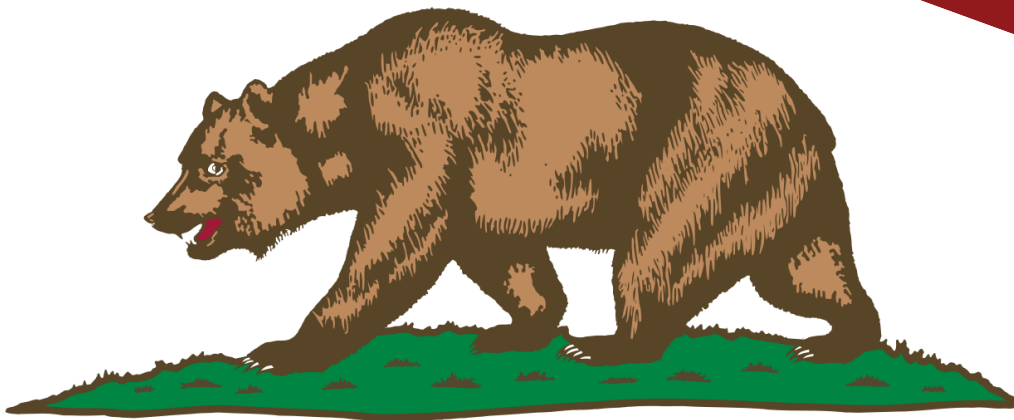




# CALIFORNIA ADVANCED ENERGY EMPLOYMENT SURVEY

Prepared by BW Research Partnership



# CALIFORNIA REPUBLIC



## About the Advanced Energy Economy Institute

The Advanced Energy Economy Institute (AEEI) is a 501 (c)(3) charitable organization whose mission is to raise awareness of the public benefits and opportunities of advanced energy. AEEI provides critical data to drive the policy discussion on key issues through commissioned research and reports, data aggregation and analytic tools. AEEI also provides a forum where leaders can address energy challenges and opportunities facing the United States. AEEI is affiliated with Advanced Energy Economy (AEE), a 501(c)(6) business association, whose purpose is to advance and promote the common business interests of its members and the advanced energy industry as a whole.

## About BW Research Partnership

BW Research Partnership ([www.bwresearch.com](http://www.bwresearch.com)) is a full-service research consulting firm with offices in California and Massachusetts. Recognized by the Congressional Research Office as developing the most accurate data to date, BW Research has conducted more clean energy labor market analyses than any other firm. Recent projects include: The Solar Foundation's National Solar Jobs Census, wind and solar labor market reports for the National Renewable Energy Laboratory (NREL), and clean energy studies for the Natural Resources Defense Council (NRDC), the Massachusetts Clean Energy Center, the Clean Energy Trust (Illinois), the State of Vermont, and many others.

California Advanced Energy Employment Survey

Copyright 2014 Advanced Energy Economy Institute

## Introduction and Key Findings

California is the nation's most populous state and the nation's leader in policies to promote secure, clean, affordable energy. It should be no surprise that California has a large and growing advanced energy economy as a result. Just how large and how fast growing has not been known – until now.

This first-time survey finds that the Golden State is home to more than 40,000 businesses serving advanced energy markets, spanning the entire value chain and including a wide range of energy technologies that address both supply and demand.

Based on this survey of more than 2,000 companies doing business in California, advanced energy employment in the state is currently 431,800, an increase of 5% over last year. Employers are optimistic about the future as well, with about half of all firms expecting to add employees during the coming year, for more than 70,000 new jobs – a 17% projected increase. (See Methodology, page 15, for details on research methods.)

California has long been a national leader in policies to support advanced energy, from the first vehicle emissions standards to pioneering programs to promote residential solar power. To this day, California continues to lead, with the nation's most ambitious renewable energy standard and a building code that requires high levels of energy efficiency. Today, California is #1 in installed solar capacity and solar jobs,<sup>1</sup> #1 in total advanced energy investment,<sup>2</sup> #1 in electric vehicle sales,<sup>3</sup> and #2 in energy efficiency.<sup>4</sup>

Unlike other states that have studied advanced energy or closely related industries, California has significant activity across the entire value chain of advanced energy. While deployment of advanced energy goods and services make up the majority of activity, R&D, manufacturing, and professional services all play important roles in the state's advanced energy economy.

Perhaps surprisingly, relatively few firms (3%) reported that their customer base is outside of the United States, while 77% of firms reported that their customers are predominantly within California. In part, this reflects the scale of opportunity within California itself. But given California's coastal location and proximity to Asian markets, in particular, export opportunities could be substantial for California's advanced energy industry.

As is the case in each state studied for advanced energy and related industries, energy efficiency is far and away the largest segment of the California advanced energy economy, representing 70% (303,117) of jobs statewide. Advanced electricity generation, the next largest segment, contributes nearly 95,000 jobs, or 22% of the total.

Detailed information about these findings, and other responses from the 2014 survey of California's advanced energy firms, can be found in the pages that follow.

# Industry Overview

## California is home to a large advanced energy industry with 431,834 workers

The State of California has a significant advanced energy industry, employing 431,834 workers at 43,673 business establishments in 2014. This is more than California's employment in the motion picture, television, and radio industries (266,358 jobs); mining and quarrying (28,966); semiconductors (50,864); and aerospace (170,695). Advanced energy employment represents approximately 2.4% of California's workforce overall.<sup>5</sup> Seven out of 10 California advanced energy workers (301,326) devote at least half of their work time to advanced energy, and 226,036 (52%) spend all of their time on advanced energy.

Although there is no consistently applied, rigorous national assessment in all 50 states, of the 10 states studied using a similar methodology, California ranks first in absolute size of employment in advanced energy and is tied with Massachusetts for second in percentage of total employment (2.4%), behind only Vermont (4.3%).<sup>6</sup>

## Advanced energy employment growth outpaces state and national averages

The advanced energy industry added jobs at a 5% rate in California from 2013 to 2014, more than double the rate of overall state job growth of 2.2% and about three times faster than the national job growth rate of 1.6%.<sup>7</sup>

When asked if they expected to hire more or fewer workers over the next 12 months, only 1% expected any reduction in staff size. Nearly half (49%) expected to add jobs over the coming 12 months, projecting net growth of more than 70,000 jobs (Figure 1). Nearly one third of firms surveyed have current openings that they are actively trying to fill (Figure 2).

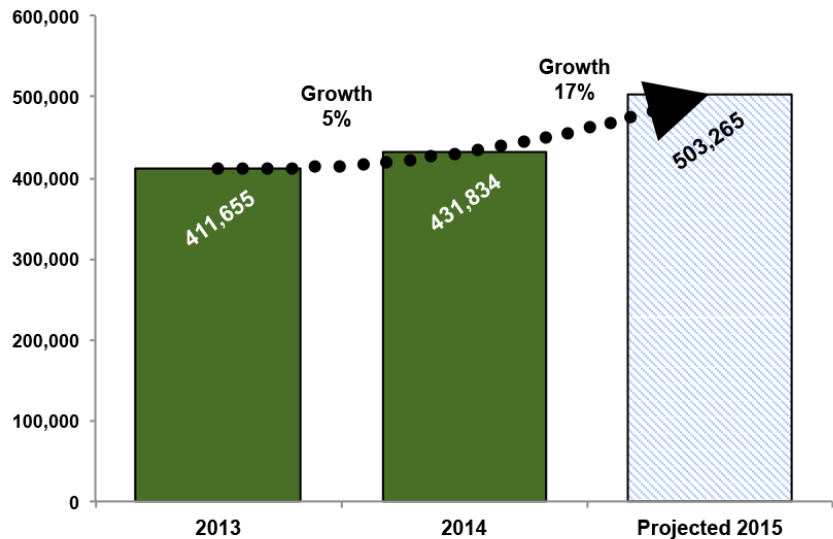


Figure 1: Advanced Energy Employment in California, 2013-2015

The projected overall growth of 17% would push 2015 advanced energy employment over 500,000 jobs. By comparison, overall employment growth in California is only expected to be in the neighborhood of 1%.<sup>8</sup>

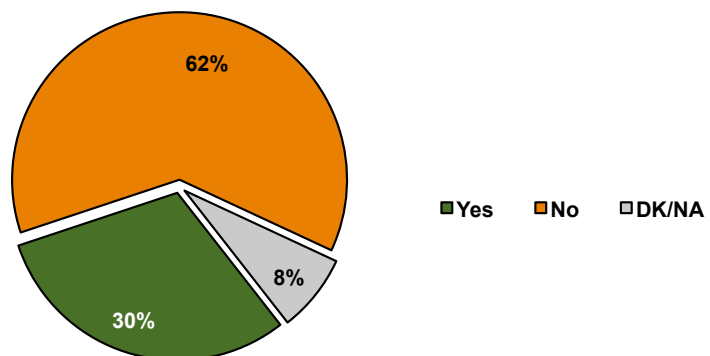


Figure 2: Establishments with Current & Active Job Vacancies



## Building efficiency is the largest segment by employment

Building Energy Efficiency is by far the largest segment of the advanced energy economy in California (Figure 3). This is not surprising, given California's #2 standing in the energy efficiency rankings from the American Council for an Energy Efficient Economy (ACEEE), particularly due to its building codes and incentives.<sup>9</sup> The second-largest segment is advanced electricity generation. Together, these two segments represent more than 90% of advanced energy employment.

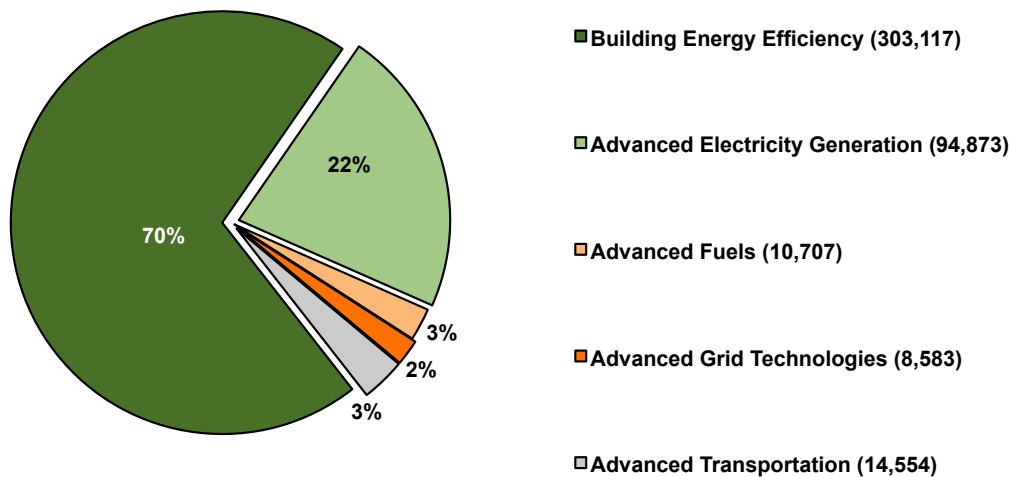


Figure 3: Employment by Advanced Energy Segment

While it is easy to see the many solar rooftops, as well as large-scale wind and solar plants in the passes and deserts, building efficiency is less visible but a large part of the state's advanced energy economy.

## Advanced electricity generation employs nearly 100,000 workers in California

California is one of the nation's leaders in advanced electricity generation. California ranks first in solar energy<sup>10</sup> and second in wind power.<sup>11</sup> The 94,873 advanced energy workers in this segment in California make up a significant part of the economy on their own, accounting for one out of every 200 jobs in California.



## Solar energy dominates advanced electricity generation

The AEE Institute partnered with The Solar Foundation to develop detailed California-specific data on the solar industry, which is by far the largest advanced energy subsegment in California, representing nearly 73,000 jobs (Figure 4). To compare these figures to previous Solar Jobs Census studies,<sup>12</sup> employers were asked to provide the number of workers spending a majority of their time in solar activities. In 2014, this number is 54,690, up 16% from 2013.

California’s advanced electricity generation segment is rounded out by several other technologies, including combined heat and power (CHP), advanced gas turbines, wind energy, and nuclear power, collectively contributing 17% of advanced electricity generation employment.

### Advanced transportation and energy storage establish employment base

While only capturing slightly more than 3% of the total advanced energy jobs in California, the absolute number of workers engaged in advanced transportation is substantial, at nearly 15,000. Considering the additional workers building electric vehicle charging infrastructure (included in advanced grid technologies, below), it is clear that California is developing an employment base in advanced transportation as well as energy efficiency and advanced electricity generation.

At more than 8,500 jobs, advanced grid technologies, especially energy storage, have also established a foothold in California. Storage now involves more than half (53%) of firms involved in advanced grid business, including companies ranging from startups in lithium ion, molten salt, and flow batteries to large-scale partnerships between companies like SolarCity and Tesla Motors that are pairing solar power with storage (Figure 5).

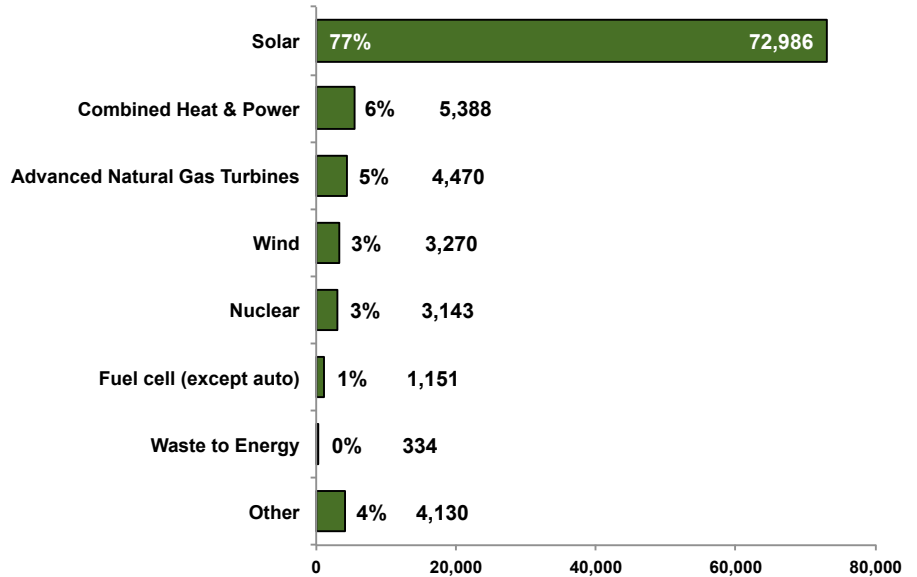


Figure 4: Employment by Advanced Electricity Generation Subsegments

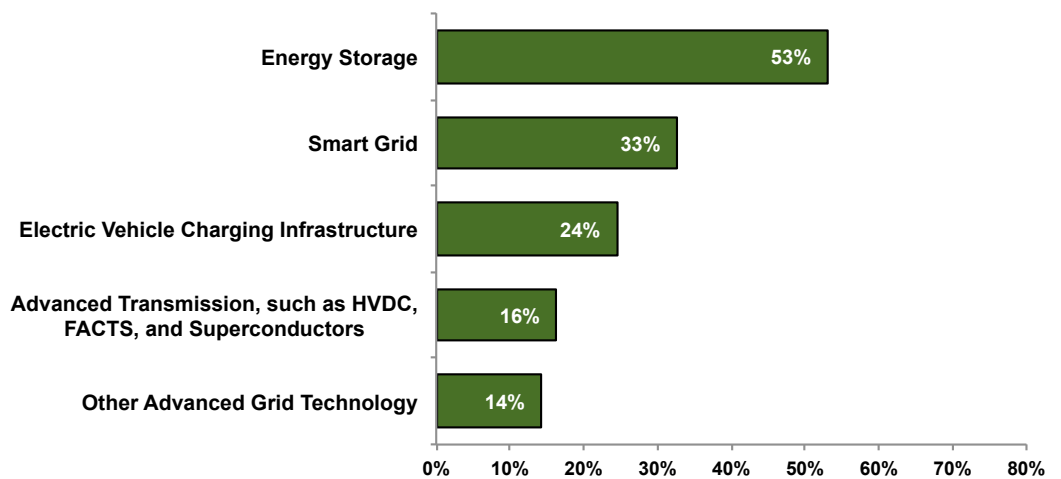


Figure 5: Establishments by Advanced Grid Subsegments. Results total more than 100%, as respondents could choose more than one technology



California’s first-in-the-nation requirement that investor-owned utilities procure both grid-scale and distributed energy storage<sup>13</sup> is likely to drive growth in this advanced energy business line.

**Installation, sales, and distribution are the largest advanced energy activities**

As with its counterparts in other states, California’s advanced energy industry is primarily involved in deployment, with 57% of firms primarily conducting installation or sales (Figure 6). Nevertheless, engineering and research are important components of advanced energy activity in California, including early-stage research as well as engineering services for utility-scale plants and large building projects.

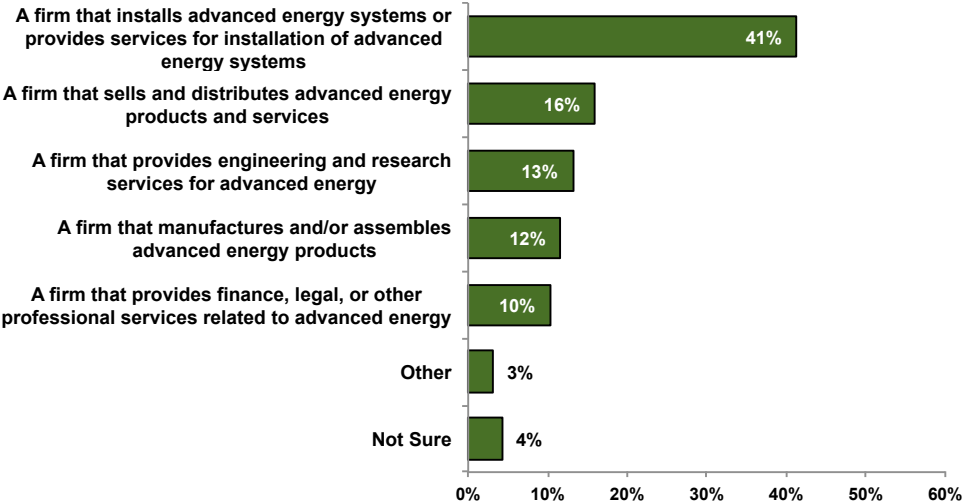


Figure 6: Advanced Energy Firms by Primary Activity

41% of California’s advanced energy firms are primarily involved in the business of installing, constructing, and maintaining advanced energy systems. The next highest share (16%) is focused on sales and distribution. These findings underscore the importance of policies to expand market opportunities such as building codes and binding targets for advanced energy deployment.

Engineering and/or research firms account for 13% of all advanced energy firms in California, and manufacturing/assembly companies make up 12% of the total.

California is a state that has prioritized advanced energy and has continued to accelerate the market within California. At the same time, its nation-leading policies on carbon emissions (AB 32 cap-and-trade), building codes, and renewable energy production have led to the development of new technologies to reach state goals, spurring advanced energy development worldwide. The policy push toward better energy solutions has also fit well with the spirit of entrepreneurship and innovation that is the hallmark of the California economy.



## Advanced energy employment is overwhelmingly at small businesses

Two-thirds of advanced energy businesses in California have fewer than 10 advanced energy employees, while 87% of businesses have fewer than 50 employees (Figure 7). These figures are consistent with other states that have significant advanced energy and related industries. It also demonstrates the importance of small businesses, such as building contractors, to the state's advanced energy economy.

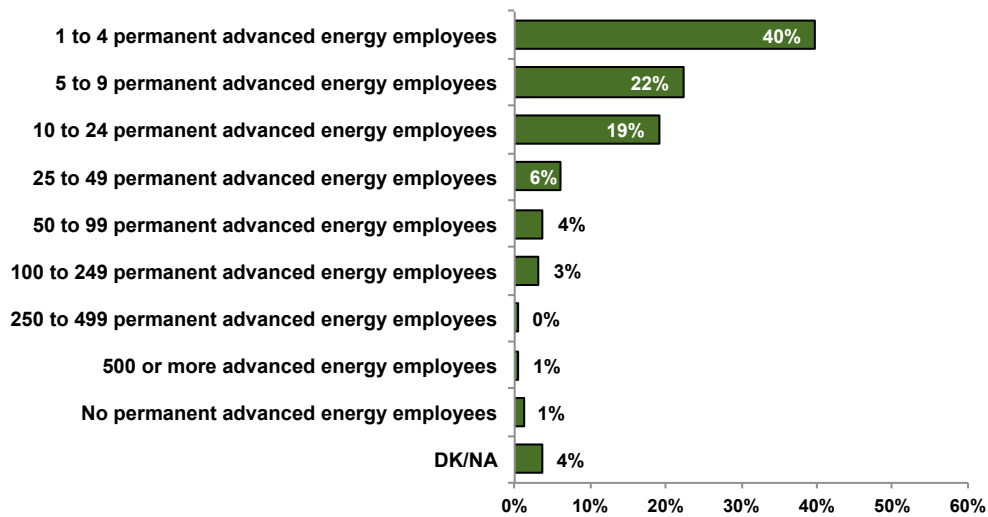


Figure 7: Firms by Number of Advanced Energy Employees

## Advanced energy provides an important revenue stream for many California businesses

Nearly two-thirds of advanced energy businesses attribute a majority of their revenue to advanced energy goods and services, and 41% report that all of their revenue is derived from advanced energy (Figure 8). Each is significantly higher than in other states studied, suggesting that California's mature markets offer more opportunities for predominantly advanced energy-focused firms.

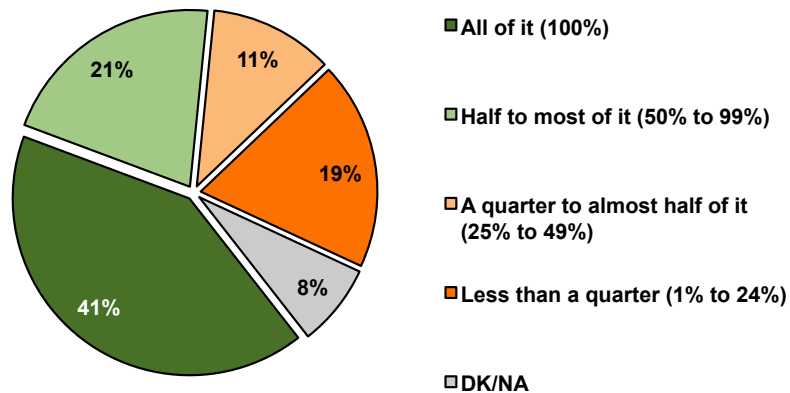


Figure 8: Percentage of Firm's Revenue Related to Advanced Energy





## California's advanced energy industry remains locally focused

The advanced energy industry in California largely derives revenue from in-state customers, but is also connected to vendors and suppliers in the surrounding states.

A high proportion (77%) of advanced energy firms report that their customers are primarily in California (Figure 9). This figure is consistent with a deployment-focused industry.

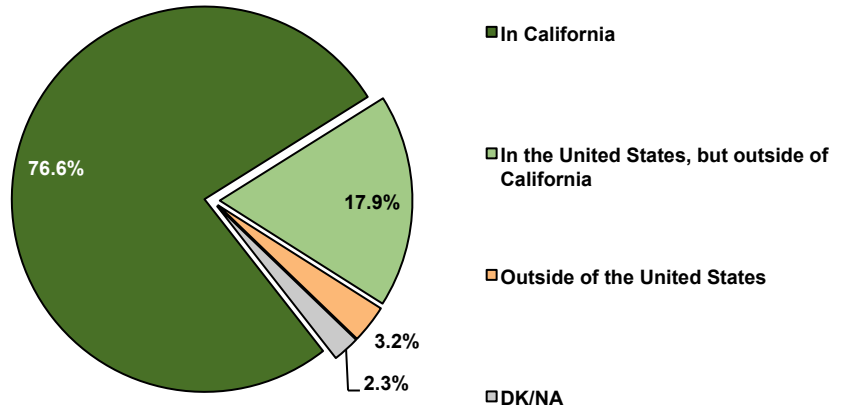


Figure 9: Location of Customers

Similarly, almost 60% of California's advanced energy industry's suppliers and vendors are located within California, and only 7% come from international imports (Figure 10). This is largely consistent with other states that have been studied across the United States.

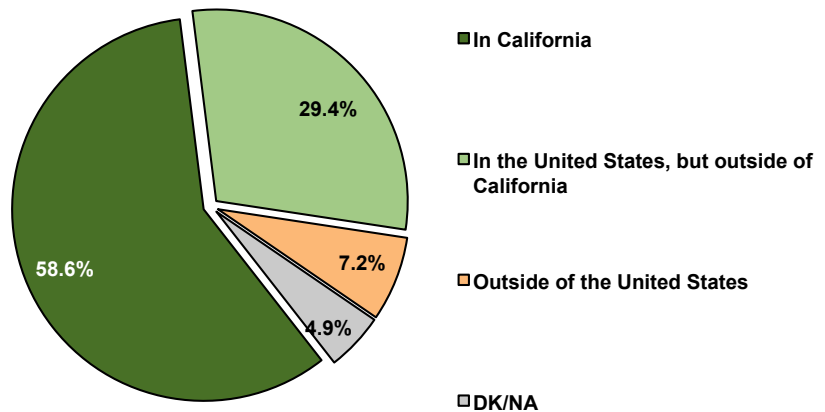


Figure 10: Supplier and Vendor Location

The predominance of in-state customers and suppliers suggests that California is currently contributing to the state and national advanced energy economy but also has potential to expand its business relationships – for both import and export – to the global market.

## Tax credits, incentives, and programs cited for growth

When asked to name specific policies that are important for accelerating the growth of advanced energy, California employers frequently cited tax credits, rebates, and other incentives and standards (Figure 11). Several specific programs

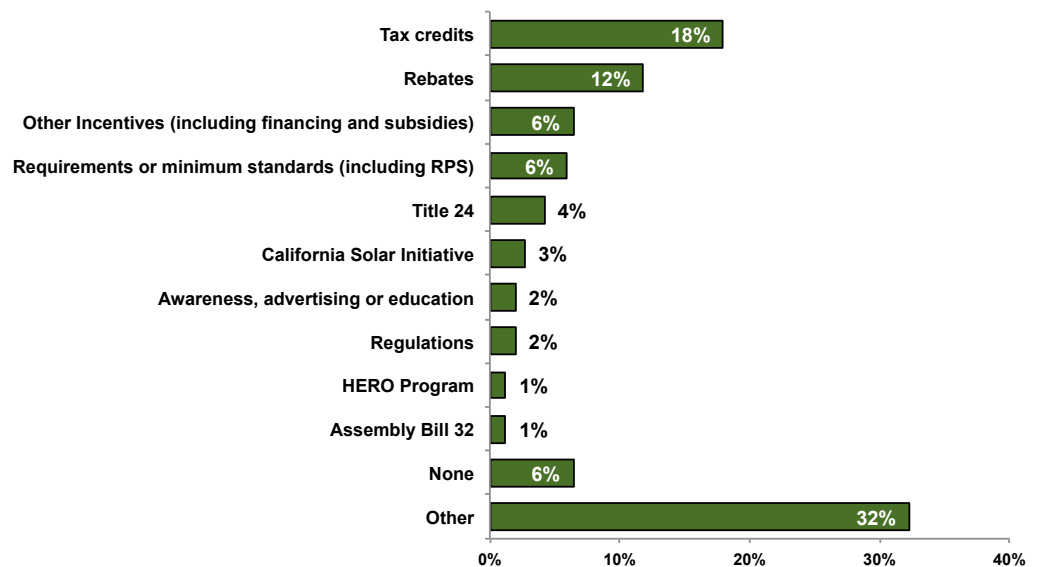


Figure 11: Policies Accelerating Advanced Energy Growth

were cited by a significant number of firms, among them Title 24 building energy standards; the California Solar Incentive; Home Energy Renovation Opportunity (HERO) financing with repayment on property tax bills in certain municipalities; and the AB 32 cap-and-trade program for reduction of carbon emissions.

### Advantages and Disadvantages of Doing Business in California

While most people might assume that California’s advanced energy growth is predominantly attributed to policies and incentives, the weather (including the abundant sunshine) and quality of life (firms are located where owners/ employees want to live) are also cited as significant advantages of being in business in California (Figure 12).

When employers were asked what they thought was the biggest disadvantage to doing business in California, taxes were named mostly frequently, followed by business costs and regulations (Figure 13).

### Advanced Energy in California by Region

The statewide data document the size of California’s advanced energy economy, but employment and business activity in this industry are not equally distributed across the state. This section shows how the growth of the advanced energy industry is impacting various regions in California (Figure 14).

### Nearly two-thirds of California’s advanced energy employment is in Southern California and the Greater San Francisco Bay area

That the bulk of advanced energy businesses and employment is found in Southern California and the Greater San Francisco Bay Area is not

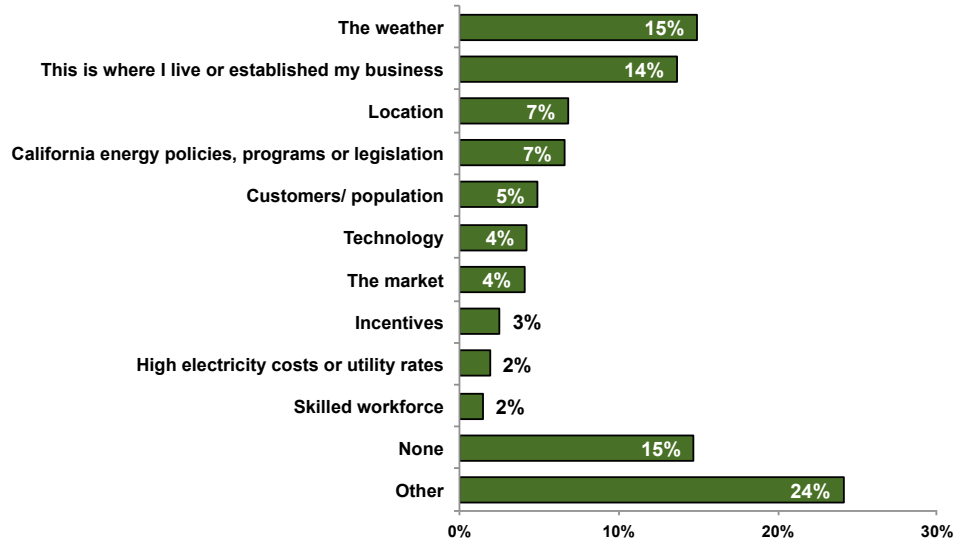


Figure 12: Advantages of Being in California

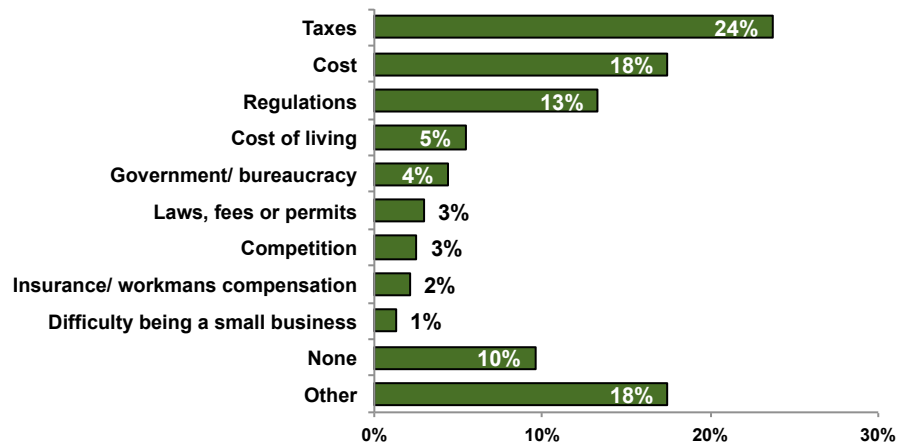


Figure 13: Disadvantages of Being in California

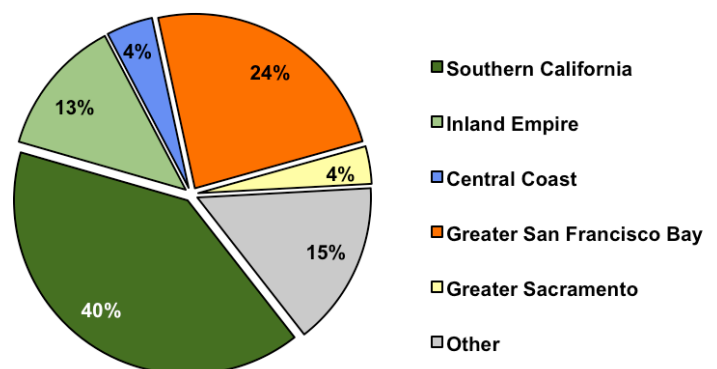


Figure 14: Advanced Energy Employment by Region



surprising, given that these are the two most populous regions in the state. When adjusted for population and the number of total jobs in the region, however, the Inland Empire shows the highest concentration of advanced energy workers (Table 1).

| Region                    | Population | Advanced Energy Jobs | Total Jobs | % of Total Jobs |
|---------------------------|------------|----------------------|------------|-----------------|
| Southern California       | 16,388,822 | 172,400              | 8,028,889  | 2.1%            |
| Inland Empire             | 4,516,614  | 55,300               | 1,471,736  | 3.8%            |
| Central Coast             | 2,001,606  | 18,600               | 905,006    | 2.1%            |
| Greater San Francisco Bay | 7,448,810  | 104,500              | 3,921,367  | 2.7%            |
| Greater Sacramento        | 2,405,593  | 15,000               | 1,034,997  | 1.5%            |
| Rest of California        | 5,947,967  | 65,900               | 2,578,705  | 2.6%            |
| California Total          | 38,709,412 | 431,800              | 17,940,700 | 2.4%            |

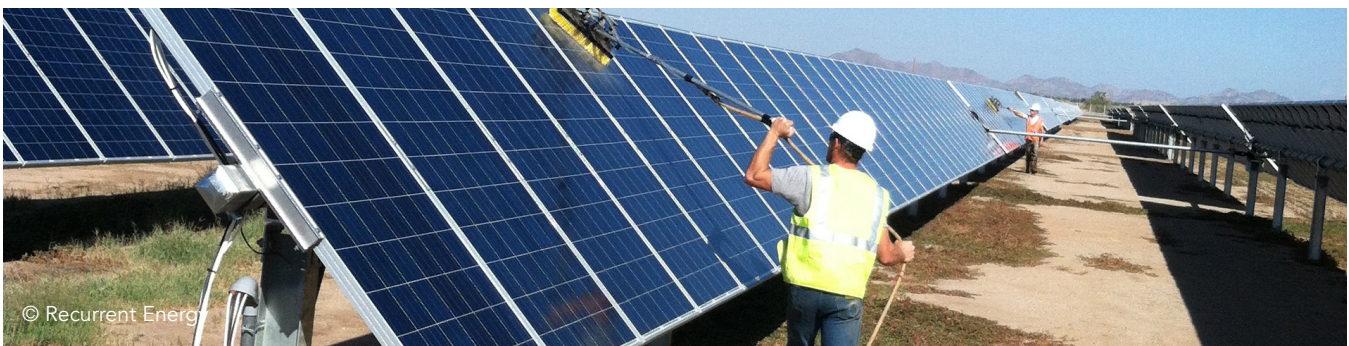
Table 1: Advanced Energy Jobs by Region

### Energy efficiency is the largest segment in all regions of California

In Southern California and the Inland Empire, efficiency workers account for three out of every four advanced energy jobs. But energy efficiency is well represented throughout the state (Table 2). It is a truly ubiquitous advanced energy business, with thousands of jobs in every region of the state.

| Region                    | Energy Efficiency Jobs | Percent of AE Jobs |
|---------------------------|------------------------|--------------------|
| Southern California       | 130,000                | 77%                |
| Inland Empire             | 40,500                 | 74%                |
| Central Coast             | 10,000                 | 58%                |
| Greater San Francisco Bay | 65,500                 | 64%                |
| Greater Sacramento        | 7,500                  | 57%                |
| Rest of CA                | 47,513                 | 73%                |

Table 2: Energy Efficiency Jobs by Region



© Recurrent Energy

## Greater San Francisco Bay is a hub of advanced energy activity – and jobs

The Bay area is home to many corporate headquarters of national advanced energy companies, including SolarCity, Tesla, and Sungevity, as well as many early stage innovation companies in Silicon Valley. Not surprisingly, the San Francisco Bay region has the highest concentration of solar workers in the state. The region also accounts for 38% of statewide advanced grid employment, 44% of advanced transportation employment, 31% of advanced electricity generation employment (including solar), and 19% of advanced fuels employment (Figure 15). No other region has this breadth of advanced energy employment.

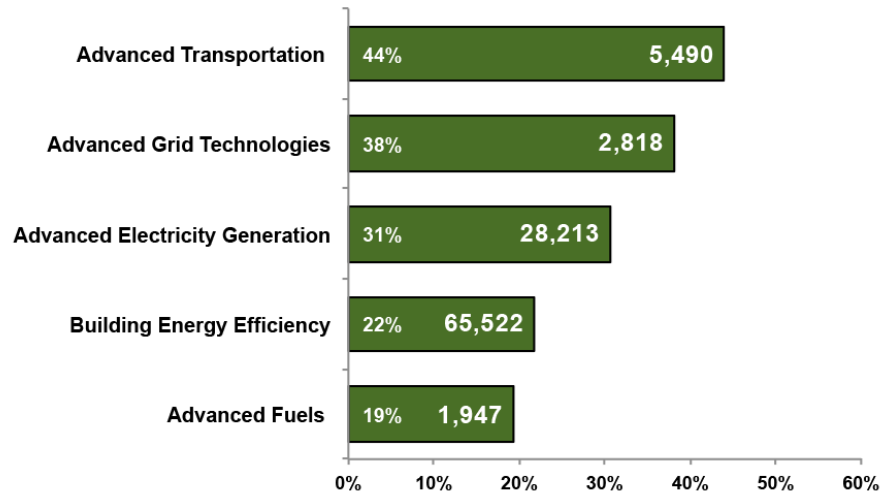


Figure 15: Greater San Francisco Bay Share of Employment by Segment

## Utility-scale generation drives employment in the Inland Empire

3.8% of all jobs in the Inland Empire are connected to advanced energy, the largest concentration in the state, and one-and-a-half times the statewide percentage (Table 1). This is largely due to the higher-than-average concentration of advanced electricity generation jobs, predominantly from utility-scale wind and solar installations in the region, such as the 350 megawatt Soda Mountain Solar Project and the 615 MW San Gorgonio Pass Wind Farm. Deployment of advanced energy technologies at scale in this region has resulted in a disproportionate number of advanced energy jobs.

## Southern California leads in energy efficiency and wind energy

Southern California accounts for 43% of all energy efficiency jobs statewide, totaling nearly 130,000 workers (Figure 16). This represents three-quarters of the advanced energy employees in the region. Much of this employment appears to be connected to the construction boom in Southern California. At the same time, Southern California is home to more than 30% of the state's wind energy jobs (another 32% is found in the Inland Empire). This employment concentration is largely driven by numerous large wind farms found in Kern, Riverside, San Bernardino, and Imperial Counties, as

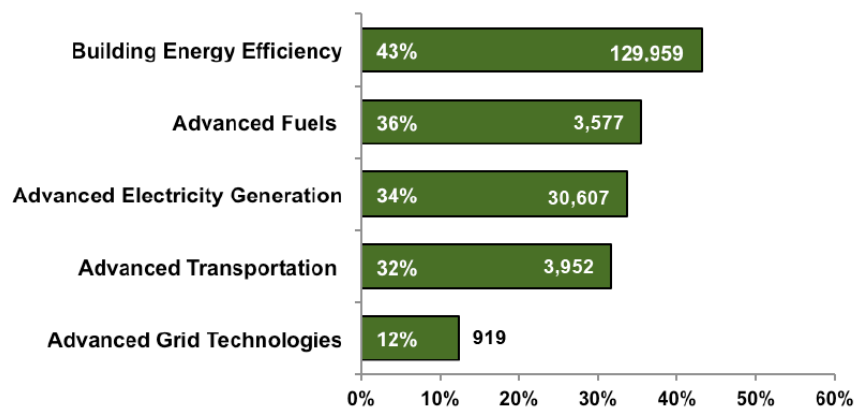


Figure 16: Southern California Share of Employment by Segment



well as the related manufacturing and professional services that comprise the value chain. Due to the size (and difficulty in shipping) of turbine components, as well as the land requirements for building wind farms, the wind energy supply chain tends to be more localized than in other industries, further explaining the concentration of jobs around the Tehachapi pass and other southern regions. with the greatest installed wind capacity.

**Employment in Greater San Francisco Bay is concentrated in the north**

A breakdown of employment within the Bay area shows that 67% of advanced energy workers in that region are employed in the San Francisco-Oakland-Fremont metropolitan area (MSA), significantly more than Silicon Valley’s 24%, represented by the San Jose-Sunnyvale-Santa Clara MSA (Figure 17). San Francisco firms tend to be more focused on professional services, such as consulting and finance. This metropolitan area is also home to more headquarters than the San Jose MSA. San Jose, in contrast, appears to hold more of the early-stage startups focused heavily on technology development as opposed to deployment.

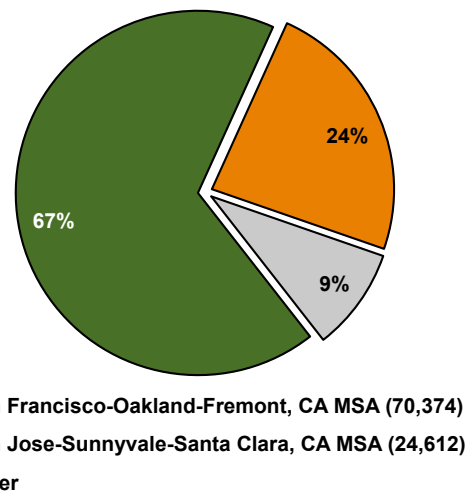
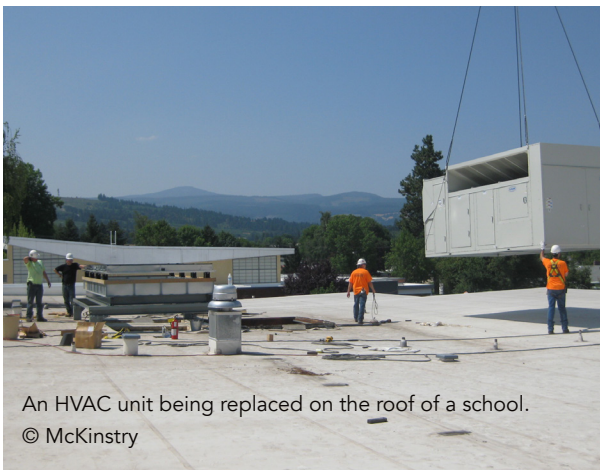


Figure 17: Greater San Francisco Bay Employment by MSA

Similarly, the Los Angeles MSA accounts for nearly three-quarters of Southern California’s advanced energy employment, with most of the remainder found in the San Diego metropolitan area (Figure 18).

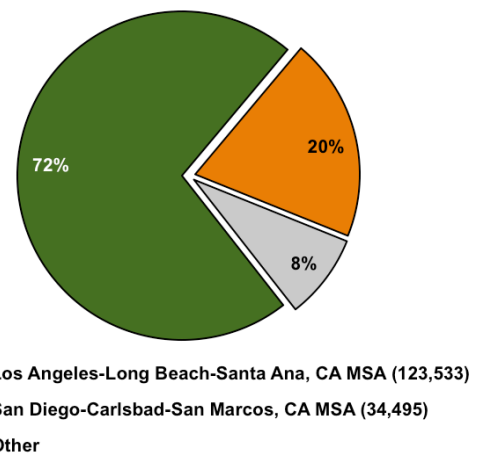


Figure 18: Southern California Employment by MSA

## Conclusion

California is an acknowledged national leader in advanced energy policy. Now it can be said with certainty that California is a national leader in advanced energy businesses and employment as well.

Among the states that have studied advanced energy and related industries to date, which include Massachusetts, Illinois, Pennsylvania, Vermont, and Florida, California has the largest absolute number of advanced energy employees, and is second only to Vermont in percentage of the state's workforce employed in advanced energy.

With more than 430,000 advanced energy workers at 40,000 employment locations across the state, and strong growth projections over the coming year that should push employment past a half-million workers, California's leadership position should remain intact.

As in other states, advanced electricity generation technologies, such as wind and solar, receive the most attention in the media and the general public. However, this survey shows that, in terms of both employment and the number of businesses, energy efficiency is the largest segment of the advanced energy industry in California. Indeed, more advanced energy workers – more than 300,000 – are employed in energy efficiency than in all other segments combined. Supported by California's long-standing policy commitment to energy conservation, energy efficiency is the largest line of advanced energy business in the Golden State, and still growing.

Solar energy is another major component of the advanced energy economy in California. In by far the nation's largest solar market, more than 70,000 people are employed in the solar industry in California. Growth in solar over the past 12 months has been particularly dramatic, with employers adding nearly 7,500 jobs since 2013, representing nearly 17% growth in employment of workers spending more than half their time on solar business.

Electric vehicles account for only a small fraction of the advanced energy jobs in California, but they are beginning to make their presence felt. The same is true for energy storage.

California also stands out as a state where the entire value chain of advanced energy is represented. Deployment – i.e., installation and sales – of goods and services dominates advanced energy commerce in the state, as is true elsewhere, but significant portions of California advanced energy companies are involved in engineering and/or research (13%) and manufacturing/assembly (12%).

Finally, a relatively high proportion of businesses derive all (41%) or most (two-thirds) of their revenue from advanced energy work. That so many firms are fully or mostly focused on advanced energy is a sign of the maturity of the market for these goods and services in California, and the scale of the business opportunity to be pursued.



## Appendix: Methodology

In October and November of 2014, BW Research Partnership conducted a survey of advanced energy businesses in California. To be included in the survey, participants were required to answer a number of screener questions to ensure that their organization: a) conducts activities directly related to the advanced energy industry; and b) employs workers in California who spend at least some portion of their time conducting advanced energy-related activities.

For the purposes of this report, an advanced energy firm is defined as being directly involved with researching, developing, producing, manufacturing, distributing, selling, or implementing components, goods or services related to alternative fuels and vehicles; energy efficiency; renewable, nuclear, and natural gas electricity generation; smart grid; and other related technologies. This can include supporting services such as consulting, finance, tax, and legal services related to advanced energy. It does not include farm workers involved in growing feedstock (corn, soy, etc.) for advanced fuels.

Advanced energy employees are defined as full-time and part-time permanent employees who support the advanced energy portion of the business, including administrative staff and excluding interns and other temporary workers.

In order to accurately capture data from the industry, surveys were administered by telephone to a list of known employers as well as to a representative sample of companies from the NAICS industries identified by the Bureau of Labor Statistics and BW Research Partnership as being potentially related to the renewable energy, energy efficiency, advanced fuel and advanced transportation segments. This NAICS listing is similar to those used in surveys conducted in Massachusetts, Vermont, Missouri, Florida, Iowa, Pennsylvania, and Illinois, with a few minor modifications to reflect the uniqueness of each state's economy. The California analysis also includes employment in nuclear energy and some portions of natural gas generation and transportation that are excluded in other state studies that employ a similar methodology.

The research team attempted over 30,600 telephone calls and sent over 9,300 emails to employers. The survey effort, with an overall combined margin of error for employment estimates of +/-2.13% at the 95% confidence interval, yielded 2,073 survey responses with an average of 13 minutes in length per completion. The overall margin of error for other survey questions is +/-3.5% at a 95% confidence interval.

Survey data were combined with responses from the 2014 Solar Jobs Census, under a data-sharing agreement with The Solar Foundation.

Surveys for this study were administered by BW Research Partnership to a list of businesses that were identified by AEE, various state agencies, and other publicly available sources (the "known universe"). Telephone surveys were administered to the known universe and to a random sampling of businesses identified by NAICS code by IHR Research Group.

## Endnotes

1. <http://www.thesolarfoundation.org/solarstates>
2. <http://www.masscec.com/content/2014-clean-energy-industry-report>
3. <http://www.edmunds.com/industry-center/analysis/drive-by-numbers-tesla-in-all-50-stateshtml>
4. <http://aceee.org/state-policy/scorecard>
5. Economic Modeling Specialists, Inc. (EMSI) Class of Worker, Q3, 2014. Note that EMSI data may include a wider set of workers than official “covered employment” estimates from the Bureau of Labor Statistics and California Employment Development Department, including self employed/sole proprietors, among others. Given the inclusion of self-employed workers in the survey sample, EMSI is the most appropriate comparison set.
6. Clean Energy Trust, *Clean Jobs Illinois*, <http://www.cleanjobsillinois.com>; Massachusetts Clean Energy Center, *Clean Energy Industry Report 2014*, <http://www.masscec.com/content/2014-clean-energy-industry-report> ; Vermont Clean Energy Development Fund, *Vermont Clean Energy 2014 Industry Report*, <http://publicservice.vermont.gov/sites/psd/files/Announcements/Vermont%20Clean%20Energy%20Industry%20Report%20FINAL.pdf> ; Environmental Entrepreneurs, et. al, *Clean Jobs Florida* <http://cleanjobsflorida.com/>; Environmental Entrepreneurs, et. al, *Clean Jobs Pennsylvania*, <http://cleanjobspa.com>
7. EMSI Class of Worker 2014.3.
8. *Id.*
9. <http://database.aceee.org/state/california>
10. <http://www.thesolarfoundation.org/solarstates>
11. <http://www.awea.org/Resources/state.aspx?ItemNumber=5232>
12. <http://www.thesolarfoundation.org/research/national-solar-jobs-census>
13. [http://www.mercurynews.com/business/ci\\_24331470/california-adopts-first-nation-energy-storage-plan](http://www.mercurynews.com/business/ci_24331470/california-adopts-first-nation-energy-storage-plan)









[www.aee.net/aeei](http://www.aee.net/aeei)

@aeeenet