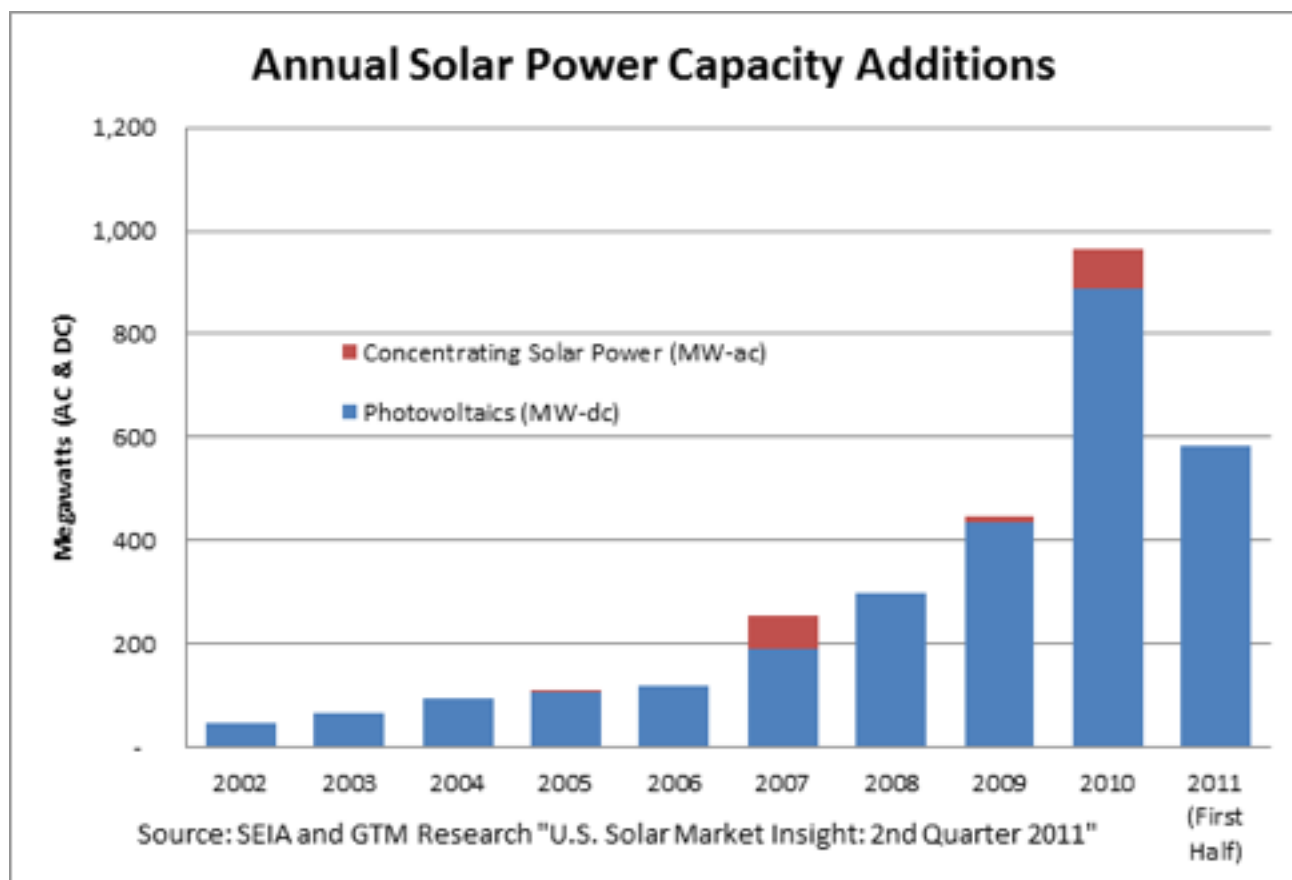
BW Research Partnership, Inc. was created out of a belief that the highest quality research products and consulting services to corporations, government agencies, educational institutions, and non-profit agencies are a result of: 1) A research process that is focused on providing the most reliable results using the most effective methodologies; 2) Creating a partnership of professionals, not employees, who have a vested interest in the quality of our products and services; 3) A commitment to research that builds communities, supports workers and consumers, and provides a clear direction for decision makers.

Through its Green LMI Division, 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 results.

## 2. Introduction

The solar industry is a strong and growing segment of our national economy. The industry has experienced rapid growth over the last decade, and thanks to increased incentives, price and cost declines, consumer awareness, cultural shifts, and positive policies, this growth has only accelerated in recent years.

**Figure 1: Annual Solar Capacity Additions**

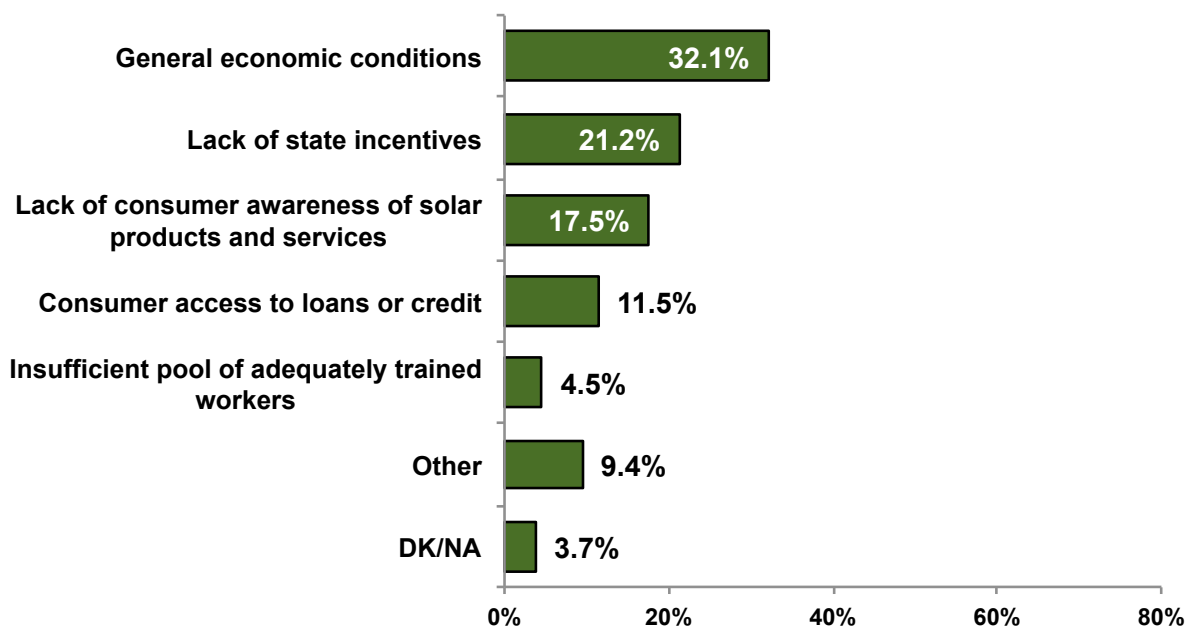


The impact of this growth on the labor market has been significant. Companies that design, manufacture, sell, install, and maintain solar systems have emerged in all regions of the United States, providing tens of thousands of jobs throughout the country. These employment opportunities span numerous industries and occupational titles, from skilled laborers to customer service and sales representatives.

Yet this impressive growth has not been without setbacks; stalled legislative initiatives such as the PACE (Property Assessed Clean Energy) program and decreased funding for state-level consumer incentives led to slower-than-expected job growth in 2010.

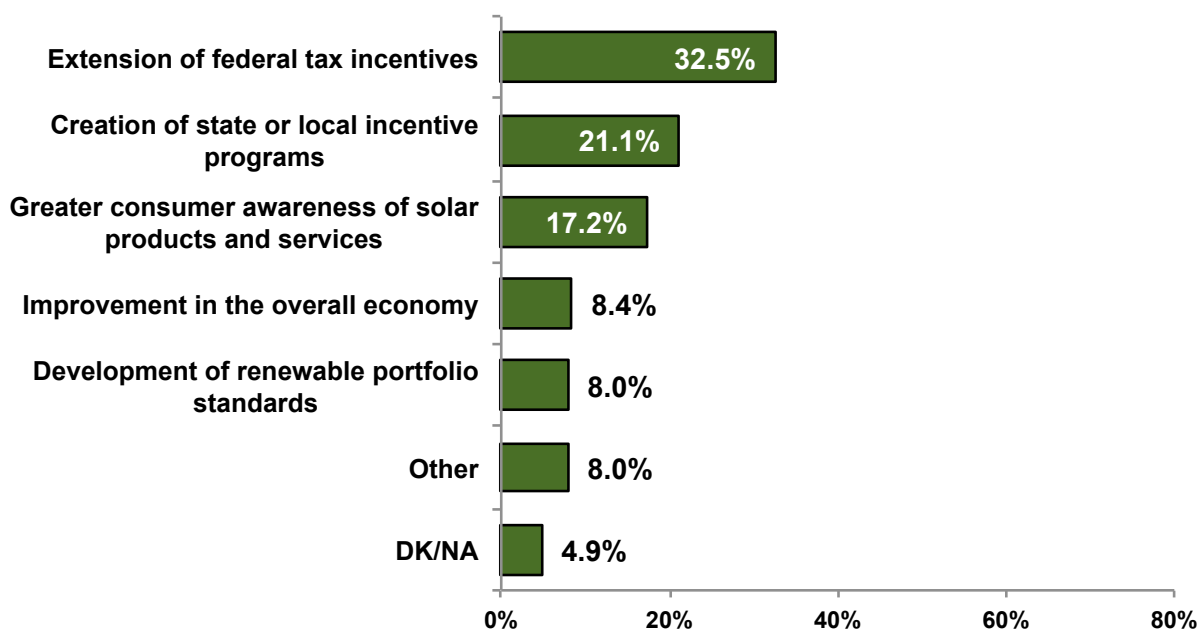
Employers reported several major obstacles to growth, including general economic conditions, lack of state incentives, and lack of consumer awareness, among others (Figure 2).

**Figure 2: Barriers to Growth**



Employers reinforced the importance of these barriers when asked to identify the positive factors related to their growth between August 2010-2011 (Figure 3).

**Figure 3: Positive Factors for Growth**





This report is an update of The Solar Foundation's™ 2010 comprehensive analysis of U.S. solar labor market conditions. The research findings provide stakeholders with fresh and credible information to understand the annual changes to the solar industry's labor market and its potential for further growth. The report includes information about all types of companies engaged in the production, sale, installation, and use of all solar technologies, ranging from photovoltaics to concentrating solar power to solar thermal systems for the residential, commercial, and utility sectors.

Unlike economic impact models that generate employment estimates based on revenue and other economic data and rely on jobs-per-dollar (or jobs-per-megawatt) assumptions, this report provides statistically valid and current data gathered directly from employers. The primary data contained in this report are drawn from a mixed-method survey using direct contact with individuals. Information was collected in July and August 2011<sup>1</sup> from a measure of so-called "known universe" firms, which includes firms from industry and government databases, and a random sampling of businesses within various construction, sales and distribution, and manufacturing industries, as well as an over-sampling of states which had larger employment counts in 2010 to provide a more complete state assessment.

This method allows us to accurately update last year's effort and draw broad conclusions about the solar industry with a high degree of confidence. The figures included in this report are conservative estimates, meaning that there may well be more solar workers than reported herein. (There are limits to this approach, however: because the research findings are based on survey responses, the employment estimates herein represent only solar employers' best estimates of how many jobs they will add over the coming year. As seen in the 2010 census, actual growth may vary.).



<sup>1</sup> California known employers were surveyed in April 2011 as part of Center of Excellence research.

Unlike some other sectors, the United States government does not yet quantify solar employment. The lack of information has presented difficulties to policymakers and training providers. As a result, the Bureau of Labor Statistics (BLS) has commenced data collection on one solar occupation, Solar Photovoltaic Installers, and may continue their efforts for other solar occupations in the future.

The Solar Foundation's Census 2011 highlights some of the difficulties with categorizing solar workers into the neatly organized BLS frameworks. For example, many of the solar employers surveyed for this project report that their installers are electricians who work on both solar and non-solar projects. It is therefore difficult for employers to classify such workers when given an either/or choice of electrician or solar installer. This level of nuance is significantly easier to capture in a targeted survey related directly and only to solar employment.

It is important to note that the estimates provided in this report are estimates based on survey findings with employers in manufacturing, sales and distribution, and installation, as well as utilities. The data do not capture the government, academic, or nonprofit sectors, nor many of the research and development firms, finance and accounting establishments, law offices, or other ancillary employers that do solar work. As a result, the firm and employment counts included in the Census represent a minimum baseline level of solar employment.

The National Solar Jobs Census 2011 has been conducted by The Solar Foundation™ and BW Research Partnership's Green LMI division. Cornell University provided technical assistance in reviewing and validating the entire process, from data collection through results analysis. With support from BW Research, Cornell University conducted the state-level baseline data analysis available in the Appendix (Section 5.3).

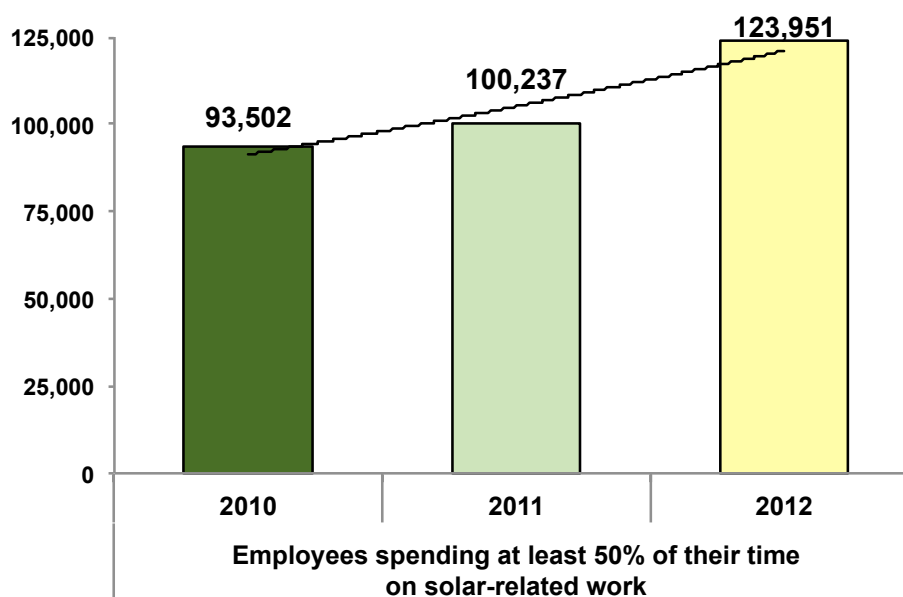


### 3. Labor Market Analysis: Primary Data

This section includes a 2011 labor market analysis of solar occupations and industries. In addition to a summary of solar employment in the United States, it presents primary data for installation, manufacturing, sales and distribution, utilities, and other fields. Primary data includes survey responses from solar employers throughout the country, drawn from a sample of known employers and a random sample of companies from relevant industries.<sup>2</sup> Based on a literature review and discussion with industry experts, the research team also selected specific occupations or job areas for more in-depth analysis.

Overall, the primary data—or information gathered by our survey of solar employers—indicate that there are currently 17,189 solar establishments<sup>3</sup> employing 100,237 solar workers. This represents an overall growth rate of 6.8% over the past year, nearly 10 times higher than the national average employment growth rate of 0.7%.<sup>4</sup> The number of these solar workers is expected to grow by almost 24%, or by approximately 24,000 new jobs, by 2012 ((Figure 4).

**Figure 4: 2010, 2011, and 2012 Expected U.S. Solar Jobs**



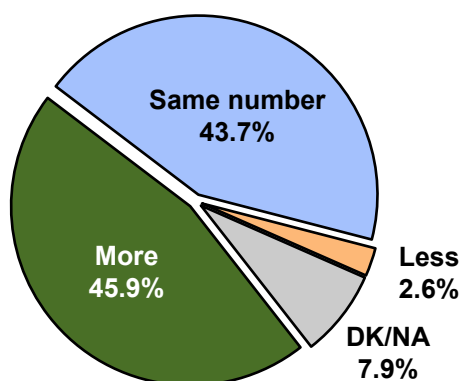
<sup>2</sup> The utility data is an exception; that data is collected biennially by The Solar Foundation, and the 2010 survey data used in this report include only utilities already known to have integrated solar technology. This report is augmented with data collected separately by the Solar Electric Power Association, which conducts surveys annually.

<sup>3</sup> The establishment figures provided in this Census refer to employment locations. Many companies report having several employment locations, all of which are captured in this report.

<sup>4</sup> Economic Modeling Specialists, Inc. Complete Employment 2011.3

As further evidence of solar employer optimism, 45.9% of surveyed firms expect to add solar employees over the next 12 months while only 2.6% expect to cut solar workers over the period (Figure 5).<sup>5</sup> These findings show an industry that is clearly growing much more rapidly than the economy as a whole, which is expected to experience employment growth of only 1.4% over the coming year.<sup>6</sup>

**Figure 5: 12-Month Hiring Expectations—All Solar Firms**



Employers were asked several preliminary questions to ensure that the sample included only firms that work in solar. The survey respondents were asked to select the appropriate subsector to which their firm belongs, choosing from installation, manufacturing, sales and distribution, or, for those that did not fit neatly into a category, “other,” such as research and development firms and project developers. Many firms reported that their work spanned several subsectors, illustrating the interconnected and interrelated nature of the solar industry and its workers. Although this makes it harder for researchers to categorize companies, it shows that solar firms are active in multiple traditional industry sectors and that growth in any given sector, such as utility energy production or manufacturing, is important to firms outside of those sectors as well. In other words, the U.S. solar industry has strength throughout the entire value chain of activities.

<sup>5</sup> This compares with 2010, when 55.8% of employers expected to add solar workers and 2.2% expected declines.

<sup>6</sup> *Id.*

Figure 6: Percentage of Respondents, by Subsector

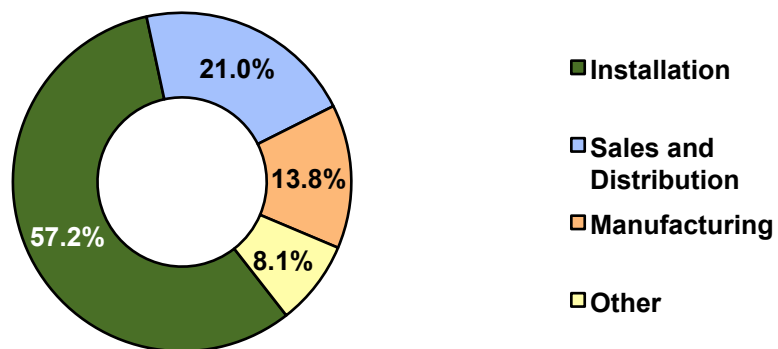


Table 1: Data by Subsector—Number of Solar Workers<sup>7</sup>

| <i>Subsector</i>          | <i>2010 Jobs</i> | <i>2011 Jobs</i> | <i>2012 Jobs</i> | <i>2011-2012<br/>Expected<br/>Growth</i> | <i>2011-2012<br/>Expected<br/>Growth Rate</i> |
|---------------------------|------------------|------------------|------------------|------------------------------------------|-----------------------------------------------|
| Installation              | 43,934           | 52,503           | 65,571           | 13,068                                   | 25%                                           |
| Manufacturing             | 24,916           | 24,064           | 27,537           | 3,473                                    | 14%                                           |
| Sales and<br>Distribution | 11,744           | 17,722           | 23,910           | 6,188                                    | 35%                                           |
| Other                     | 12,908           | 5,948            | 6,933            | 985                                      | 17%                                           |
| <b>Total</b>              | <b>93,502</b>    | <b>100,237</b>   | <b>123,951</b>   | <b>23,714</b>                            | <b>24%</b>                                    |

<sup>7</sup> In this section only, utility employment is included in “Other.”

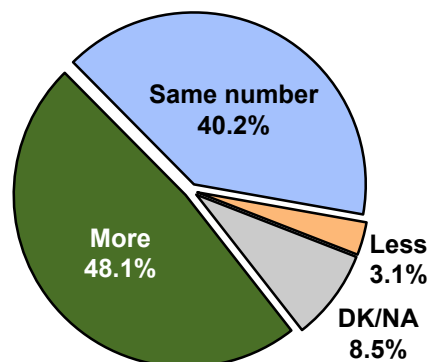
### 3.1 Installation

The 2011 research includes responses from hundreds of installation firms to update the employment figures for the current year. Based on the responses, this study finds 10,304 establishments deriving at least some of their revenue from the installation of solar goods and services. These companies employ 52,503 solar workers. By fine-tuning the methodology since the 2010 effort, this study finds that installers make up a greater percentage of the solar workforce (52.4% of all solar workers work at installation firms) and the sector grew by 5.6% since last year.



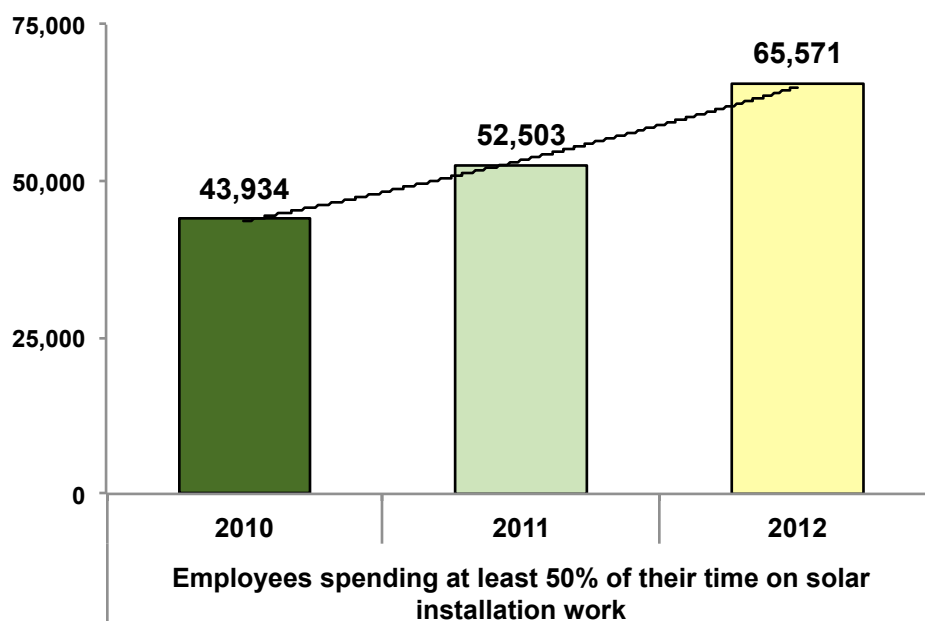
Solar installation firms expect to add 13,068 solar workers over the next 12 months, representing 25% growth, and nearly half of all employers expect to add solar workers (Figure 7).

**Figure 7: 12-Month Hiring Expectations—Installation Firms**



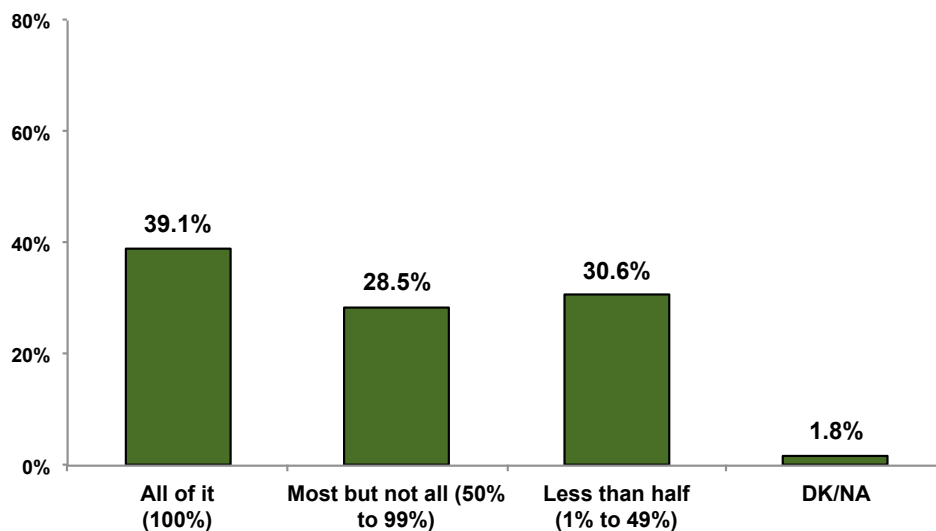


**Figure 8: 2010, 2011, and 2012 Expected Solar Workers—Installation**



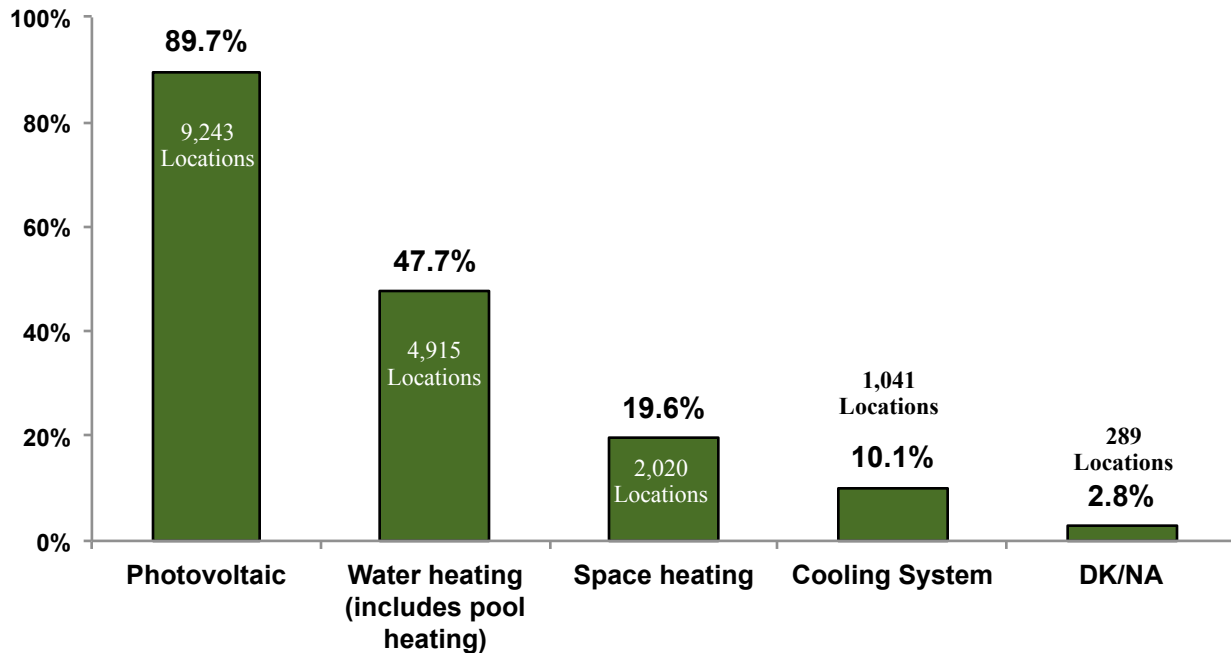
This year, a greater number of solar installation workers were identified, but a smaller percentage of the firms reported that they receive all or most of their revenue from solar projects (Figure 9). These results indicate that there are more establishments entering the solar industry and that existing firms are diversifying into other related technologies, such as energy efficiency products and services and energy auditing.

**Figure 9: Solar as a Percentage of Revenue—Installation**



As shown in Figure 10 below, many establishments install more than one type of system. Ninety percent of firms install photovoltaic systems while just under half install solar hot water systems.

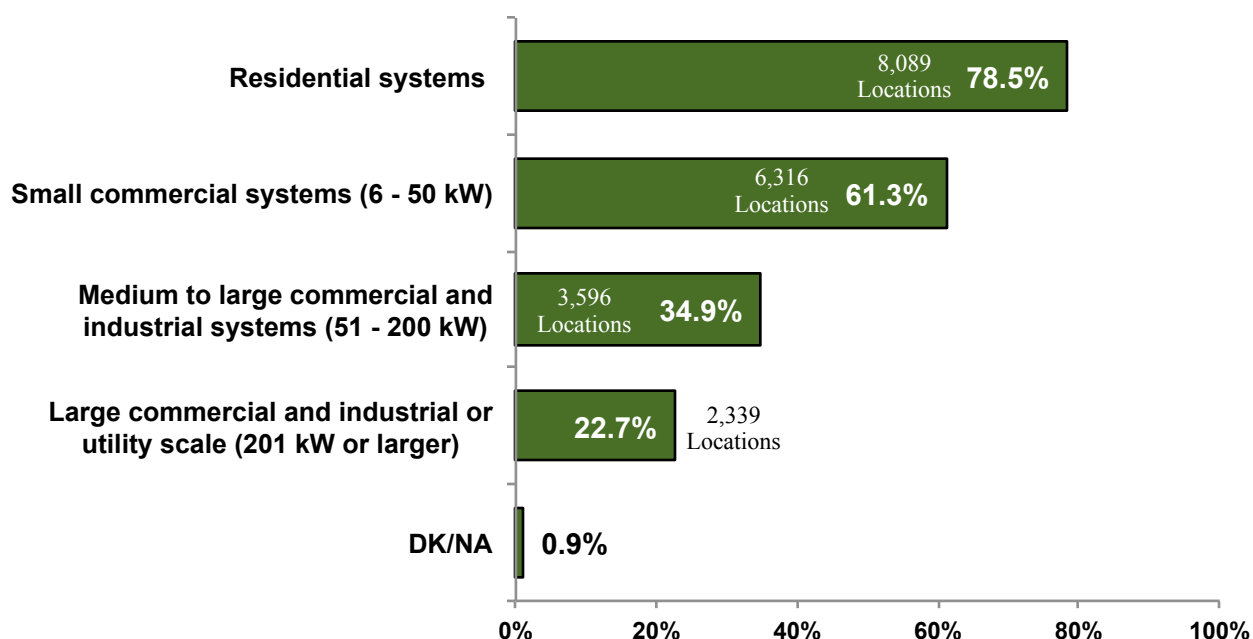
**Figure 10: Establishments by Technology—Installation**



Because of the number of establishments working with multiple technologies, it is impossible to provide reliable estimates of the numbers of employees working with each specific technology. Similarly, the establishment counts provided include overlap (i.e., establishments working with multiple technologies are counted in each technology, so the totals do not add up to the total number of installation firms in the U.S.).

U.S. installation companies are working on systems of varying sizes. As would be expected, the majority of installation firms are working on smaller systems (Figure 11).

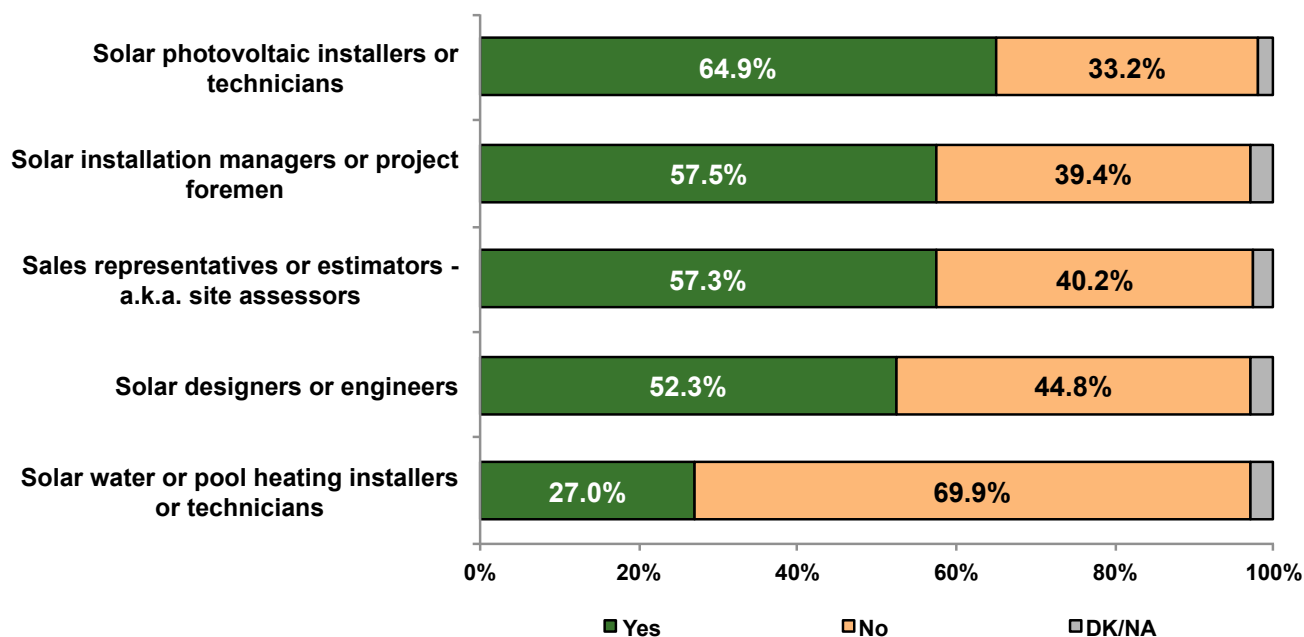
**Figure 11: Percentage of Establishments Working on Systems, by Size—Installation**



The research findings illustrate a potential trend toward specialization. More firms appear to be contracting out portions of their solar work, including administrative, on-site installation, and other parts of the installation process. As a result, there appears to be greater efficiency in the installation process, with more highly refined specific occupational areas and fewer workers who are expected to conduct multiple installation activities (such as assessment, customer service, and roof-top installation).

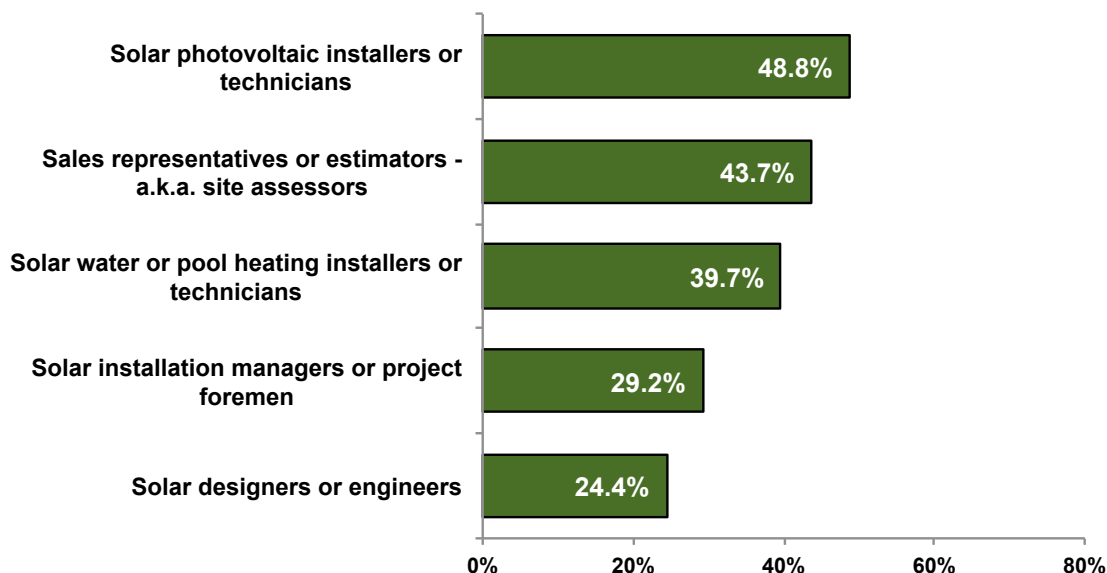
This year, The Solar Foundation™ wanted to learn about specific solar occupations, including the workforce needs of employers, difficulties in hiring qualified workers, growth rates, and other metrics to develop a better understanding of the solar workforce. Five installation categories were selected for review and additional occupational categories were tested to discover specific skill requirements and determine occupational titles used in practice. As the installation sector has matured, electrician and dedicated solar technician have become the most prevalent job titles for installers. Figure 12 shows the percentage of installation firms that employ workers in each of the categories. All reported occupations refer only to those workers who spend at least half of their time supporting the solar portion of the business.

**Figure 12: Occupational Hiring—Installation**



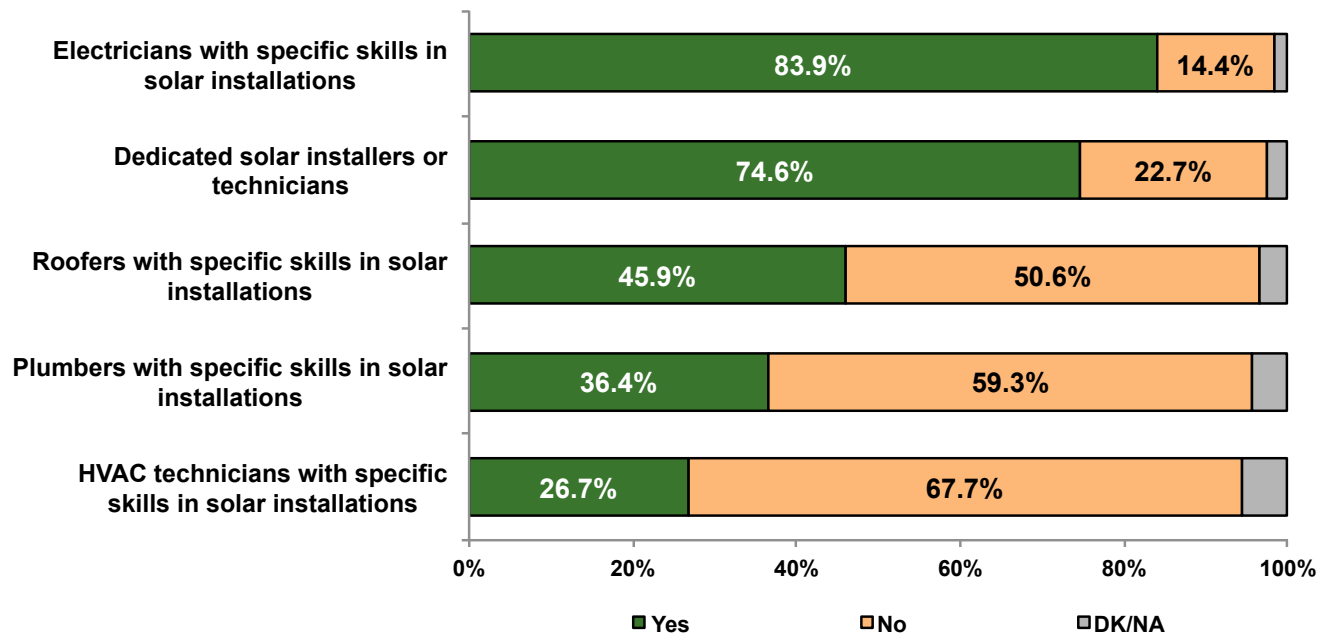
Installation firms expect all of these job categories to grow over the coming 12 months, led by photovoltaic installers and technicians. In fact, installation establishments that employ such occupations expect 40-50% growth in their PV installation occupations, sales representatives, and water and pool heating installers, 30% growth of installation managers, and nearly 25% growth in solar designers (Figure 13).

**Figure 13: Occupational Growth—Installation**



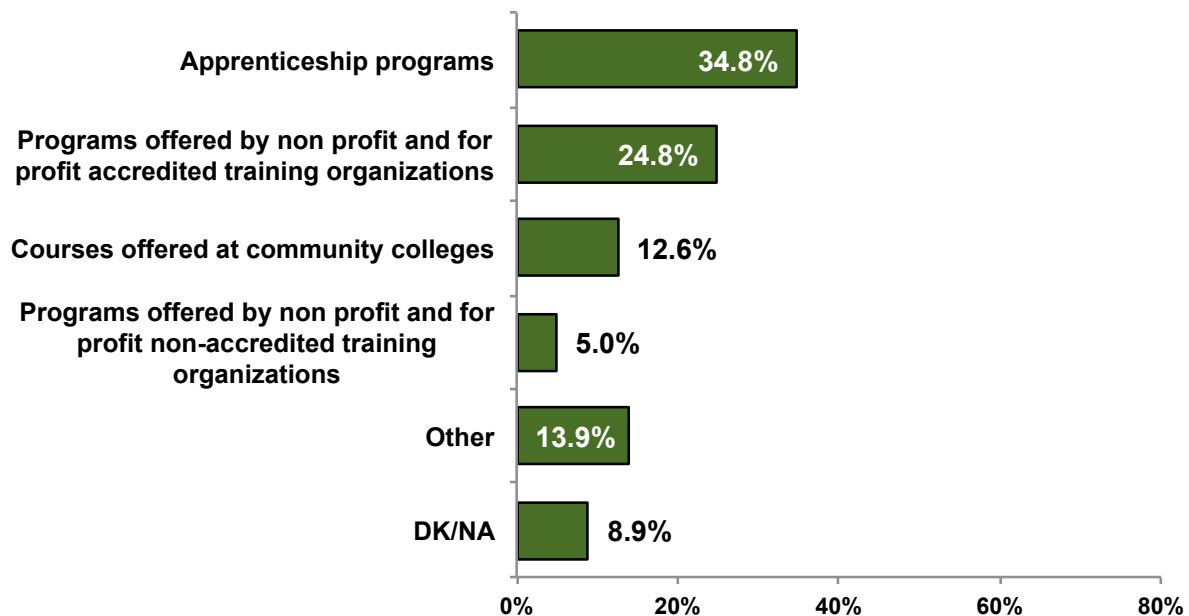
The Solar Jobs Census 2011 also asked employers about specific job titles to learn which titles they use for their workers who spend at least half of their time supporting solar installations, as many terms are used simultaneously and there is still little standardization among job titles in the workplace. As the installation sector matures, it seems that electrician and dedicated solar technician are now the most prevalent job titles for installers.

**Figure 14: Occupational Titles—Installation**



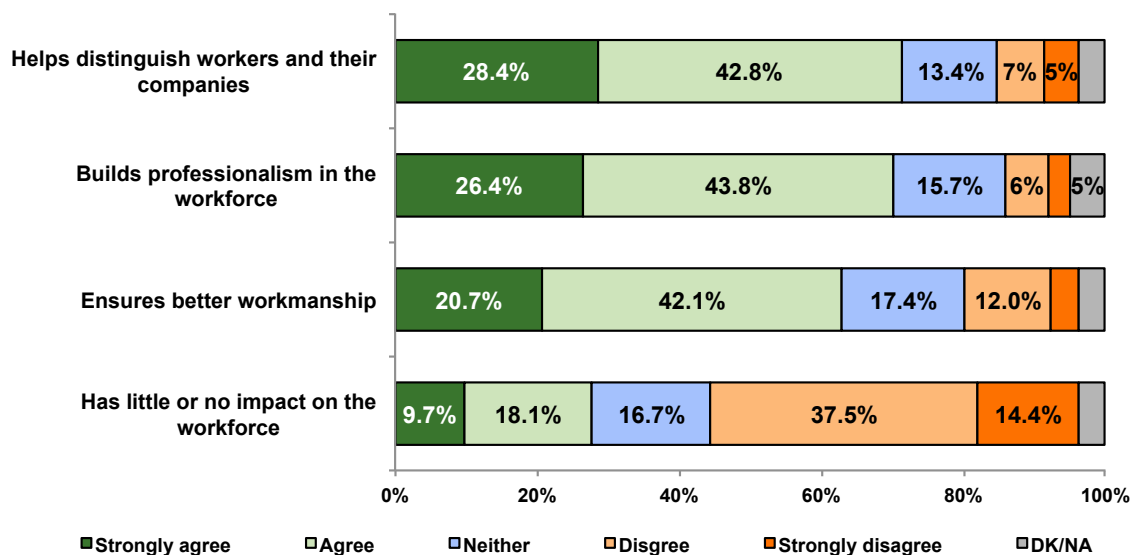
Survey respondents were also asked about their preferred training backgrounds for applicants, and again they indicated the importance of on-the-job training through apprenticeship programs. It is important to note that as employers become more familiar with accredited training programs with rigorous standards, these preferences may change in the future.

**Figure 15: Preferred Training Methods—Installation**



Employers were also asked about third-party certifications, such as NABCEP and UL. There are clear advantages reported by many employers (Figure 16).

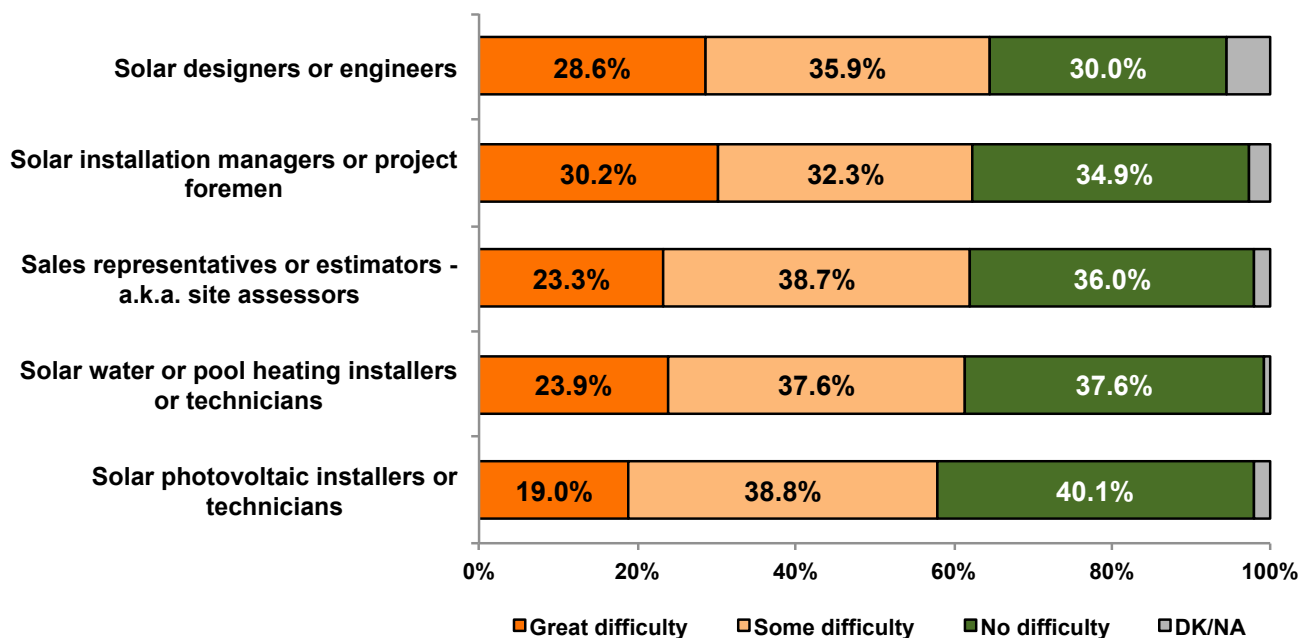
**Figure 16: Value of Credentials**





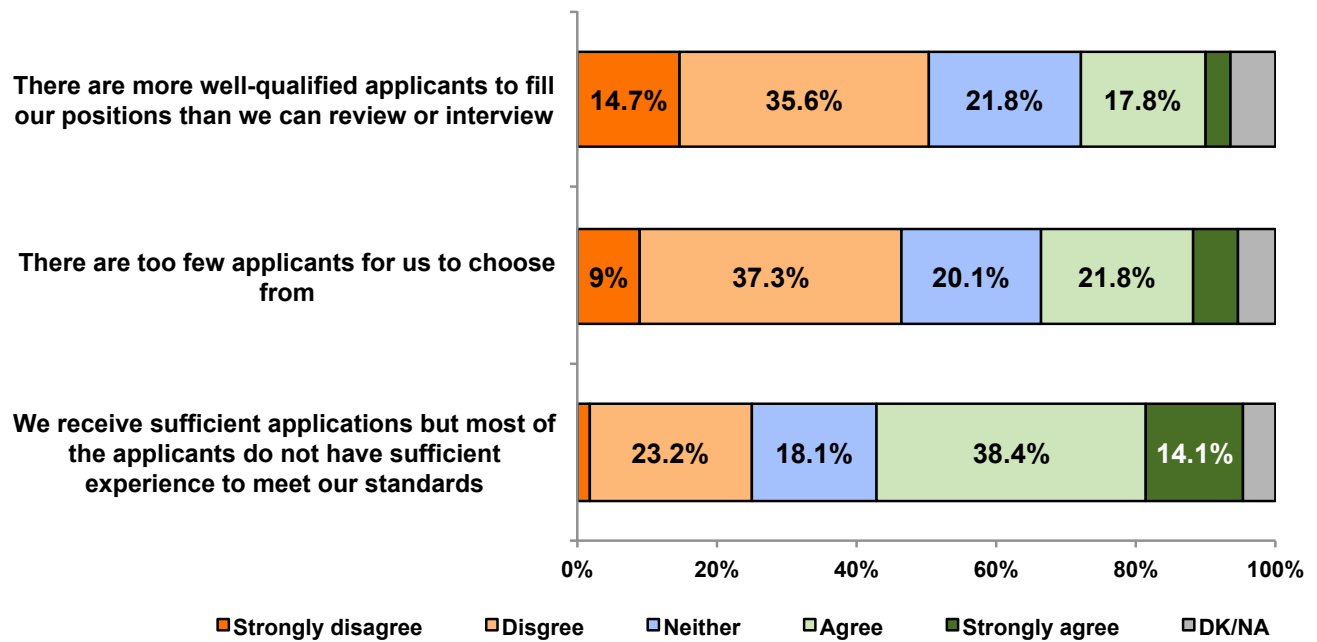
Although installation firms grew at a slower-than-expected pace over the past 12 months, reports of difficulty finding qualified job applicants are on the rise. Upon further discussion with solar employers, it appears that the difficulty is related more to the quality of the workers, not the quantity. In fact, employers noted that there is an abundance of applicants, but they lack the electrical or plumbing experience and work background necessary to meet employers' standards, suggesting that solar training should be integrated into existing electrical and plumbing programs (Figure 17).

**Figure 17: Difficulty Hiring—Installation**

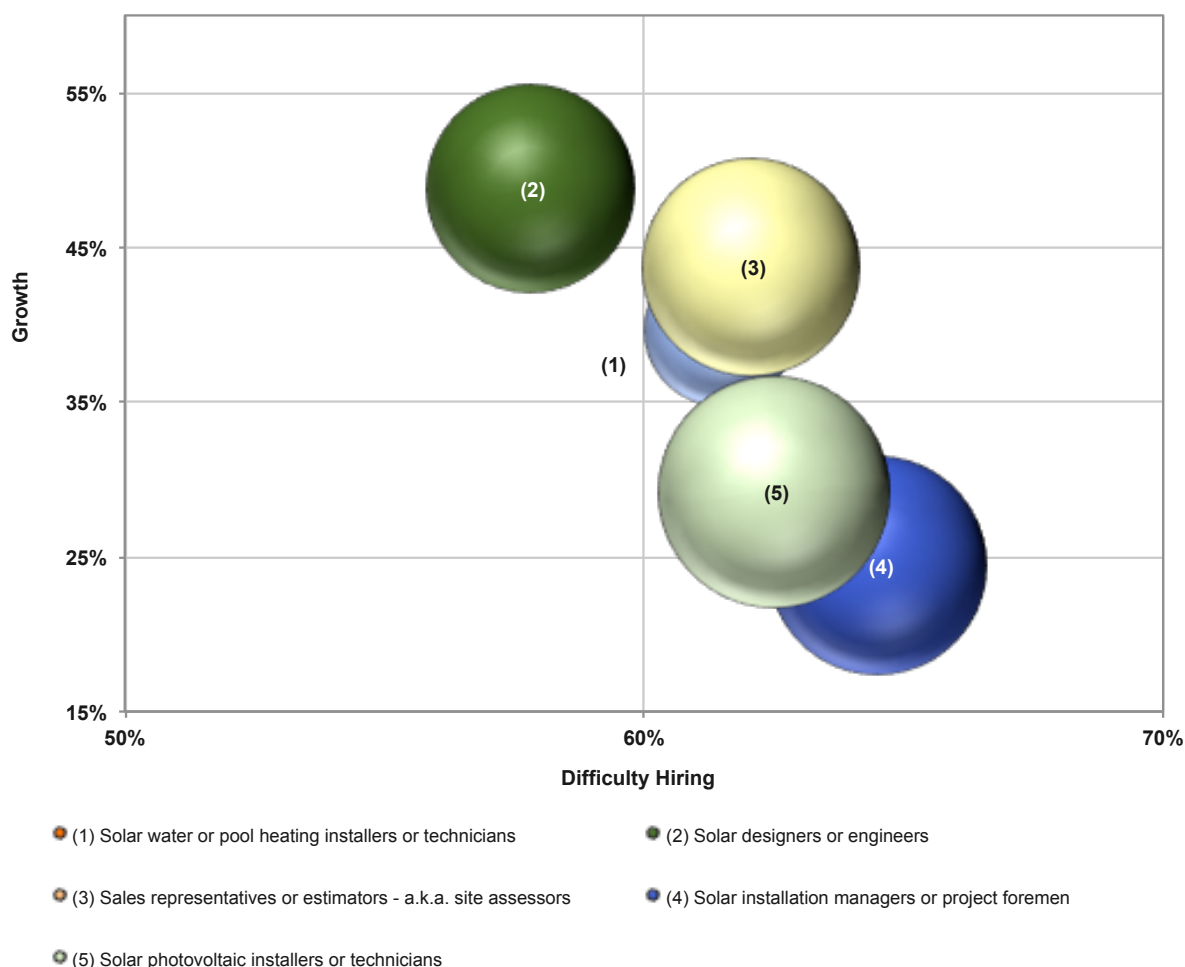


This finding is specifically highlighted in Figure 18, which shows that 53% of employers reported receiving a sufficient number of applications for job openings but found that too few met their standards.

**Figure 18: Employer Difficulties—Installers**



**Figure 19: Occupational Incidence, Growth, and Difficulty—Installation**



In Figure 19 above, the diameter of the bubble represents the percentage of establishments from the sample that hire each occupation, the vertical axis illustrates the 12-month growth rate, and the horizontal axis represents the percentage of establishments that report some or great difficulty hiring applicants that meet their firms' expectations regarding qualifications and/or experience.

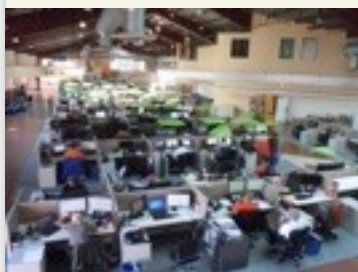
These findings indicate that those without significant work experience will be less able to compete for solar jobs. For installers, on-the-job apprenticeship programs or other training that includes experience-based learning are the most desirable pathways to employment, but these programs take significant time to complete. Job-seekers should consider certifications and training such as UL and NABCEP, as employers clearly value industry credentials.<sup>8</sup>

<sup>8</sup> The Interstate Renewable Energy Council and the Solar Instructor Training Network will soon be releasing detailed career pathway information.

## Installation Company Profile: Sungevity

In just four years, Sungevity has become a prominent third party residential PV leasing installation company. Sungevity is focused on connecting solar technologies with customers at the end of the supply chain through a leasing program that helps to dramatically reduce the cost of installing a solar system in a residential setting. Sungevity's services include remote solar design of systems for homes, paperwork and project management, contracting local certified installers, and providing follow-up services to customers on their systems, even after they are installed.

Sungevity's business model is based on maximizing capital and labor efficiencies. As the demand for residential solar has dramatically increased over the past year, Sungevity's workforce has almost tripled from roughly 100 employees in August 2010 to nearly 300 employees in August 2011. Such impressive growth can be attributed to Sungevity's business expansion into new markets across the U.S. Based in Oakland, California, most of its market has been in California and in Colorado and Arizona. Sungevity has also begun hiring field managers and support staff to expand work into new markets including Maryland, Delaware, Massachusetts, New York, and New Jersey. In addition to its regular employees, Sungevity has a strong sub-contractor pool that has been built up from 50 in August 2010 to over 100 sub-contractor partners currently in the Sungevity network.



Company: Sungevity  
Headquarters: Oakland, CA  
Subsector: Installation  
Employees: 285 in-house  
Website: [www.sungevity.com](http://www.sungevity.com)

When asked about short-term in-house employment growth projections, Sungevity founder and president Danny Kennedy emphasized that in an efficient, scalable business model like Sungevity's, it is not necessary for employment growth to advance in perfect unison with business volume. In other words, Sungevity's business may double or triple over the next year without the need to double or triple the company's in-house head count. With healthy growth, there won't be any need to create jobs simply for jobs' sake within the Sungevity umbrella. Kennedy went on to explain that the sub-contracting workforce, on the other hand, has the potential to grow exponentially as volume increases.

The Sungevity workforce, both in-house and those contracted on a project-by-project basis, aims to hold itself to the highest standards. The skills and knowledge required to be a quality solar installer or operations manager are not the kind one can learn in a day. To ensure the best safety practices and on-the-job quality, Sungevity insists that its sub-contractors be experienced, well trained through NABCEP/IREC or a comparable program, and committed to a reputation of high standards within the community—practices common throughout the solar industry.

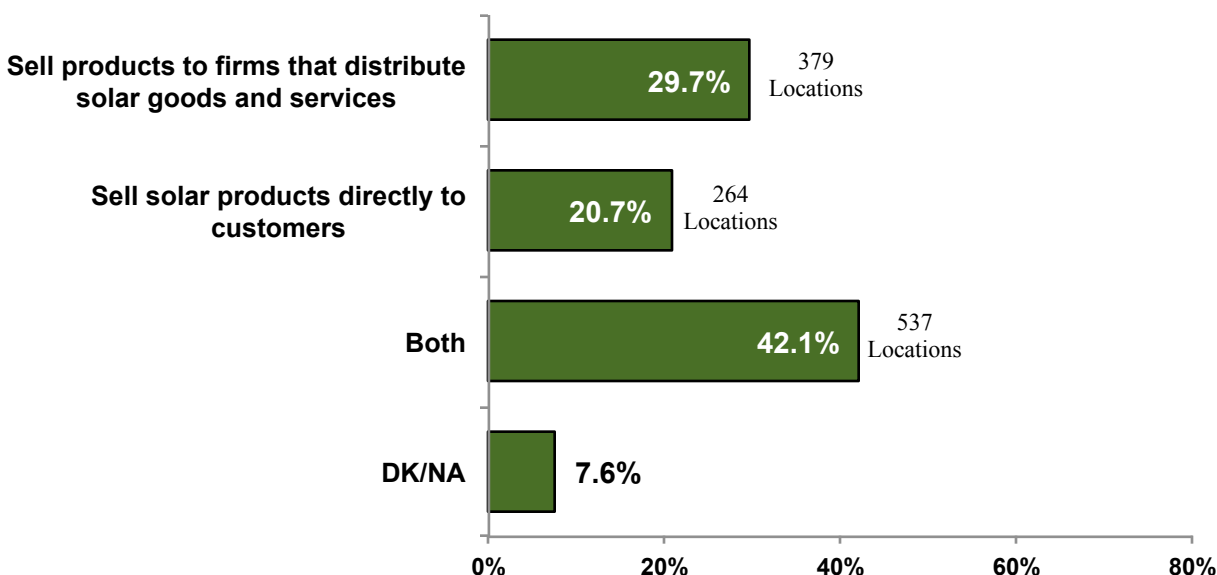
According to Kennedy, Sungevity takes special pride in knowing that its employees not only understand the "magic of the machine" (i.e., how solar works), but that their enthusiasm in their work is key to propelling the company forward. "Our employees really care about their work," Kennedy said. According to him, a few universal policies will be necessary to ensure long-term stability and help the solar market grow into the strong industry it promises to become: Surety of SREC markets, rebates that don't have an "on-again, off-again" existence, and a long-term ITC will go a long way to instilling confidence in continued market stability.

### 3.2 Manufacturing

Similar to installation firms, the solar manufacturing firms surveyed for this study can be found in all parts of the country, producing goods across many technology types and selling them directly to consumers and to distributors. Improvements to the methodology in the 2011 Census show that manufacturing makes up a slightly smaller percentage of the solar establishments in the U.S. than was previously believed, at 7.5%. The 2011 Census finds 1,275 solar manufacturing establishments in the United States, employing 24,064 solar workers.<sup>9</sup>

As might be expected, the majority of establishments sell goods to both distributors and consumers, and only about 20% sells exclusively to consumers. The Solar Foundation™ asked specifically about whether manufacturers sell products directly to customers or to other businesses (Figure 20).

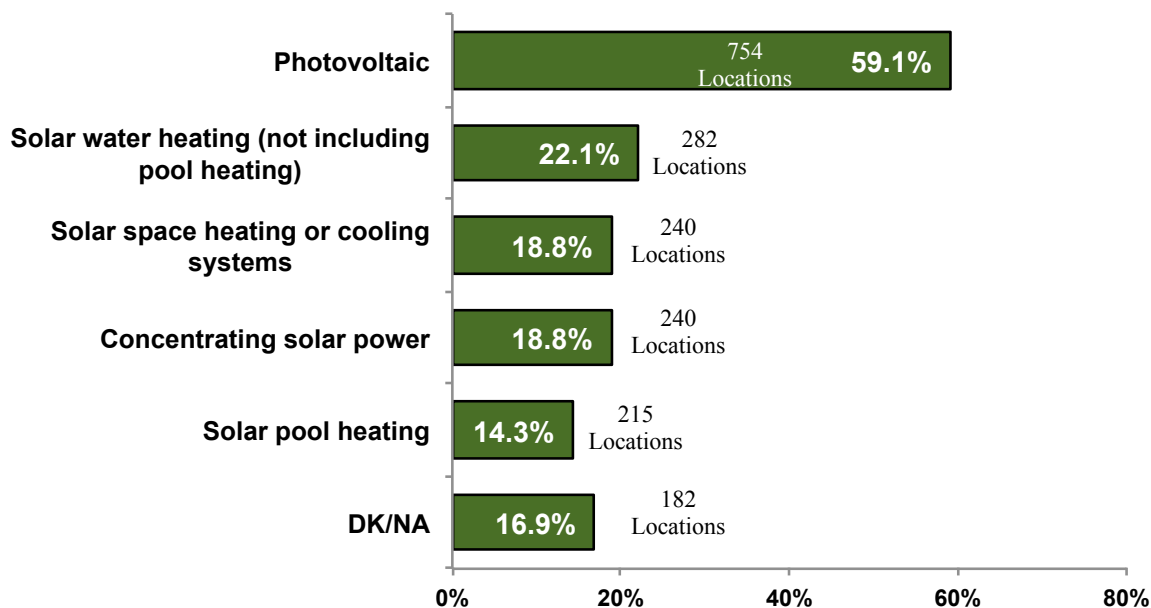
**Figure 20: Solar Sales—Percentage of Manufacturing Establishments by Sales Channel**



<sup>9</sup> Establishments identified as manufacturers in the 2010 census grew by 24.9%.

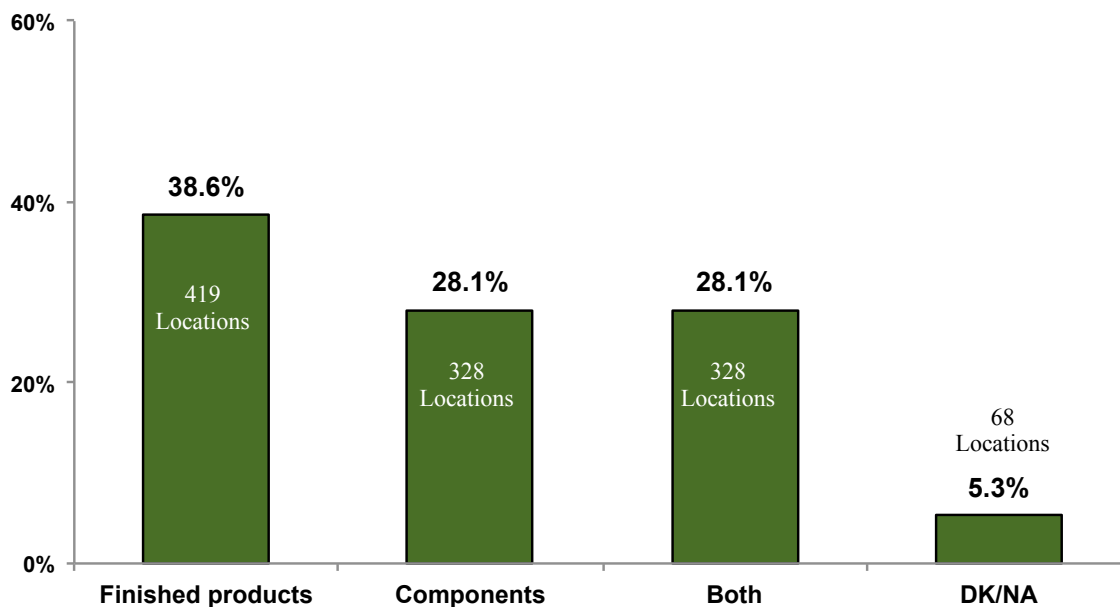
The surveyed companies domestically manufacture a variety of products, and the majority of them manufacture photovoltaic systems or supply components for photovoltaic manufacturers (Figure 21).

**Figure 21: Percentage of Establishments by Product—Manufacturing**



As demonstrated in Figure 22, solar manufacturers produce both components and finished products.

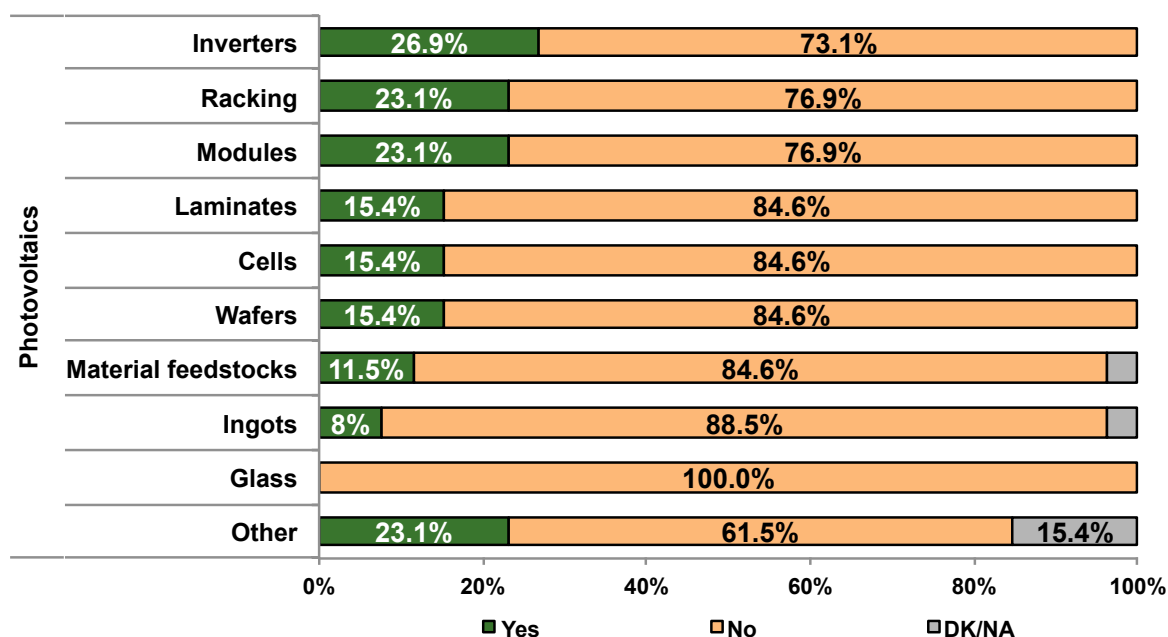
**Figure 22: Percentage of Establishments by Product—Components and Finished Products**



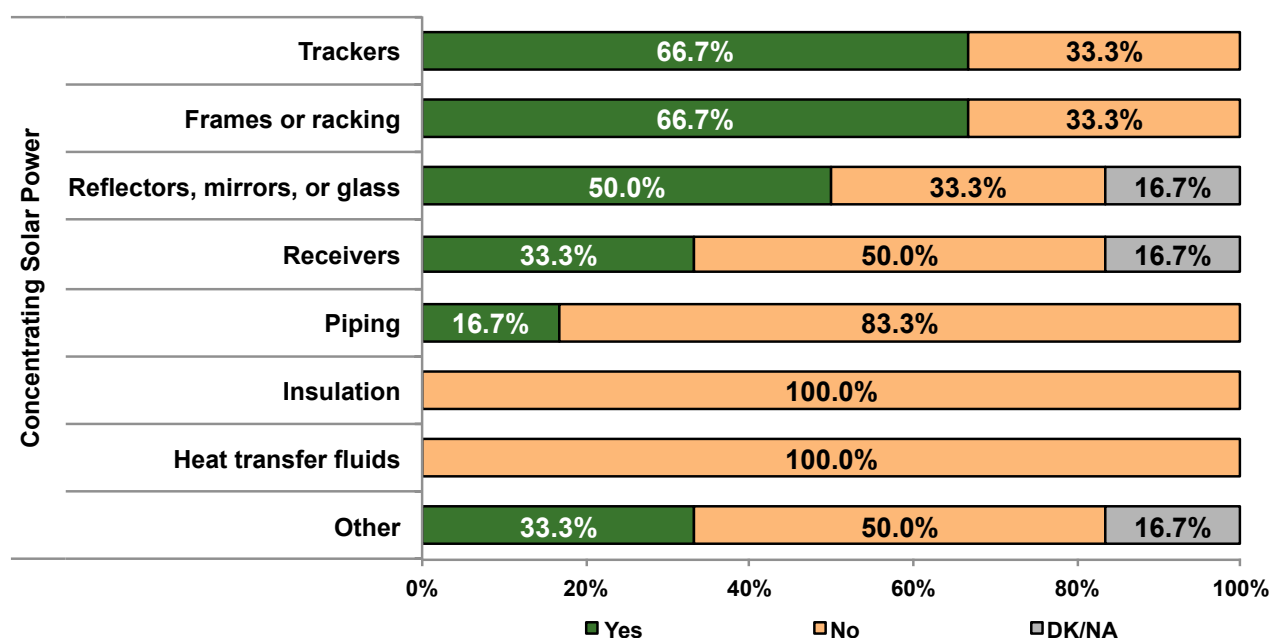


Firms that manufacture components make a variety of items and are involved with many different technologies, as evidenced in Figures 23 - 25 below, which show the percentage of solar manufacturing establishments within each category that make specific components for photovoltaic, concentrating solar power, and solar water heating technologies.

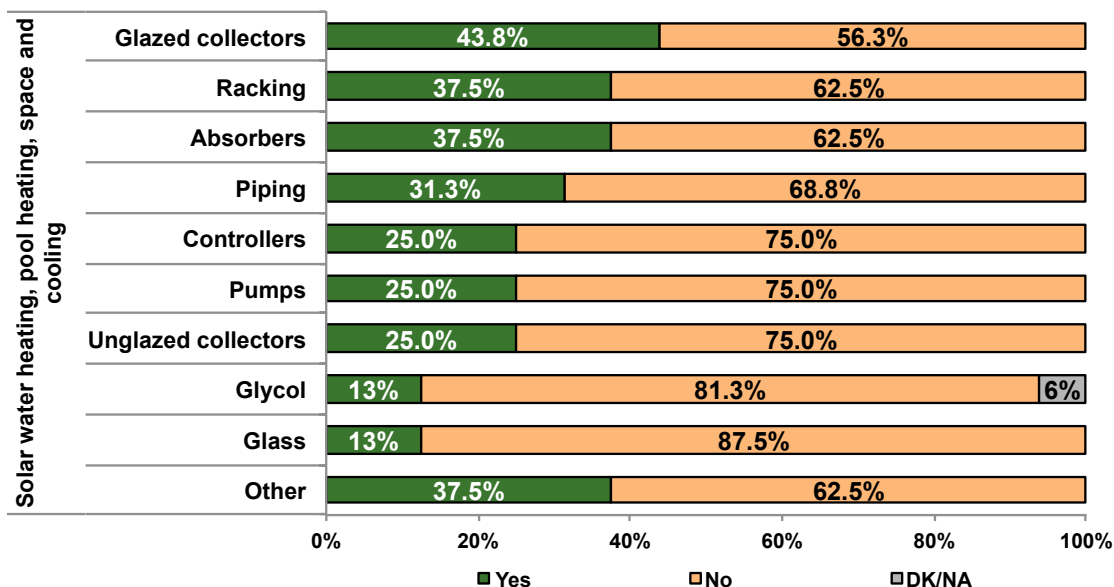
**Figure 23: Percentage of Establishments by Component—Photovoltaics**



**Figure 24: Percentage of Establishments by Component—Concentrating Solar Power (CSP)**

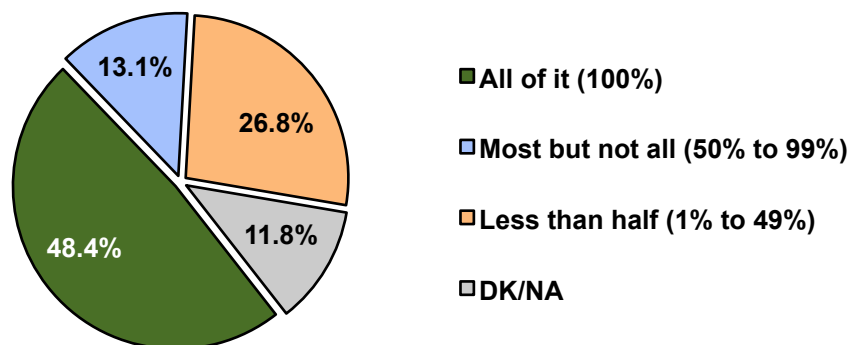


**Figure 25: Percentage of Establishments by Component—Solar Water Heating, Heating, and Cooling**



It is likely that more establishments produce components for solar products than those reported in Figures 23-25, but those establishments may not know their final products' destination. Nearly half of the manufacturing firms surveyed produce solar products exclusively, while about one quarter of the firms report earning less than 50% of their revenue from solar. In comparison with 2010 data, it appears that manufacturers are receiving more revenue from solar than was previously the case.<sup>10</sup>

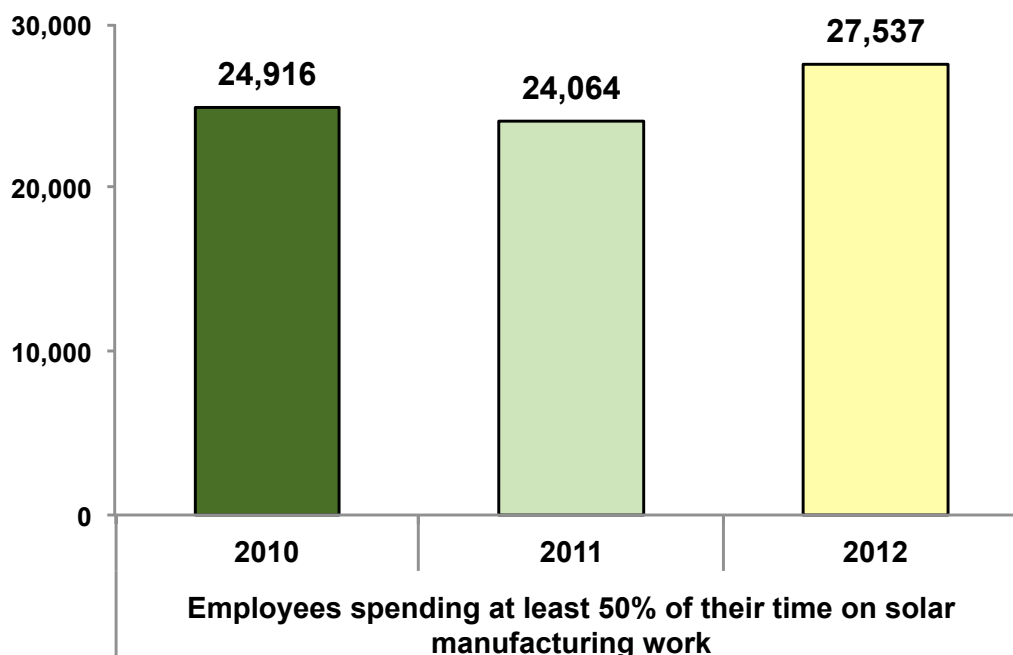
**Figure 26: Percentage of Revenue Related to Solar Products—Manufacturing**



<sup>10</sup> In 2010, 40.1% of manufacturers reported that all of their revenue came from solar goods. This number grew to 48.4% in 2011.

Solar manufacturers employ 24,064 solar workers and expect strong growth over the coming year. Though this number is lower than the reported figure in 2010, the reduction is not due to layoffs or plant closures but to fine-tuning of how firms are classified. In fact, manufacturers increased their workforce by 24.9% since August 2010.

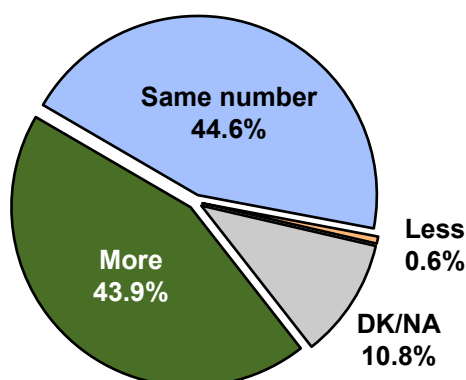
**Figure 27: 2010, 2011, and 2012 Expected Solar Workers—Manufacturing**



Solar manufacturing companies anticipate adding 3,473 solar workers over the next 12 months, a 14.4% growth rate. This compares to an expected nationwide 2.6% decline in overall manufacturing for the same period.<sup>11</sup>

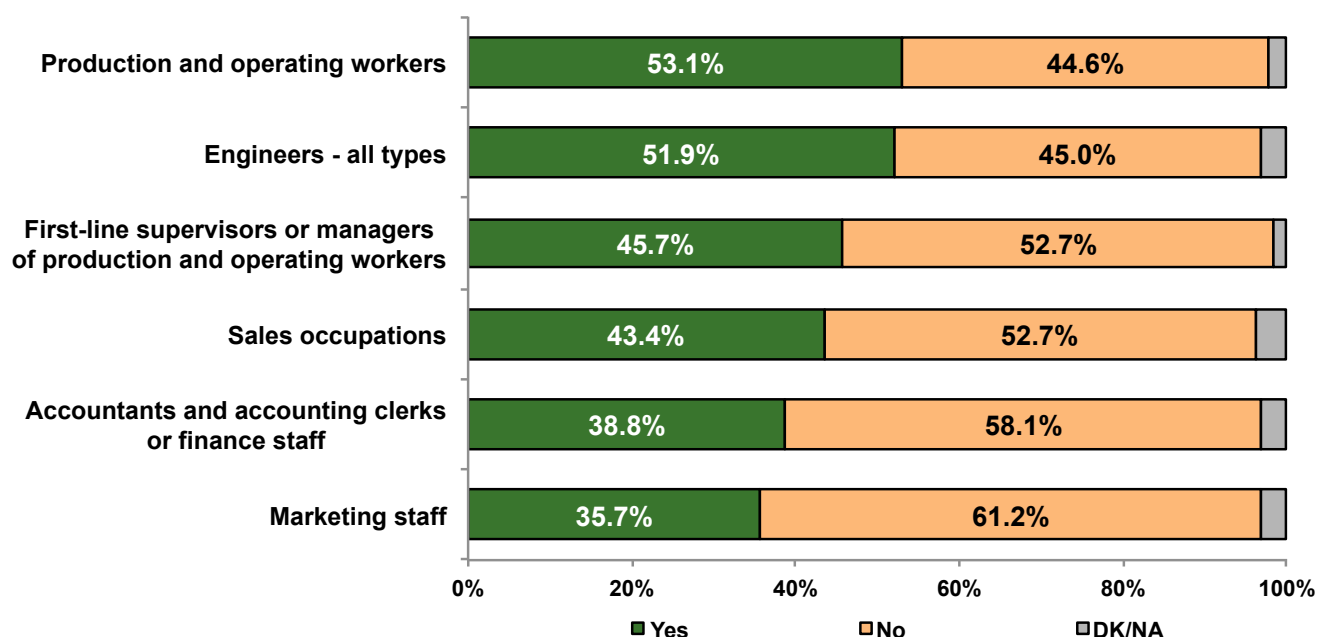
<sup>11</sup> EMSI Complete Employment, 2011.3

**Figure 28: 12 Month Hiring Expectations—Manufacturing Firms**



The Solar Foundation™ also asked manufacturers about specific occupational areas that spend at least half of their time supporting the solar portion of their business. Not surprisingly given the nature of their work, production and operating workers are the most prevalent occupational area among the six considered (Figure 29).

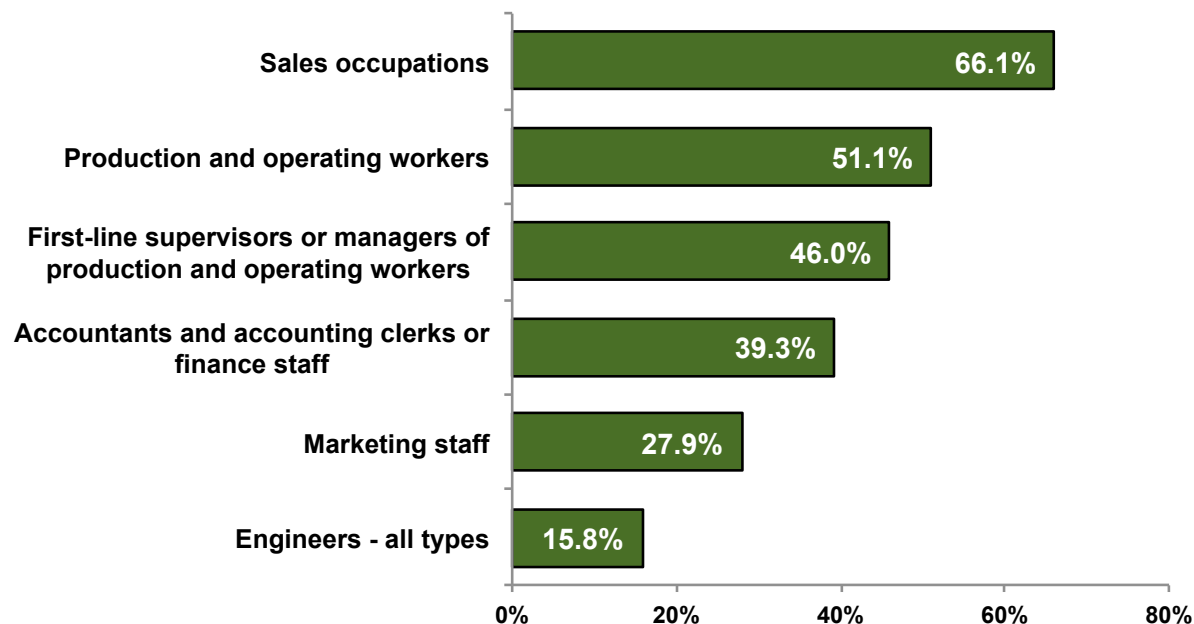
**Figure 29: Occupational Hiring—Manufacturing**



Like in other sectors, all solar occupations show growth potential, and as demonstrated in Figure 30, sales is again a leading category. This may be related to the growing number of manufacturing firms that are conducting their own business development by selling directly to installers and consumers rather than using sales and distribution firms. The occupational growth

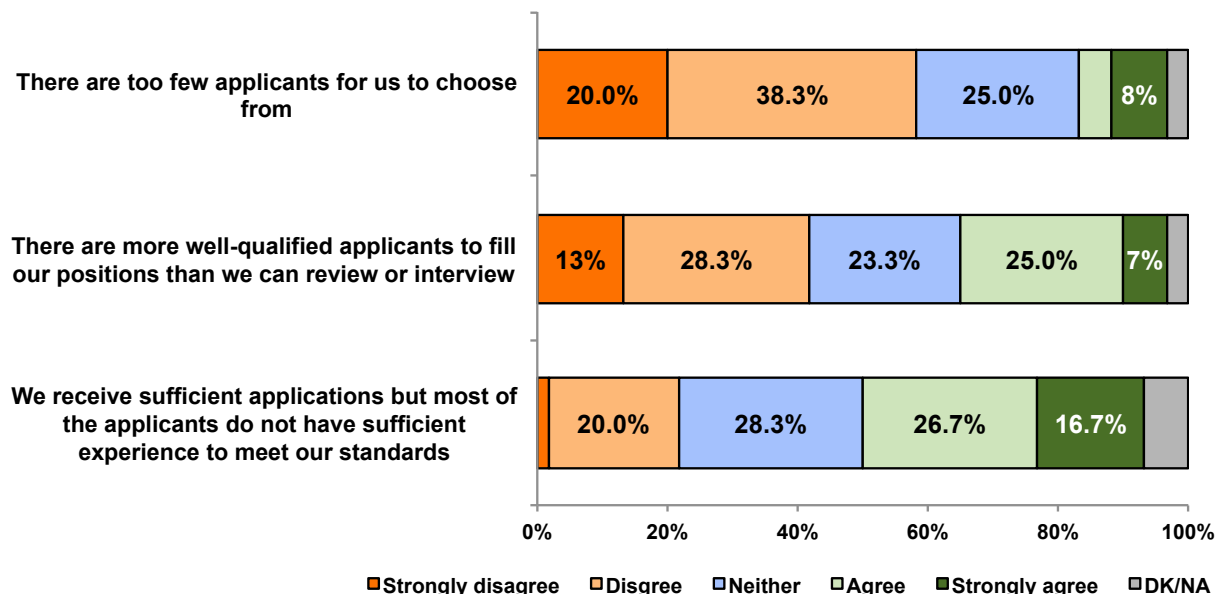
rates reported by manufacturing firms shows tremendous optimism from the surveyed employers (Figure 30).

**Figure 30: Occupational Growth Rates —Manufacturing**

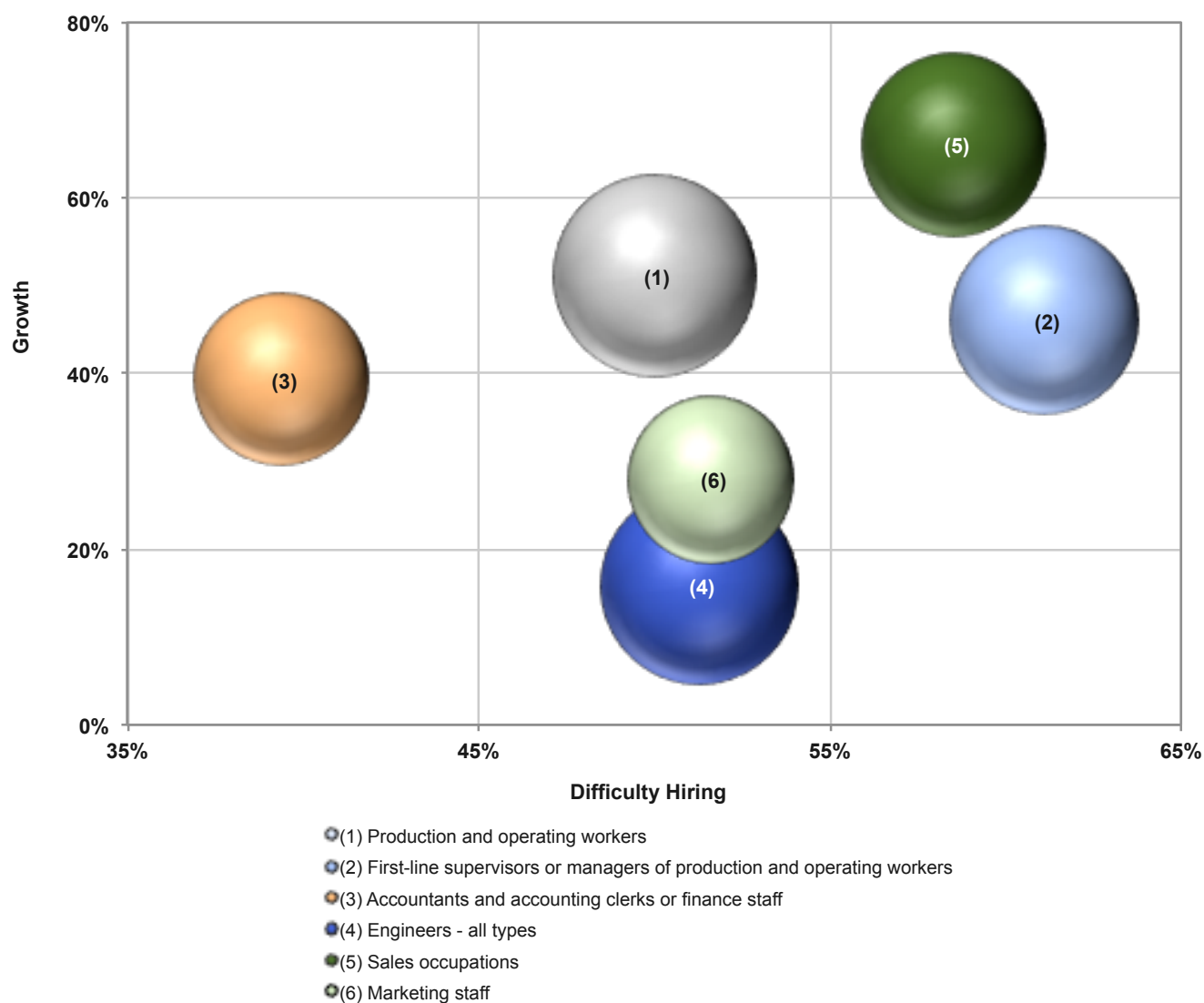


As with installation firms, manufacturing firms are having some difficulty filling open positions with qualified workers (Figure 31).

**Figure 31: Employer Difficulties—Manufacturing**



**Figure 32: Occupational Incidence, Growth, and Difficulty—Manufacturing**



In Figure 32 above, the diameter of the bubble represents the percentage of establishments from the sample that employ each occupation, the vertical axis illustrates the 12-month growth rate, and the horizontal axis represents the percentage of firms that report some or great difficulty hiring applicants that meet their firms' expectations regarding qualifications and/or experience.

When asked specific questions about the labor pool, manufacturers were concerned about both the quantity of applicants and the quality of workers available. Manufacturers have specific requirements, suggesting that relationships between training providers and employers are critical in solar manufacturing.



These findings suggest that experienced candidates are much more competitive for solar manufacturing jobs. In the case of first line managers and supervisors, it may not be enough to have been a production worker for many years, as employers note the importance of management experience for the position. Though some firms do offer on-the-job training, this is increasingly less common.



## Manufacturing Company Profile: Hemlock Semiconductor

Over the course of 50 years, Michigan based Hemlock Semiconductor has become one of the world's largest manufacturers of the key raw material used in solar panel construction; polycrystalline silicon. Though it has historically served the semiconductor market for electronics, Hemlock Semiconductor has recognized the value of solar technology and has been at the forefront of the industry. Prior to 2005, over 90% of the polycrystalline silicon manufactured by Hemlock Semiconductor was distributed to the electronics industry. Over the past six years, however, Hemlock Semiconductor's business in the solar industry has multiplied many times over, resulting in over \$4.5 billion USD invested in its solar division in just six years. While they still serve the growing electronics industry, today roughly three quarters of Hemlock's polycrystalline silicon ends up being used in solar panels.

The growth of the solar industry, and Hemlock Semiconductor's associated expansion has led to an increase in employment to the tune of 2,000 new jobs. Hemlock Semiconductor is currently constructing a new production plant in Clarksville, Tennessee that will go online by the end of 2012. According to Hemlock Semiconductor Public Affairs Manager, Jarrod Erpelding, Hemlock Semiconductor's investments have not only kept between 1,000 and 2,500 hundred construction workers busy over a sustained 10 year construction period, but once the new plant goes online and volume demand increases, 500 permanent plant jobs will be created. Over the last six years alone, as volume demand from the Michigan plant increased due to solar industry expansion, steady and reliable job growth has emerged.

Company: Hemlock Semiconductor  
Headquarters: Hemlock, Michigan  
Subsector: Manufacturing  
Employees: 1,800+  
Website: [www.hscpoly.com](http://www.hscpoly.com)



To find highly skilled and qualified workers, Hemlock Semiconductor has tapped into local community colleges and universities. Specifically, Hemlock Semiconductor has collaborated with local community colleges to create two-year programs that give the rising workforce the education and training needed to join the skilled workforce in an operations-level position. Additionally, there are many workers from Michigan's automotive industry whose skill sets are transferrable to positions at Hemlock Semiconductor. For these workers, who have extensive experience in related fields but lack specific skill, one-year programs are sufficient to quickly educate and train the workers and connect them with jobs. As an active member of its community, on a local, regional, and even national scale, this is just one of the ways that Hemlock Semiconductor's solar interests are reaching beyond the bounds of the immediate solar industry by training workers for other careers as well.

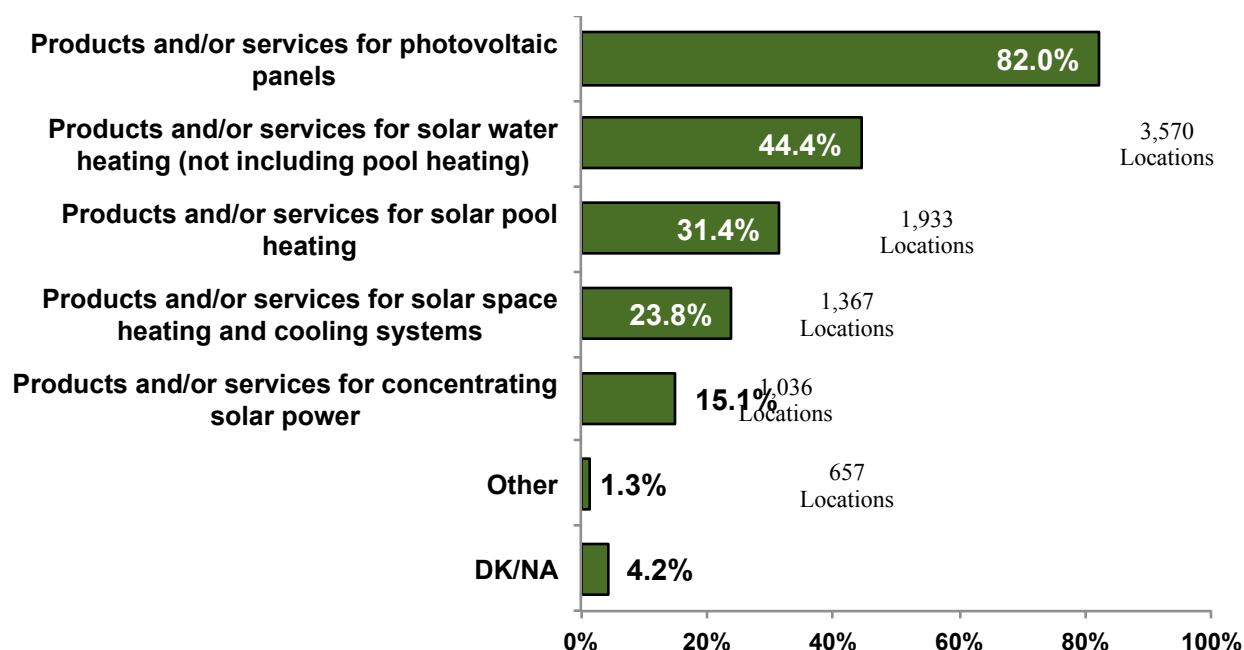
Hemlock Semiconductor's success requires it to operate three shift sets for 24 hours a day to match the demand of the growing solar industry. Hemlock Semiconductor's success isn't independent of the industry, and for investment to continue into the future, the solar industry—including the U.S. solar market—will need to keep growing. To support this growth, federal renewable energy manufacturing tax credits are needed to help encourage business and create jobs throughout the solar industry value chain. Hemlock Semiconductor understands that even though its role appears early on the solar value chain, end user incentives like renewable energy standards and net metering, as well as solar technology R&D and financing, are absolutely essential to keeping its solar manufacturing business alive and well.

### 3.3 Sales and Distribution

As reported in the 2010 Census, sales and distribution firms<sup>12</sup> are important, yet often overlooked. The employers in the solar sales and distribution subsector sell all types of systems, from residential solar pool heaters to commercial-scale photovoltaic systems. They also sell components, raw materials, and other critical items to finished product manufacturers, assemblers, and project developers. The firms sell directly to consumers and also to other businesses and can be found in every state in the nation.

The surveyed establishments sell a variety of products, and the majority sell photovoltaic systems and solar water heaters.

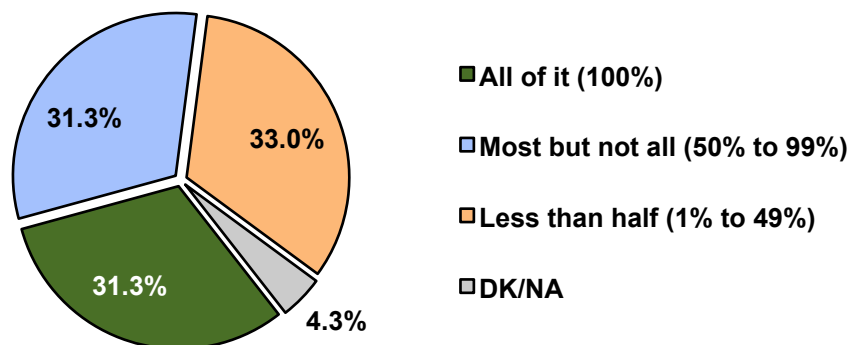
**Figure 33: Percentage of Establishments by Product Sales—Sales and Distribution**



Sales and distribution establishments are also diverse in their size and offerings and are evenly distributed with regard to the percentage of their revenues related to solar products. This suggests that firms that sell solar products frequently sell other products as well, though many are exclusively selling solar products (Figure 34).

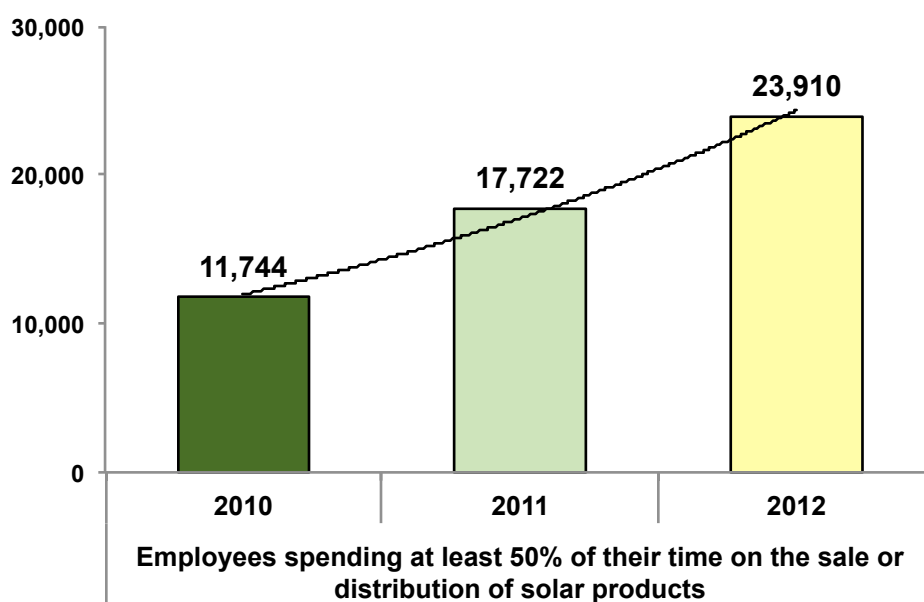
<sup>12</sup> These establishments were referred to as wholesale trade in 2010, but sales and distribution is a more accurate descriptor.

**Figure 34: Percentage of Revenue Related to Solar Products—Sales And Distribution**



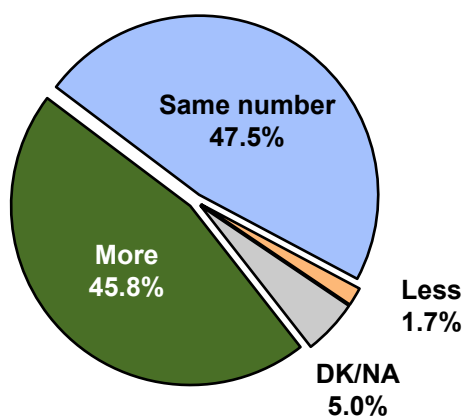
Solar sales and distribution is the fastest growing of the solar subsectors, with the fastest growth from 2010 and the highest expected growth through 2012. The 2011 improvements to the research methodology suggest that sales and distribution also make up a larger percentage of the solar industry than previously reported; this year's research indicates that there are 4,354 solar sales and distribution establishments in the United States employing 17,722 solar workers (Figure 35). The sector grew by 13.8% since 2010.

**Figure 35: 2010, 2011, and Expected 2012 Solar Workers—Sales and Distribution**



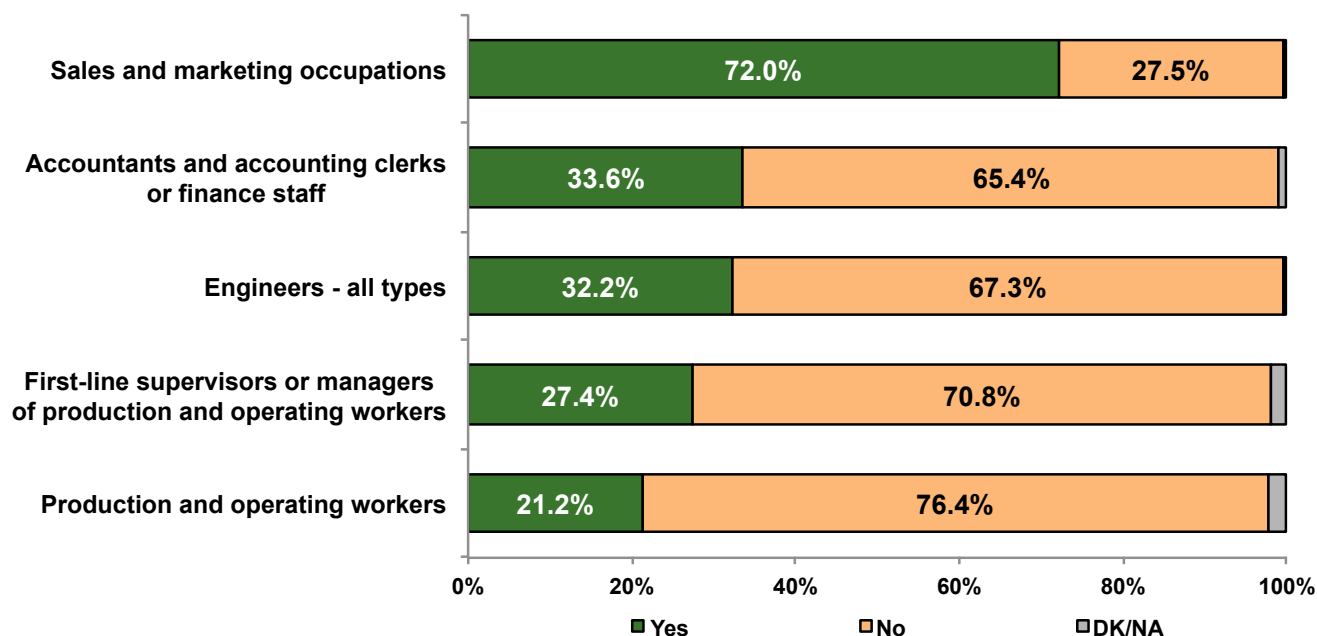
Solar sales and distribution firms are also bullish about their future, expecting to add nearly 6,200 workers—a growth rate of 35%—through July 2012, with over 45% of establishments expecting to add solar workers and fewer than 2% expecting to cut solar jobs (Figure 30).

**Figure 36: 12 Month Hiring Expectations—Sales and Distribution**



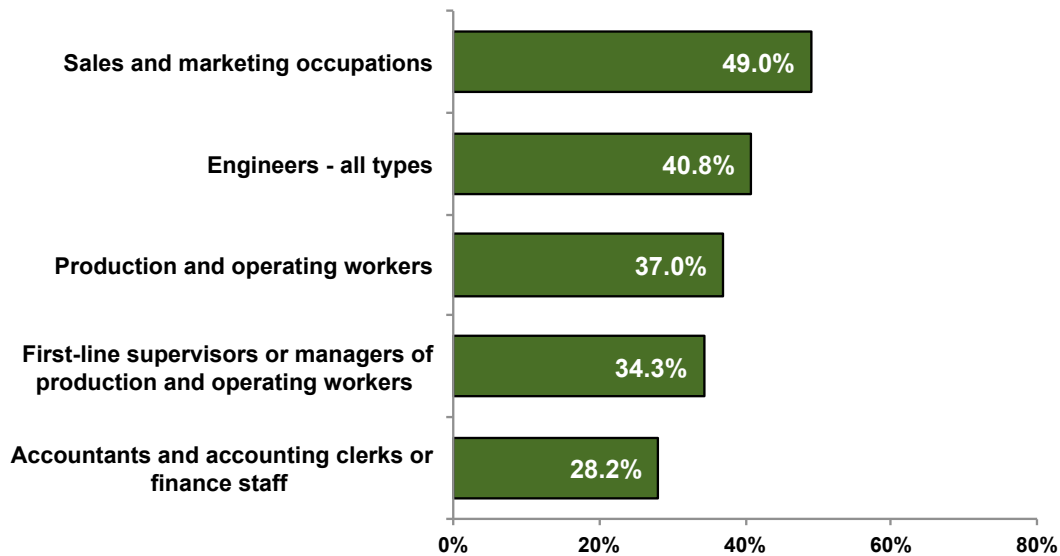
The Solar Foundation™ also asked sales and distribution firms about five specific occupational categories that spend at least 50% of their time supporting the solar portion of the business. Not surprisingly, Figure 37 shows that sales and marketing positions are most prevalent.

**Figure 37: Occupational Incidence—Sales and Distribution**



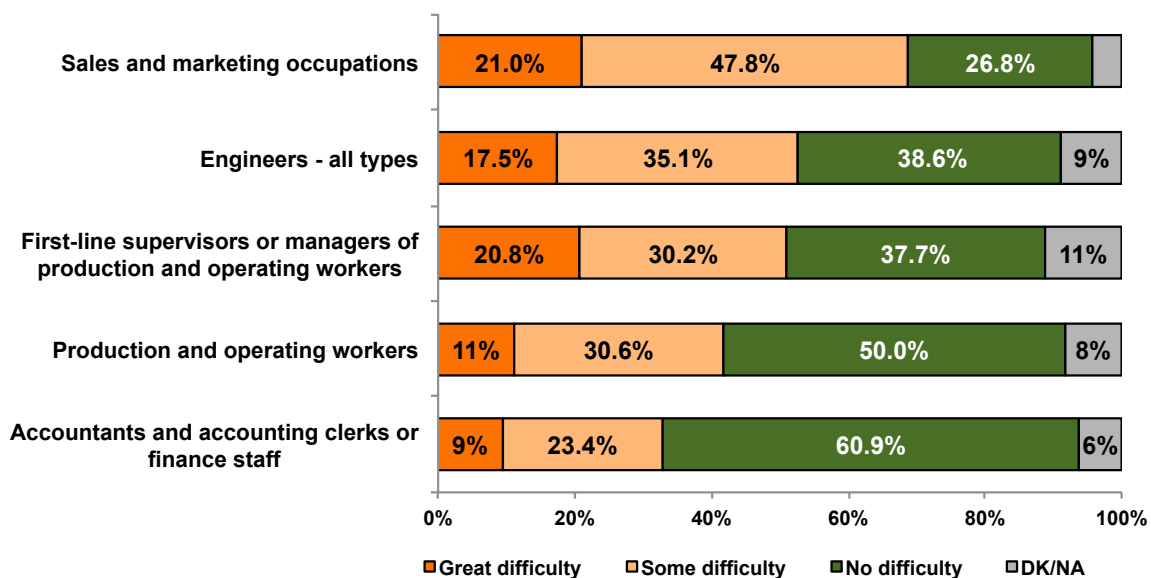
All of these occupational areas are expected to grow at impressive rates over the coming year. Growth rates are expected to be greatest for sales and marketing positions, followed by engineers and production and operating workers (Figure 38).

**Figure 38: Occupational Growth Rates —Sales and Distribution**



Employers also note significant difficulty finding qualified workers to meet their needs. This is again particularly true for sales-related occupations, highly educated workers, and managers and supervisors (Figure 39).

**Figure 39: Employer Difficulties—Sales and Distribution**



In reviewing specific hiring difficulties, it seems that sales and distribution firms have plenty of job applicants to choose from, but a large number of employers believe those applicants do not meet their standards (Figure 40).

**Figure 40: Employer Difficulties—Sales and Distribution**

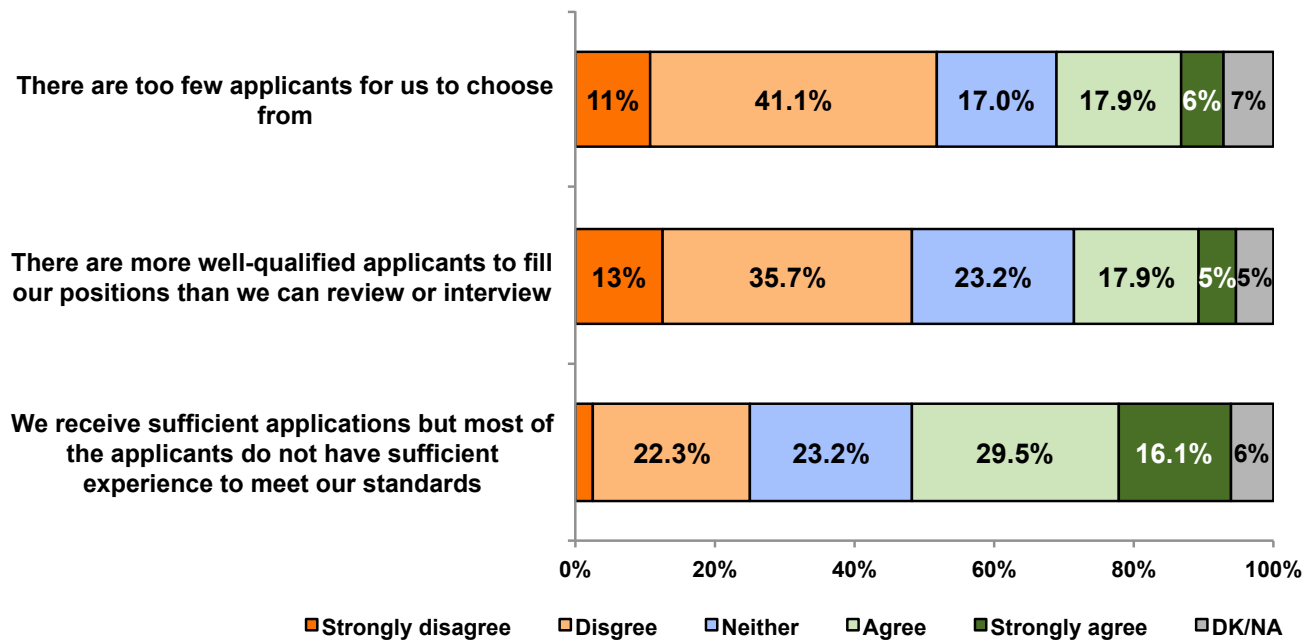
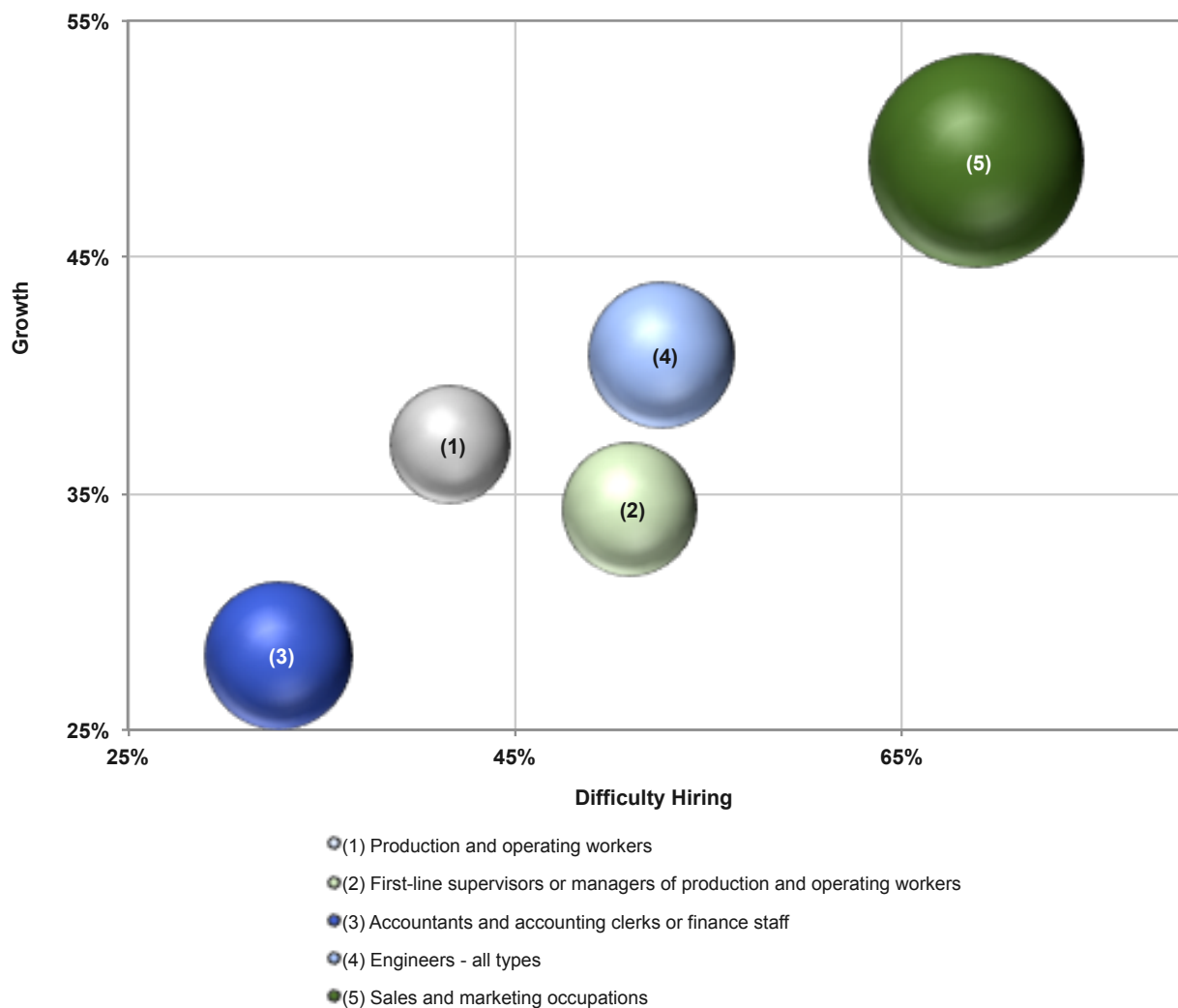




Figure 41 below graphically illustrates the growth rates and hiring difficulties for these important occupational areas.

**Figure 41: Occupational Incidence, Growth, and Difficulty—Sales and Distribution**



In Figure 41 above, the diameter of the bubble represents the percentage of establishments from the sample that employ each occupation, the vertical axis illustrates the 12-month growth rate, and the horizontal axis represents the percentage of firms that report some or great difficulty hiring applicants that meet their firms' expectations regarding qualifications and/or experience.

These findings illustrate tremendous potential opportunities for experienced, qualified, entrepreneurial, job candidates in sales, marketing, and business development. Employers' expectations are high, however, and many of these opportunities are solely commission-based.

## Sales and Distribution Company Profile: Ontility

Ontility is a full-service solar sales, distribution, and development firm dedicated to promoting solar through professional training, both from a technical as well as business perspective. Support services include NABCEP and IREC's ISPQ training, system design and engineering services, financial solutions, and business management services including marketing and project planning. While it is not responsible for installing systems itself, Ontility has a vast network of sub-contractors and over 120 manufacturing vendors it can tap to complete solar projects.

Like many in the solar industry, Ontility is currently undergoing substantial growth. Recently opened at its Texas campus was an 80,000 square foot warehouse used for housing product inventory. Soon to follow is a new state-of-the-art training lab that can be used for maintenance, troubleshooting and installation training for solar technicians.



Company: Ontility  
Headquarters: Houston, Texas  
Subsector: Sales and Distribution  
Employees: 77  
Website: [www.ontility.com](http://www.ontility.com)

On the business side of their work, Ontility offers consulting and on-site services for contractors, whether novice or experienced. With the solar industry still experiencing rapid growth and with many contractors new to the business, having a helping hand to call on as is invaluable not only to the individual contractor on-site, but also as a service to the entire industry to help it grow project-by-project and mold the larger solar landscape. Ontility partners with electrical supply companies, the Solar Instructor Training Network, and local colleges and universities to work to this end. As the solar industry grows, outside workers from other industries (roofing, electrical) are also experiencing substantial growth as a result of solar expansion.

In-house employment growth hasn't passed Ontility by, either. The recent boost in business has required Ontility to hire operations managers, sales staff, and internal support staff- in addition to the increases in its contractor network growth. In the last year, Ontility has more than doubled from 35 employees to 77. This growth can be attributed to the increase in volume of project requests. This trend is expected to continue over the next twelve months as well, requiring additional sales, administrative, consultant, marketing, solar engineering, and operations positions to be made available. Because of its specialized services, Ontility has clientele that has business inside and outside the solar fields. Their partners in electrical supply fields, for example, don't only work in solar, but other fields as well. This is an example of how Ontility's impact can go beyond the direct contact they have on a project-by-project basis.

As solar expansion continues and more jobs are created, gauging when and how to fill those positions is one of the challenges faced by companies like Ontility. According to Janet Hughes, Ontility's Executive Vice-President and ISPQ Master Trainer, growing fast doesn't inherently mean hiring fast. While backed by a strong confident investor, Ontility's financial resources are not endless and jobs for the sake of jobs aren't possible. Before creating a new position and hiring someone to fill that position, team roles are shifted, workloads are adjusted, and resources are reallocated to ensure maximum efficiency. This business strategy, adopted by Ontility, is found across the solar industry and is helping to ensure that the solar economy is built on a strong foundation.

### 3.4 Utilities

Electric utilities represent a small but fast-growing supporting segment of the overall solar jobs picture in the U.S. At a minimum, all grid-connected solar electric projects are interconnected and contracted through the utility, but utilities also provide facilitating roles for many solar technologies in different market segments and sizes through incentives, formal procurement mechanisms, industry development and education initiatives, and long-term utility planning. This involves a limited number of job types that might work on solar the majority of the time—primarily program or project managers and engineers—as well as an expanded list of supporting roles including planning, legal, policy, procurement, regulatory, customer service, and others. As solar markets expand with increasing numbers of distributed projects, large-scale individual projects, and new initiatives involving utility ownership, the breadth and depth of utility employees touched by solar will continue to grow.

#### Employment Data

The 67<sup>13</sup> electric utilities that responded to the 2010 Census employ over 157,447 workers across all divisions.<sup>14</sup> Nearly 879 of those, or 0.6%, spend at least half of their time working on renewable energy projects, and almost 211, or 24% of those renewable workers spend at least half of their time on solar projects. If this data is extrapolated to include the 211<sup>15</sup> most solar-active utilities in the United States for 2010, it is estimated that there are more than 690 utility employees that dedicate at least half of their time to working on solar projects.<sup>16</sup>

Of the original survey respondents, two-thirds of utilities expect to employ the same number of people in renewable energy through 2012 (Figure 42). A quarter, however, expect to hire additional staff to manage the anticipated increase in renewable market activity in their service territories.

---

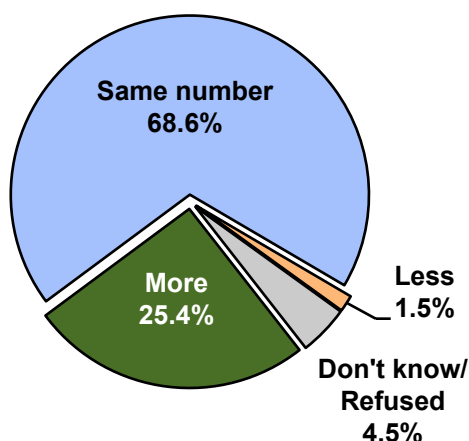
<sup>13</sup> 12 of the original 79 respondents were reclassified as project developers in 2011 (included in the “Other” category).

<sup>14</sup> The utility chapter is based on the original 2010 Census, the data from which was reanalyzed and where appropriate, combined with other data covering the 2010 reporting year. However, future hiring estimates for the utilities were over a 24-month period, i.e. 2010-2012, which aligns with the 2011 survey estimates for the solar industry covering 2011-2012.

<sup>15</sup> Both ‘211’ numbers are correct and only coincidentally the same.

<sup>16</sup> Based on information published in SEPA’s 2010 Utility Solar Rankings report, the participating utilities of which represented an estimated 99% of the solar market in 2010.

**Figure 42: 24-Month Renewable Energy Hiring Expectations—Utilities**



However, the types of occupations employed by utilities vary depending largely on the kind of solar market activity occurring in the state for that utility, i.e. distributed, centralized or both. Table 2 depicts employment projections for 2012 in four example occupational categories posed in the survey. Customer management, associated with distributed, net metered solar projects, was the most common employee type; utility procurement, associated with formal, centralized project developments, the least. This corresponds well with almost all utilities having distributed market activity, often as their first area of solar growth, while centralized project development is a more early stage area of solar market development for a fewer number of utilities, though it is growing.

SEPA's 2010 Utility Solar Rankings Report identified large growth in both of these distributed and centralized market areas, including almost 50,000 distributed projects nationally. On the centralized side only two solar projects greater than 10 megawatts were completed in 2009, and an additional seven were completed in 2010. Project tracking for 2011 indicates that upwards of 25 of these larger projects may be completed this year. Given the rapid growth of both distributed and centralized markets across the U.S., it is no surprise that employment growth projections ranged from 10 to 19 percent across these categories (Table 2).<sup>17</sup> However, given the nature of combining two specialized employment areas—utilities and solar—utilities did indicate a high degree of difficulty hiring qualified staff in these areas.

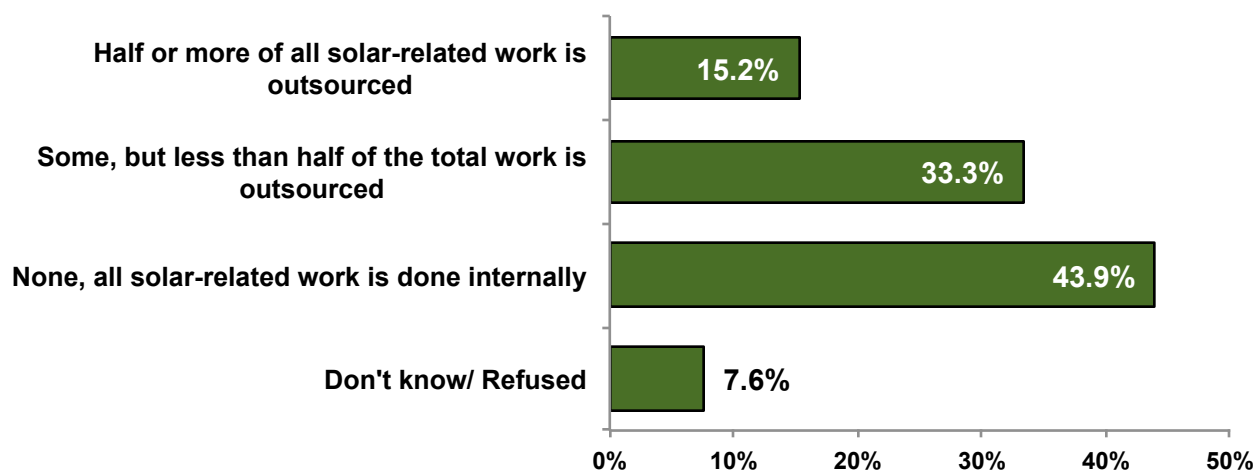
<sup>17</sup> The range for solar utility procurement is based on including (28%) or excluding (14%) one outlier data point.

**Table 2: 2012 Projection of Occupational Data—Utilities**

| <i>Occupation Category</i> | <i>Primary Solar Market Segment</i> | <i>Percent Employing</i> | <i>Difficulty hiring</i> | <i>Growth</i> |
|----------------------------|-------------------------------------|--------------------------|--------------------------|---------------|
| Solar customer management  | Distributed                         | 73%                      | 45%                      | 10%           |
| Solar utility procurement  | Centralized                         | 50%                      | 41%                      | 14-28%        |
| Solar planners             | Centralized                         | 59%                      | 47%                      | 12%           |
| Solar support staff        | Both                                | 67%                      | 30%                      | 19%           |

Given these hiring difficulties, the specialized employment area that solar represents in the utility industry and the overall economic pressure, it is not surprising that almost 50% of the respondents indicate that they outsource at least some of their solar work (Figure 43) – 33% outsource less than half; 15% outsource half or more. Outsourcing can take the form of anything from solar incentive program design and/or management to request-for-proposal procurement assistance to market or engineering studies and analysis.

**Figure 43: Utility Outsourcing**

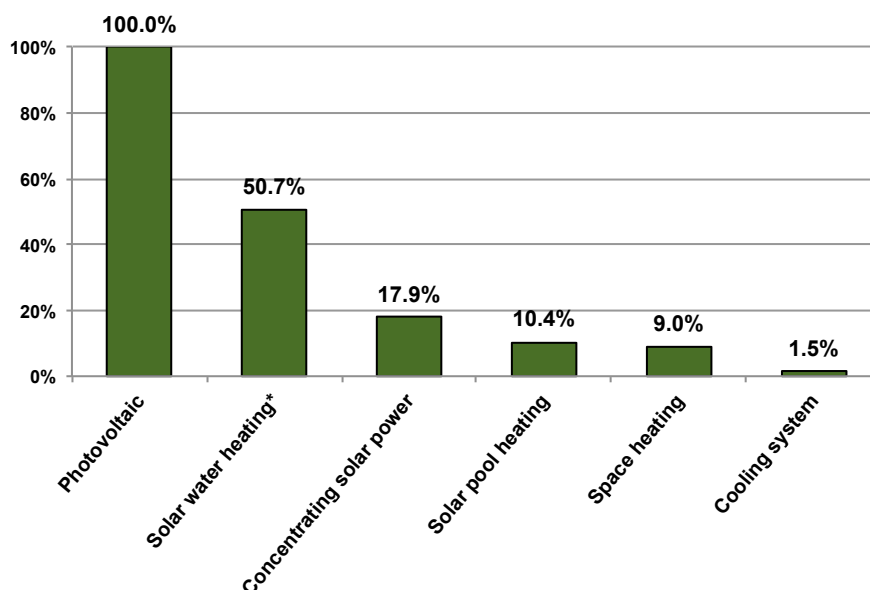


## Solar Market Data

In the electricity markets, according to SEPA's 2010 Utility Solar Rankings report, utilities integrated 780 MW<sub>AC</sub> of solar in 2010, the majority PV, and the majority of that in distributed markets. It is not surprising that the survey indicated 100% of utilities were involved with PV technologies, followed by 18% in concentrating solar power (Figure 44). CSP's lower percentage is also not surprising given the solar irradiation bias toward the southwestern U.S., where fewer utilities are located. However, over half of the surveyed utilities also indicated that they have

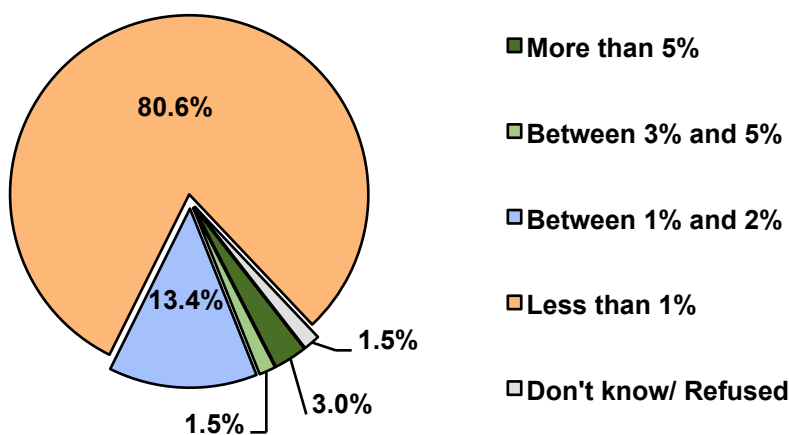
been involved with solar water heating technologies and significantly smaller numbers in solar pool heating, spacing heating or cooling.<sup>18</sup>

**Figure 44: Utility Experience with Solar Technology**



However, even with the large growth, solar makes up a small percentage of utilities' electricity on a cumulative basis, totaling less than one percent for over 80% of respondents (Figure 44). Only three percent indicated having portfolios that include more than five percent solar.

**Figure 45: Utilities Percentage of Electricity from Solar**

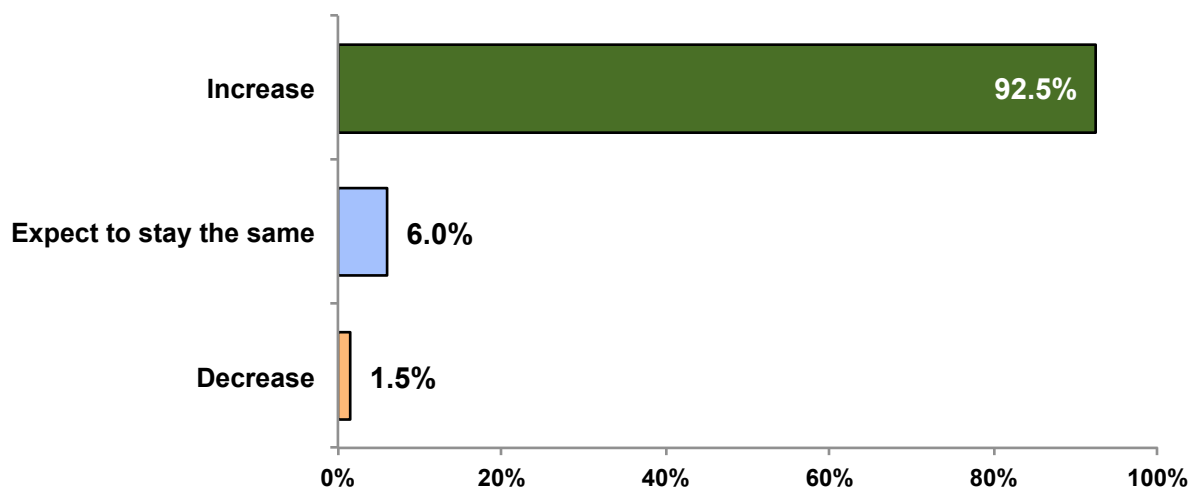


<sup>18</sup> The survey distribution was biased toward SEPA member electric-only or electric-gas utilities (versus gas-only), which may under-represent non-electric solar thermal utility activity in the overall market.

While these cumulative numbers are small, solar makes up a larger proportion of new generation constructed annually. According to the Energy Information Administration, nationally there were 16,409 MW of new generating capacity from all fuel sources (coal, gas, wind, solar, etc.) added in 2010, of which 221 MW<sub>AC</sub> or 1.3% were solar.<sup>19</sup> However, this data only captures solar projects on the utility side of the meter, excluding an estimated 559 MW<sub>AC</sub> of net metered photovoltaics. When this is factored in, solar's proportion of new generating capacity is estimated at 4.6% in 2010, a small, but more notable amount. Solar capacity is expected to increase 1200-1600 MW<sub>AC</sub> in 2011, an amount that if new generating capacity held constant (an admitted unknown), would increase solar's percentage to 7-10%.<sup>20</sup> These numbers show that relative to new generation, solar is gaining ground.

The survey appears to support this data. According to the 2010 survey, nearly all utilities expect an increase in their solar portfolio by 2012 (Figure 46). Relatively few utilities expect to stay the same, and almost none expect a decrease in their solar profile.

**Figure 46: Expected Change in Solar Portfolio by 2012—Utilities**



<sup>19</sup> U.S. Energy Information Administration, *Electric Power Monthly*, March 2011, Table ES3. New U.S. Electric Generating Units by Operating Company, Plant and Month, 2010 and 2011. <http://www.eia.gov/ftproot/electricity/epm/02261103.pdf>

<sup>20</sup> Solar generating capacity percentages will be higher than actual electricity generated in a similar comparison due to solar's lower capacity factors.



## “Utility” Company Profiles: Austin Energy and Pacific Gas and Electric

Utilities vary greatly from one another in terms of utility type, size, wholesale costs, customer rates, and regulatory considerations, all of which relate the type (distributed, centralized, or both), scale (tens of kilowatts or megawatts annually) and growth rates of their particular solar market. Largely distributed markets will bias toward utility staff involved in customer relationships related to interconnection oversight, incentive program management, and marketing/education. Centralized markets, or those predicting growth in the future, will include staff managing planning and procurement on the supply side of the utility. Many utilities work in both areas.

The following utility profiles illustrate two solar-active utilities of very different types and geographies – Austin Energy, a municipal utility in Texas, and Pacific Gas & Electric, an investor-owned utility in California. These profiles have been abbreviated to fit into this report chapter; more detailed information and additional utilities will be provided in a SEPA technical brief to be issued in late 2011.

Distributed market activity includes incentives for both residential and commercial customers, the installation of projects on city-owned buildings, and a solar schools outreach and education program.



Company: Austin Energy  
Location: Austin, Texas  
Utility-Type: Municipal  
Employees: 1,700  
Website: [www.austinenergy.com](http://www.austinenergy.com)

Installations on City buildings currently total about 450 kW, increasing annually. The first ribbon cutting for a Solar for Schools project is expected in late 2011. The school installations are free-standing solar-covered learning centers that are designed with education in mind, rather than the generation of solar kilowatt-hours. Austin Electric currently employs approximately seven full-time equivalent employees (FTEs) to manage its customer, city and schools solar programs, which totaled 1.4 MW and 172 projects in 2010.

The Solar Incentives Unit manages the incentive and schools program with four full-time employees. Engineering Services handles the city projects with a portion of two people's time, one at about 50 percent and the other at about 25 percent. Market Operations, which procures fuel and alternative energy, is overseeing the development of the 30 MW plant and procured the project in a request for proposals, and is now ensuring that project milestones are met with the private solar developer. One person works on this project between 50 and 75 percent of the time during this development phase, but when the plant goes online, that workload will “decrease dramatically.” Two people in Market Research work on solar about 25 percent of the time each in regulatory and reporting requirements.

With all of the inspections currently scheduled, the city's electrical inspector is working about “200 percent” of the time on solar right now. The Vice President of Distributed Energy Services spends about 15 to 25 percent of time meeting with people in the community and talking about solar. Many other utility staff, such as those in customer service, legal, billing, etc, also touch solar “a bit,” but not to a large degree.

## Pacific Gas & Electric (PG&E)

PG&E is an investor-owned utility in San Francisco, California, serving over 5 million electric customers. Approximately 55,000 of its customers have on-site solar systems totaling close to 500 MWAC. PG&E is preparing for compliance with the state's new 33% by 2020 renewable portfolio standard, and implementation of a separate 765 MW customer rooftop allocation under the California Solar Initiative. PG&E has a significant large solar project pipeline totaling an estimated 35 projects and 4,350 MWAC coming online between 2011-2017.

In general, PG&E offers two types of solar energy programs, one for customers of the utility and one for providers, i.e. solar developers. Furthermore, PG&E is participating in a five-year solar PV program to develop and/or execute power purchase agreements (PPAs) for up to 500 MW of solar PV facilities in the 1 to 20 MW range in PG&E's service territory.

Rather than using solar project size as an internal staff or workload organizing principle, the utility divides the effort by the project metering configuration, i.e. customer or utility side the meter.

Company: Pacific Gas & Electric  
Location: San Francisco, California  
Utility-Type: Investor-owned  
Employees: 20,000  
Website: [www.pge.com](http://www.pge.com)



For customer-side generation, PG&E offers both residential and commercial programs for net metered rooftop solar installations. The majority of the work revolves around the solar incentives program, following the California Solar Initiative program guidelines. Customer Generation is part of the overall Customer Care program, which reviews customer applications, qualifies customer projects, and cuts rebate checks. The Marketing Group promotes the solar program to customers, while the Generation Interconnection Services Group is responsible for the interconnection of solar projects.

In addition, PG&E staff actively participates in regulatory and other stakeholder processes related to renewable policy development, and program implementation. Government Relations works on the legislative side of solar, advocating for or against proposed state or federal legislation. Service Analysis is involved in the broad policy issues surrounding distributed generation.

The utility-metered provider program is supply-focused and involves an assortment of solicitation programs for obtaining solar on the utility side of the meter from various sources and project sizes managed by the Energy Procurement Group. PPA procurement options include traditional centralized RFPs, bilateral negotiations with individual projects, and streamlined distributed generation auctions (i.e., the Renewable Auction Mechanism).

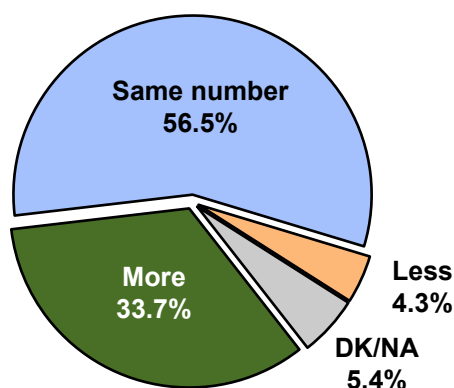
The Renewable Resource Development group within the Energy Procurement organization works on the projects PG&E will own, and solicits the necessary services to engineer, procure and construct the utility-owned PV project. Separately, PG&E may purchase PV modules directly from a PV module supplier. For these projects, either PG&E personnel or a contractor will operate and maintain the project through the sister department to Energy Procurement called Energy Generation.

Regulatory Relations and Government Relations focus on renewable portfolio standards, including implementation and other renewables issues. Legal reviews contracts and participates in all aspects of renewable program development and implementation. The Generation Interconnection Services Group is responsible for the interconnection of these types of projects as well.

### 3.5 Other

In addition to the solar industry subsectors already referenced in this report, a significant number of the solar establishments participating in this study did not identify with any of the specific subsectors presented to them. These firms, which have been grouped into the “other” category, include those engaged in project development, research and development, and finance. Though none of these additional solar subsectors was large enough from an employment perspective to warrant its own section<sup>21</sup>, the firms in this category collectively employ more than 5,500 workers. The “other” firms surveyed for this report are expecting a strong growth rate of 15.5%, growth of 855 new jobs, over the coming 12 months, and about one firm in three expects to add solar workers.

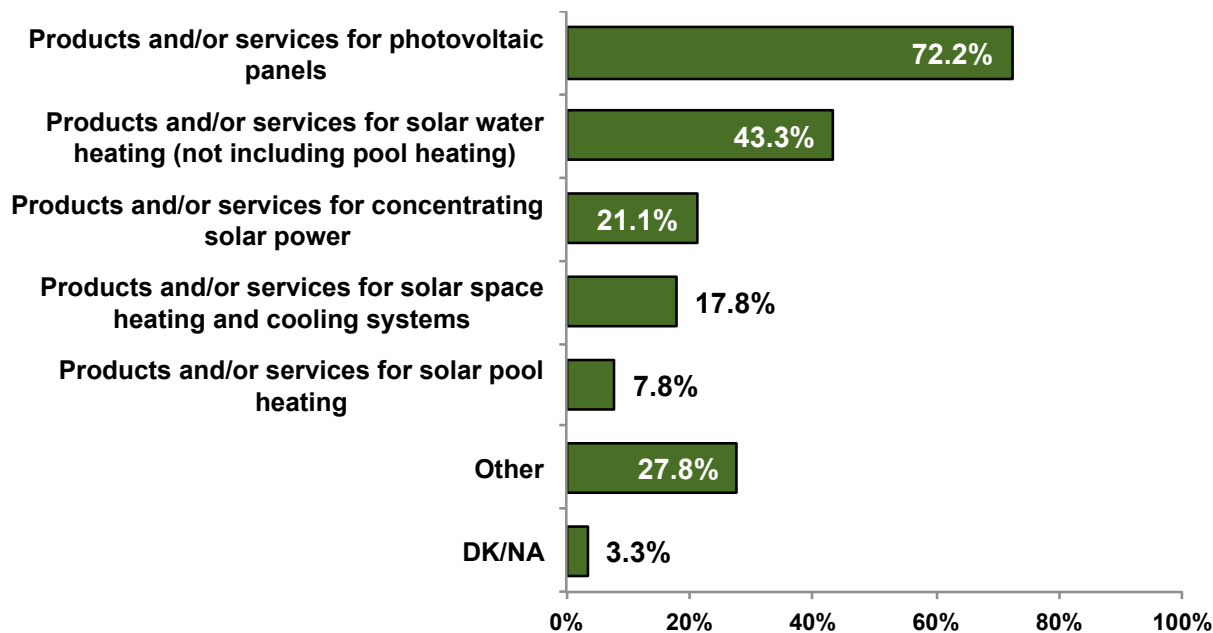
**Figure 47: 12-Month Growth—Other**



<sup>21</sup> Nor were they specifically targeted.

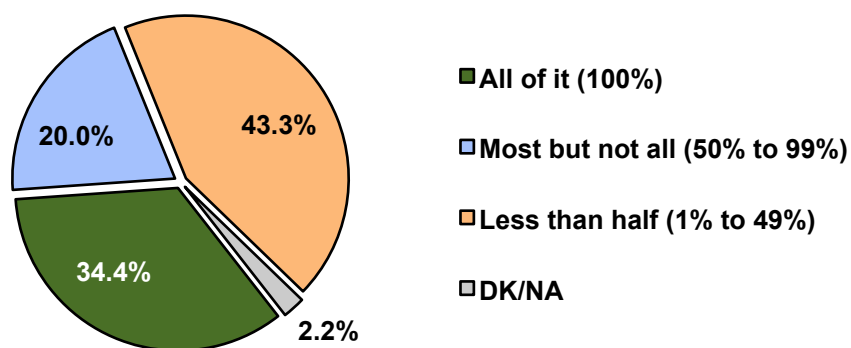
Establishments in this category reported working predominantly with photovoltaic panels, though water heating is also clearly important. Many firms work with more than one technology (Figure 48).

**Figure 48: Percentage of Firms by Technology—Other**



Though more than one-third of the establishments in this category reported being a 100% solar-related businesses, this category has the highest percentage of establishments (43%) that report less than half their revenue coming from solar work (Figure 49).

**Figure 49: Percentage of Revenue Related to Solar Products—Other**



## “Other” Company Profile: Seminole Financial

Seminole Financial Services (SFS) is the operating company for the Seminole Companies (Seminole) -- a group of interrelated financial services companies operating in the commercial real estate and renewable energy sectors. Seminole was formed for the purpose of providing investment management services to various institutional investors, and to provide construction/interim financing for various real estate and renewable energy transactions. SFS is a full service, national organization that performs loan origination, in house underwriting, asset management, and loan servicing functions. Currently, SFS manages several hundred million dollars in commercial and renewable energy assets nationwide.

As the Senior Vice President of Renewable Energy Finance for SFS, Chris Diaz oversees all solar and wind financial transactions. SFS originates deals between \$2 million and \$30 million, because 500 kW – 8 MW projects frequently have difficulty being financed. SFS has created an extremely successful program to help provide capital to these finance deprived projects. According to Diaz, “Working in the solar industry is a rewarding experience because it allows us to simultaneously finance and develop important business projects while also being conscious stewards of the Earth.”



Company: Seminole Financial  
 Headquarters: Belleair Bluffs, Florida  
 Subsector: Other  
 Website: [www.seminolefinancialservices.com](http://www.seminolefinancialservices.com)

Having closed nearly \$100 million in renewable energy construction loans, SFS’s work has enjoyed tremendous success in the solar industry. SFS has completed projects in eight states (Arizona, California, Colorado, Florida, New Jersey, North Carolina, Oregon and Washington) and expects to close transactions in four additional states (Iowa, Massachusetts, Montana and New Mexico) by the end of the year.

While its work has been largely confined to construction transactions, SFS has recently begun executing and managing permanent debt transactions. The biggest challenge in incorporating this into its existing business plan is the lack of synergy between permanent debt and tax credit syndication for transactions of this size. By the end of October 2011, SFS expects to close on approximately \$25 million in permanent debt transactions. SFS also expects to expand its permanent debt work in the coming year, alongside its existing construction loan program. This increase in solar portfolio has led to an increase in solar jobs at SFS and the company plans to increase its solar workforce over the next twelve months.



## 4. *Conclusions and Recommendations*

The solar industry is a large and growing part of the economy, and its importance should only increase as incentives, consumers, and government regulations continue to favor a move toward clean energy sources. Already the solar industry is responsible for more than 100,200 U.S. jobs at more than 17,000 employment locations. The solar energy workforce grew an impressive 6.8% over the last year—nearly 10 times the overall national employment growth rate—and is expected to grow an astounding 24% in the next 12 months. In addition to beating the national average, this rate of growth soundly outpaces both the 0.7% growth predicted for the electricity generation industry as a whole and the negative growth (-2%) expected in the fossil fuels industry.

Supporting the solar industry presents an excellent opportunity to promote job creation, increase the availability of clean, locally sourced energy, and boost the economy as a whole. The research suggests several key steps that policymakers, workforce training providers, and the solar community at large can take to foster solar industry growth.

### **Recommendations for Policymakers:**

***Recommendation #1: Stable and consistent incentives and renewable goals are important ways to encourage employers to grow their businesses.*** The 2011 Census shows that employers pay attention to incentives and regulations when planning for the future. When policymakers create new incentives and encourage investments, it signals to employers that the business climate is friendly, thus prompting private investment and job creation. However, it is important to note that in order to create a healthy and vibrant market, a sequence of long-term policies is key.

***Recommendation #2: Create jobs by developing incentives that increase adoption of solar for consumers and businesses.*** The U.S. solar industry shows significant strength across the entire value chain, from research and development to maintenance. As a result, increases in solar installations lead to employment growth across the board—not only in manufacturing but in research and development, installation, and other related occupations. As evidenced in this Census, job growth has grown in correlation with installed megawatts, suggesting the strong link between solar adoption and job creation, and how appropriate policies lead to solar adoption. According to the state-level data collected for the 2011 Census, all but two of the top 20 states have a Renewable Portfolio Standard (RPS), and all but five allow third-party financing. Also, 14 of the top 20 states scored an “A” in net metering, and 16 scored “B” or better in interconnection, as rated by Network for New Energy Choices.

***Recommendation #3: Invest in solar training, but recognize that although some entry-level positions do exist, the majority of solar jobs tend to be in high-skill occupations.*** While solar energy creates jobs across a wide variety of occupations and technologies, solar jobs tend to be

for more highly skilled workers and expectations in creating job opportunities for lower-skilled workers should be managed. Programs that give high-skilled workers new or updated skills or experience and entry-level programs through technical high schools, community based organizations, and community colleges that prepare lower-skilled workers to move into more highly skilled occupations are greatly beneficial to the industry.

### **Recommendations for Workforce Training Providers**

***Recommendation #1: Connect to local employers to understand specific needs.*** The solar industry is experiencing consolidation and specialization, with several large installation firms coordinating popular alternative financing models. This is changing the way work is done in any given area, so connecting to local employers is even more important to understand specific local needs. For example, some of the larger installation employers conduct their operations—including site assessment, sales, and customer service—off-site while hiring local installation firms to perform the site work. In such a scenario, it is important for local training providers to understand their local workforce needs.

***Recommendation #2: Focus training efforts on workers who already have some occupational experience.*** Research shows that the most successful candidates for solar industry jobs are those who already have work experience directly related to the position they are hoping to fill, and solar employers tend to value this type of experience much more than classroom or on-the-job training. When choosing training program candidates, the focus should be on updating or strengthening participants' existing skills, not starting from scratch.

***Recommendation #3: Train workers for the full spectrum of solar occupations, particularly those in sales and manufacturing.*** Despite a high demand for a wide variety of occupations within the solar industry, training programs typically focus on just one or two industry job functions, with installation being particularly popular. To serve the needs of the industry and aid as many job seekers as possible, training programs should offer skill development opportunities across the full range of occupations. Training workers for jobs in sales and manufacturing will prove particularly beneficial.

### **Recommendations for Employers and the Solar Community**

***Recommendation #1: Develop targeted, regionally relevant energy usage information and promote programs that maximize rapid adoption of energy conservation policies.*** Being able to provide state and local governments with better information about local energy use patterns would help policymakers see the need for additional solar incentives and empower them to design those incentives to best benefit consumers and the industry alike. For example, the average home in the northeast uses more energy for heating than electricity, and this heat often is generated by oil and natural gas. Solar technologies are used extensively in other countries for



heating as well as electric production; knowing this could have a big impact on the types of incentives offered in that part of the country.

***Recommendation #2: Develop a better working knowledge of state, local, and federal incentives in order to help consumers make informed decisions and to offer better turnkey solutions.*** Knowing more about what incentives exist will help solar firms to develop services that best take advantage of those incentives and guide consumers to the most cost-effective solutions.

***Recommendation #3: Recognize the importance of local, state, and federal advocacy organizations.*** In any industry, developing relationships with like-minded advocacy groups is key to making the sector's voice heard. Through these groups, the solar industry can educate policymakers and the public about the benefits of solar energy and the number of jobs the industry creates. Raising awareness of these important attributes will allow the industry to effectively promote new incentives and other favorable policies.

Over the past few decades, the solar industry has grown from a niche market to a major economic force. With even greater growth in the foreseeable future, the industry stands as a notable bright spot on the nation's employment landscape. Working together to support the continued growth of solar energy, policymakers, workforce training providers, and the industry have an excellent opportunity to boost the struggling economy and reduce fossil fuel dependence while creating good jobs for skilled workers.



## 5. Appendices

### 5.1 Data Limitations and Methodology

#### 2010 Methodology

The following three-phased approach describes the survey methodology to gather employer information from both self-identified or known solar employers, those firms 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 section describes the process that was followed for all of the solar employer surveys except for those completed by utilities.

**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 a collaborative effort between the national solar industry associations and 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, research & 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, sales and distribution, 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 percent level of confidence, is between +/- 1.06 percent and +/- 1.76 percent (depending on the distribution of each question) for questions answered by all 2,181 employers from the universe of 7,440 solar employment locations estimated in the known universe. This also represents a response rate of 29 percent from the database of known solar employers, which includes employers in manufacturing, installation, sales and distribution, research & development and other related solar industries.

It is important to note that questions asked of smaller sub-groups of respondents (such as component manufacturers) will have a margin of error greater than +/-1.76 percent, 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 sales and distribution, 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 less employees or 5 or more employees). These results represent the solar employers that make up the sales and distribution, manufacturing, and construction industry employers within specific NAICS industry.

It is important to note that the percentage of overlap between the known and unknown universe of solar employers was calculated based on the incidence of firms that were sampled as part of the unknown universe but also found to be in the known universe file or firms that indicated they had already completed a similar survey. The resulting calculation of overlapping firms was taken out of the total estimate of firms in the known universe of solar employers.

**Sales and distribution:** Provides the cleanest opportunity to interview firms 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 InfoUSA, there are 1,558 firms that indicated one of these two sales and distribution designations as their primary industry classification and 778 that indicated them as their secondary classification. All 2,336 firms that identified one of these two NAICS codes as

their primary or secondary industry classification 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 firms that manufacture solar products and components. These NAICS codes were:

333611 – Turbine and turbine generator set unit manufacturing

334413 - Semiconductor and related device manufacturing

335911 - Storage battery manufacturing.

According to InfoUSA, there are 2,582 firms that indicated one of these three manufacturing designations as their primary industry classification and 1,994 that indicated them as their secondary classification. All 4,576 firms that were identified in one of these three NAICS codes as their primary or secondary 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 firms 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 214,131 firms that indicated one of these five construction designations as their primary industry classification. A total of 10,000 firms 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 sales and distribution, manufacturing, and the construction industry, at the 95 percent level of confidence,

is between +/- 3.79 percent and +/- 6.31 percent (depending on the distribution of each question) for questions answered by all 235 employers that completed a survey from the universe of 9,263 solar employment locations estimated of unknown employers in sales and distribution, manufacturing and construction.

It is important to note that questions asked of smaller sub-groups will have a margin of error greater than +/-6.31 percent, with the exact margin of error dependent on the number of respondents within each sub-group as well as the distribution of responses.

### Methodology for Utilities Survey

The survey methodology for the utilities survey was an online or telephone survey census of all solar utility employers. All solar utility employers identified by Solar Electric Power Association were sent an email invitation to complete the survey. Those employers that did not complete an online survey were called via telephone and asked to participate in a short survey. In total, 79 utilities completed a survey, from a total contact list of 149, resulting in a response rate of over 50 percent.

## **2011 Methodology**

In 2011, BW Research Partnership was commissioned to update the 2010 Census by completing additional sampling in both the known and unknown universes. This data collection effort was combined with data collected by BW Research Partnership in collaboration with The Solar Foundation for the California Community Colleges Centers of Excellence initiative. The data from California represents the known data collection from that state that is included in this report. For this study, data were collected for known employers outside of California, and a random sampling of the unknown universe was conducted on a national basis to determine growth and retraction of solar establishments since 2010.

The survey was administered by telephone and online, with a total of 1,149 survey responses for a combined margin of error of +/-2.79% at a 95% confidence interval. These figures were applied to the 2010 data to produce the results of this report.

## **5.2 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.



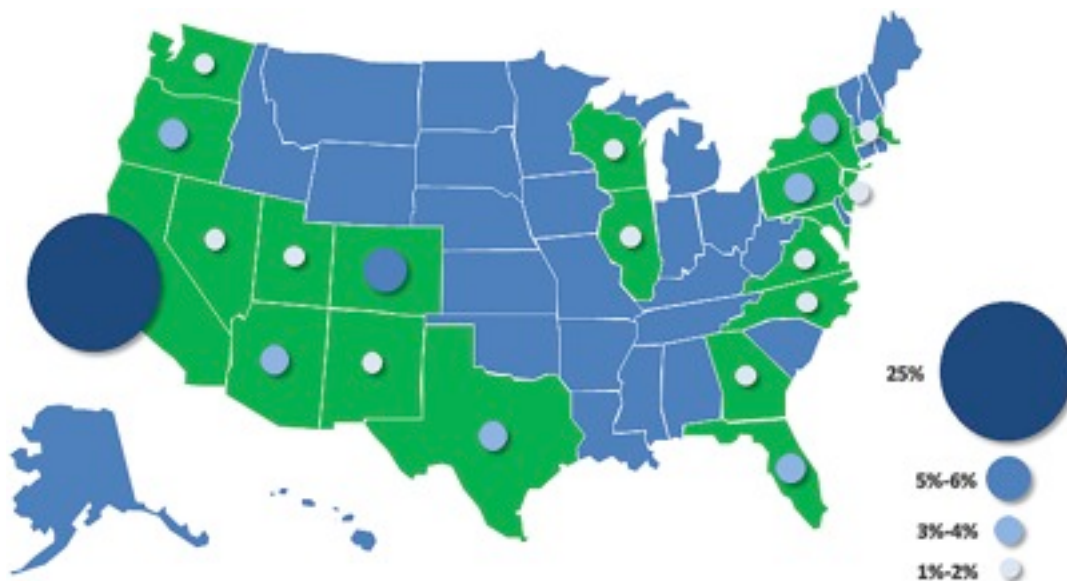
### 5.3 State-by-State Data Collection

The Solar Foundation conducted a state-level analysis of the data collected for this report. The figures reported below are conservative, baseline estimates that likely undercount the solar establishments and workers in any given state. These counts only include establishments engaged in installation, manufacturing, or sales and distribution and do not count academic institutions, government or nonprofit entities, accounting firms, legal offices, some research firms, and other ancillary employers. It should be noted that accurate and reliable state-level data require individual sampling plans for each state. States interested in individual reports should contact The Solar Foundation and BW Research Partnership.

**Please note:** the estimated state employment totals in this section of the report are subject to significant uncertainties. As a result of these uncertainties, the consequent rankings of states are subject to revision, and may not reflect state employment survey results developed from other sources.

Based on the analysis, the top 10 states for solar jobs are:

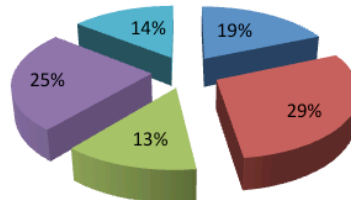
| Rank | State         | Estimated Solar Jobs | Estimated Solar Establishments |
|------|---------------|----------------------|--------------------------------|
| 1    | California    | 25,575               | 3,550                          |
| 2    | Colorado      | 6,186                | 1,020                          |
| 3    | Arizona       | 4,786                | 980                            |
| 4    | Pennsylvania  | 4,703                | 750                            |
| 5    | New York      | 4,279                | 840                            |
| 6    | Florida       | 4,224                | 825                            |
| 7    | Texas         | 3,346                | 665                            |
| 8    | Oregon        | 3,346                | 545                            |
| 9    | New Jersey    | 2,871                | 480                            |
| 10   | Massachusetts | 2,395                | 410                            |



The following figures provide the value-chain breakdowns for the top five states for solar employment.

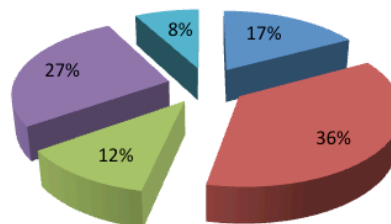
### Value Chain Breakdown for California

■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other



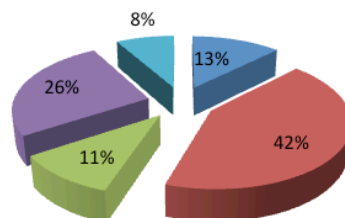
### Value Chain Breakdown for Arizona

■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other



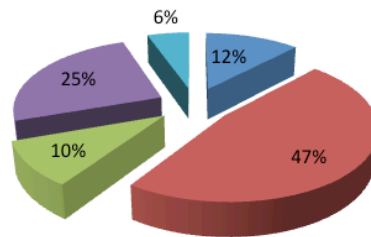
### Value Chain Breakdown for Colorado

■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other



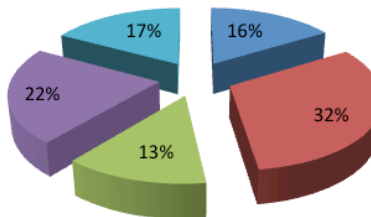
### Value Chain Breakdown for Pennsylvania

■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other



### Value Chain Breakdown for New York

■ Manufacturing ■ Installation ■ Research & Development ■ Sales ■ Other



| Demographics |           |            |                             |                                   | Energy Data                              |                                       |                                                                   |                                                                                 |                                                                |                                                                                                            |
|--------------|-----------|------------|-----------------------------|-----------------------------------|------------------------------------------|---------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|
| State        | Jobs      | Population | Rank: Solar Jobs per Capita | Percent Unemployed* [US Avg: 9.1] | FTG Grade <sup>1</sup> : Interconnection | FTG Grade <sup>2</sup> : Net Metering | Avg. IOU Electric Rates <sup>3</sup> (cents/ kWh) [US Avg: 14.58] | Avg. Natural Gas Prices <sup>4</sup> (\$/1000 ft <sup>3</sup> ) [US Avg: 12.44] | Energy Consumption <sup>5</sup> (trillion Btu) [US Avg: 1,851] | Quick Fact <sup>6</sup>                                                                                    |
| CA           | 25,575.41 | 37,253,956 | #6                          | 12.1                              | B                                        | A                                     | 15.56                                                             | 9.34                                                                            | 8,005.5 (Rank: #2)                                             | Low per-capita energy consumption due to climate; Imports more electricity than any other state            |
| CO           | 6,186.31  | 5,029,196  | #1                          | 8.5                               | B                                        | A                                     | 10.55                                                             | 8.84                                                                            | 1,452.2 (Rank: #25)                                            | Contains ten of the U.S.'s 100 largest natural gas fields and three of the nation's 100 largest oil fields |
| AZ           | 4,785.89  | 6,392,017  | #5                          | 9.3                               | N/A                                      | A                                     | 10.90                                                             | 17.26                                                                           | 1,454.3 (Rank: #24)                                            | Exports large amounts of electricity, especially to CA; Deserts offer some of the best solar resources     |
| PA           | 4,703.09  | 12,702,379 | #8                          | 8.2                               | B                                        | A                                     | 12.02                                                             | 15.16                                                                           | 3,654.1 (Rank: #6)                                             | Major coal-producing state, sells approximately half of its coal to Eastern and Midwestern states          |
| NY           | 4,278.63  | 19,378,102 | #16                         | 8.0                               | B                                        | B                                     | 17.10                                                             | 14.99                                                                           | 3,818.5 (Rank: #4)                                             | Low per-capita energy consumption due to mass transit; Among largest producers of hydroelectricity         |
| FL           | 4,224.18  | 18,801,310 | #15                         | 10.7                              | C                                        | A                                     | 12.64                                                             | 19.03                                                                           | 4,295.2 (Rank: #3)                                             | High per-capita residential electricity demand; Leads nation in petroleum-fired generation                 |
| TX           | 3,346.20  | 25,145,561 | #19                         | 8.5                               | C                                        | N/A                                   | 9.29                                                              | 11.46                                                                           | 11,297.4 (Rank: #1)                                            | Leading natural gas producer in U.S. (30% of total); Leads the U.S. in wind generation (>2,000 turbines)   |
| OR           | 3,345.76  | 3,831,074  | #3                          | 9.6                               | B                                        | A                                     | 7.41                                                              | 14.73                                                                           | 1,066.5 (Rank: #31)                                            | 2/3 of electricity from hydro; Major transmission lines allow for large interstate electricity transfers   |
| NJ           | 2,871.11  | 8,791,894  | #11                         | 9.4                               | B                                        | A                                     | 16.31                                                             | 14.94                                                                           | 2,393.6 (Rank: #13)                                            | Energy consumption dominated by transportation; Over 50% of electricity comes from nuclear                 |
| MA           | 2,395.08  | 6,547,629  | #9                          | 7.4                               | A                                        | A                                     | 17.73                                                             | 15.69                                                                           | 1,426.0 (Rank: #27)                                            | Coal accounts for 25% of electricity generation; Plans for nation's first offshore wind farm               |
| NC           | 2,391.65  | 9,535,483  | #14                         | 10.4                              | B                                        | D                                     | 9.57                                                              | 14.43                                                                           | 2,545.4 (Rank: #12)                                            | One of the top nuclear power producers in the U.S.; Ranks in top 10 states for wind power capacity         |

|    |          |            |     |      |     |   |       |       |                        |                                                                                                        |
|----|----------|------------|-----|------|-----|---|-------|-------|------------------------|--------------------------------------------------------------------------------------------------------|
| WA | 2,301.37 | 6,724,540  | #10 | 9.3  | D   | B | 8.29  | 14.46 | 2,032.9<br>(Rank: #16) | Top hydroelectric producer in the U.S.; Large producer of energy from wood, wind & wood waste          |
| NM | 2,099.53 | 2,059,179  | #2  | 6.6  | B   | B | 9.71  | 9.13  | 670.1<br>(Rank: #38)   | Produces 10% of nation's natural gas; NM is among the largest producers of crude oil and natural gas   |
| NV | 2,024.95 | 2,700,551  | #4  | 13.4 | B   | B | 13.41 | 12.93 | 707.6<br>(Rank: #37)   | "Substantial" producer of solar energy; Second only to California in geothermal electricity generation |
| UT | 1,876.28 | 2,763,885  | #7  | 7.6  | A   | A | 8.56  | 9.35  | 754.5<br>(Rank: #35)   | Among the few states with geothermal electric generation; 80% of homes heated with natural gas         |
| MD | 1,781.63 | 5,773,552  | #12 | 7.3  | B   | A | 14.46 | 14.25 | 1,429.3<br>(Rank: #26) | 25% of electricity generated in-state is nuclear; requires ethanol blended gasoline in central state   |
| GA | 1,732.80 | 9,687,653  | #18 | 10.2 | N/A | F | 10.14 | 16.26 | 2,949.3<br>(Rank: #9)  | Electricity generation and consumption among highest in U.S.; Most generation uses coal                |
| WI | 1,676.67 | 5,686,986  | #13 | 7.9  | D   | D | 11.81 | 11.27 | 1,744.6<br>(Rank #21)  | Relies on coal for 2/3 of electricity generation; Industrial sector consumes most energy in state      |
| VA | 1,527.61 | 8,001,024  | #17 | 6.3  | A   | B | 9.19  | 13.62 | 2,385.8<br>(Rank: #14) | Provides 10% of coal produced east of Mississippi River; 1/3 of in-state generation is nuclear         |
| IL | 1,491.32 | 12,830,632 | #20 | 9.9  | B   | B | 10.70 | 8.93  | 3,815.1<br>(Rank: #5)  | Among the top ethanol producers in the nation; Transportation hub for oil and natural gas              |

\* Source: U.S. Census, *Resident Population of the 50 States (2010)* [http://2010.census.gov/news/xls/apport2010\\_table2.xls](http://2010.census.gov/news/xls/apport2010_table2.xls)

° Source: U.S. Bureau of Labor Statistics, *Unemployment Rates for States (August 2011)* <http://www.bls.gov/web/laus/laumstrk.htm>

² Source: Network for New Energy Choices, *Freeing the Grid (2011)* [Preliminary Numbers]

^ Source: Energy Information Administration, *Average Retail Price by State and Utility: Residential Sector (2009)* <http://205.254.135.24/cneaf/electricity/esr/table6.xls>

ˆ Source: Energy Information Administration, *Average Price of Natural Gas Sold to Residential Consumers, by State, 2009-2011 (2009 6 month YTD)* [http://205.254.135.24/pub/oil\\_gas/natural\\_gas/data\\_publications/natural\\_gas\\_monthly/current/pdf/table\\_18.pdf](http://205.254.135.24/pub/oil_gas/natural_gas/data_publications/natural_gas_monthly/current/pdf/table_18.pdf)

° Source: Energy Information Administration, *Energy Consumption by End-Use Sector, Ranked by State, 2009* [http://205.254.135.24/state/seds/hf.jsp?incfile=sep\\_sum/html/rank\\_use.html](http://205.254.135.24/state/seds/hf.jsp?incfile=sep_sum/html/rank_use.html)

ˆ Source: Energy Information Administration, *U.S. States* <http://205.254.135.24/state/>

| Solar Technology/ Policy |                                                               |                                                                                           |                  |                        |                                    |                                                                                                                                       |
|--------------------------|---------------------------------------------------------------|-------------------------------------------------------------------------------------------|------------------|------------------------|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| State                    | Max. Solar Resource <sup>3</sup><br>(kWh/m <sup>2</sup> /day) | Cumulative Installed Capacity <sup>™</sup><br>PV MW (Rank); CSP MW (Rank); SHC tsf (Rank) | RPS <sup>™</sup> | SRECs <sup>™</sup>     | 3 <sup>rd</sup> Party <sup>™</sup> | State/ Local Incentives <sup>™</sup><br>State Programs; # of local gov't programs; # of utility programs                              |
| CA                       | PV: 6.6<br>CSP: 8.0                                           | 971.2MWdc (#1); 363.8MWac (#1); 13,564 tsf (#2)                                           | 33% by 2020      | None                   | Authorized or Currently in Use     | State Programs: California Solar Initiative, Property Tax Exemption, California Feed-In Tariff; 13 local; 41 utility                  |
| CO                       | PV: 6.3<br>CSP: 7.3                                           | 107.8MWdc (#3); 1.0MWac (#5); 5,873 tsf (#7)                                              | 30% by 2020      | None                   | Authorized or Currently in Use     | State Programs: Sales and Property Tax Exemption, State Loan Program; 12 local; 11 utility                                            |
| AZ                       | PV: 6.6<br>CSP: 7.6                                           | 101MWdc (#4); 2.5MWac (#4); 6,381 tsf (#5)                                                | 15% by 2025      | None                   | Authorized or Currently in Use     | State Programs: Sales and Property Tax Exemption, Investment and Production Tax Credits, Business Tax Incentives; 5 local; 8 utility  |
| PA                       | PV: 4.8<br>CSP: 3.8                                           | 54MWdc (#8); N/A (NR); N/A (NR)                                                           | ~18% by 2021     | Yes; 0.5% by 2010      | Authorized or Currently in Use     | State Programs: State Loans, Grants and Rebates, Business Loans and Grants; 8 local; 3 utility                                        |
| NY                       | PV: 4.6<br>CSP: 3.7                                           | 54.5MWdc (#7); N/A (NR); 8,551 tsf (#4)                                                   | 29% by 2015      | None                   | Authorized or Currently in Use     | State Programs: Tax Credits and Exemptions, State Loans, Grants and Rebates; 4 local; 2 utility                                       |
| FL                       | PV: 5.6<br>CSP: 4.9                                           | 73.3MWdc (#6); 75.0MWac (#2); 19,828 (#1)                                                 | None             | None                   | Disallowed or Restricted           | State Programs: Sales Tax Exemption; 8 local; 22 utility                                                                              |
| TX                       | PV: 6.5<br>CSP: 7.0                                           | 30.6MWdc (#13); N/A (NR); 393 tsf (#19)                                                   | 5,880 MW by 2015 | None                   | Authorized or Currently in Use     | State Programs: State Grants and Loans, Property and Business Tax Exemptions; 2 local; 23 utility                                     |
| OR                       | PV: 5.8<br>CSP: 6.0                                           | 24.8MWdc (#14); N/A (NR); 2,569 tsf (#10)                                                 | 25% by 2025      | None                   | Authorized or Currently in Use     | State Programs: State Grants, Loans and Rebates, Property Tax Exemptions, Tax Credits, Performance Incentives; 0 local; 18 utility    |
| NJ                       | PV: 4.7<br>CSP: 4.1                                           | 293.1MWdc (#2); N/A (NR); N/A (NR)                                                        | 20.38% by 2021   | Yes; 5,316 GWh by 2025 | Authorized or Currently in Use     | State Programs: State Rebates, Sales and Property Tax Exemptions, Manufacturing Grants and Loans; 0 local; 2 utility                  |
| MA                       | PV: 4.3<br>CSP: 3.6                                           | 37.7MWdc (#12); N/A (NR); 1,685 tsf (#14)                                                 | 22.1% by 2020    | Yes; 400 MW            | Authorized or Currently in Use     | State Programs: State Grants and Rebates, Sales and Property Tax Exemptions, Tax Credits, Patent Deductions; 3 local; 8 utility       |
| NC                       | PV: 5.2<br>CSP: 4.2                                           | 42.4MWdc (#10); N/A (NR); 2,449 tsf (#11)                                                 | 12.5% by 2021    | Yes; 0.20% by 2018     | Disallowed or Restricted           | State Programs: State Loans, Property Tax Abatement, Tax Credits; 7 local; 14 utility                                                 |
| WA                       | PV: 4.9<br>CSP: 5.2                                           | 7.2MWdc (#20); N/A (NR); N/A (NR)                                                         | 15% by 2020      | None                   | Unclear or Unknown                 | State Programs: Sales Tax Exemption, Manufacturing Tax Abatement; 2 local; 19 utility                                                 |
| NM                       | PV: 6.5<br>CSP: 7.4                                           | 45.1MWdc (#9); N/A (NR); 2,143 tsf (#13)                                                  | 20% by 2020      | None                   | Authorized or Currently in Use     | State Programs: Investment, Production and Manufacturing Tax Credits, Sales Tax Exemption, State Bond Program; 1 local; 3 utility     |
| NV                       | PV: 6.6<br>CSP: 7.8                                           | 97.5MWdc (#5); 64.0MWac (#3); N/A (NR)                                                    | 25% by 2025      | None                   | Authorized or Currently in Use     | State Programs: Sales and Property Tax Abatement, State Rebates; 0 local; 4 utility                                                   |
| UT                       | PV: 6.3<br>CSP: 7.2                                           | N/A (NR); N/A (NR); N/A (NR)                                                              | 20% by 2025*     | None                   | Authorized or Currently in Use     | State Programs: Investment, Manufacturing, and Production Tax Credits, Sales Tax Exemptions, State Rebates; 0 local; 3 utility        |
| MD                       | PV: 4.8<br>CSP: 4.0                                           | 11.4MWdc (#18); N/A (NR); N/A (NR)                                                        | 20% by 2020      | Yes; 2.0% by 2022      | Authorized or Currently in Use     | State Programs: Investment and Production Tax Credits, Property and Sales Tax Incentives, State Loans and Rebates; 0 local; 0 utility |
| GA                       | PV: 5.3<br>CSP: 4.3                                           | N/A (NR); N/A (NR); N/A (NR)                                                              | None             | None                   | Disallowed or Restricted           | State Programs: Investment Tax Credit, State Loans; 2 local; 11 utility                                                               |
| WI                       | PV: 4.7<br>CSP: 3.7                                           | 8.0MWdc (#19); N/A (NR); 2,201 tsf (#12)                                                  | ~10% by 2015     | None                   | Unclear or Unknown                 | State Programs: Sales and Property Tax Exemptions, State Rebates; 1 local; 2 utility                                                  |
| VA                       | PV: 5.0<br>CSP: 4.1                                           | N/A (NR); N/A (NR); 226 tsf (#20)                                                         | 15% by 2025*     | None                   | Authorized or Currently in Use     | State Programs: State Loans and Leasing, Property Tax Exemptions, Manufacturing Grants, Jobs Tax Credits; 1 local; 2 utility          |
| IL                       | PV: 5.1<br>CSP: 4.1                                           | 14.7MWdc (#17); N/A (NR); 5,175 tsf (#8)                                                  | 25% by 2025      | None                   | Authorized or Currently in Use     | State Programs: State Loans, Rebates, Grants and Bonds, Property Tax Assessments, Manufacturing Grants; 2 local; 0 utility            |

\*indicates Renewable Portfolio Goal (Voluntary Standard)

<sup>3</sup> Source: NREL PVWatts Viewer ([http://mapserve3.nrel.gov/PVWatts\\_View/index.html](http://mapserve3.nrel.gov/PVWatts_View/index.html)) [PV figures]; NREL Solar Prospector (<http://maps.nrel.gov/prospector>) [CSP figures]

<sup>m</sup> Source: U.S. Solar Market Insight: 2010 Year-In-Review (<http://www.greentechmedia.com/articles/read/seia-report/>)

<sup>u</sup> Source: Database of State Incentives for Renewables and Efficiency (DSIRE) ([www.dsireusa.org](http://www.dsireusa.org))



## Copyright Notice

All design, text, graphics, and the selection and arrangement thereof are Copyright October 2011 by The Solar Foundation™. ALL RIGHTS RESERVED. Any use of materials in this report, including reproduction, modification, distribution, or republication, without the prior written consent of The Solar Foundation™ is strictly prohibited.



Cornell University  
ILR School



RESEARCH  
PARTNERSHIP