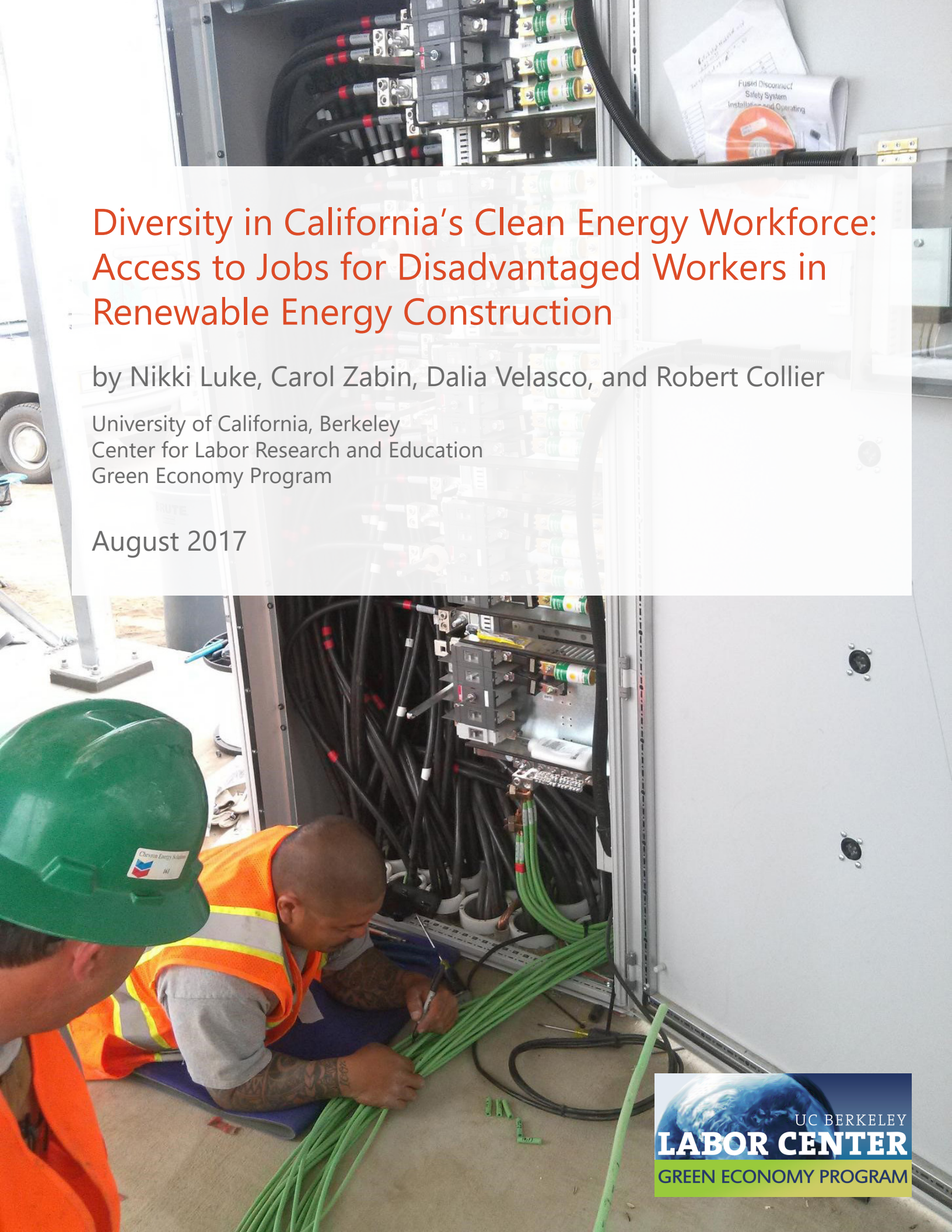


# Diversity in California's Clean Energy Workforce: Access to Jobs for Disadvantaged Workers in Renewable Energy Construction

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Photos courtesy of IBEW Local 428

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# Executive Summary

Over the past decade California has emerged as a national and international leader in vigorously addressing climate change. Throughout this time one of the state's key challenges has been to ensure that the "green jobs" being created in the clean energy boom not only have good pay and benefits but also are equitably distributed across the labor force. This report analyzes the degree to which California's underrepresented and disadvantaged workers have been able to gain access to career-track jobs in the construction of renewable energy power plants. The growth of renewable energy has been and continues to be a key element of California's climate efforts: policy-makers are now considering SB 100, which sets a goal of procuring 60 percent of the state's electricity from renewables by 2030 and 100 percent from zero-carbon sources by 2045.

In California, the construction of renewable energy power plants has primarily been carried out under collective bargaining agreements, known as project labor agreements, which entail the utilization of the state-certified apprenticeship system. Apprenticeship allows entry-level, unskilled workers to obtain free training, a job, and a defined path toward a middle-class career. Until now, little information had been available to assess the extent to which disadvantaged communities are able to access this opportunity.

This paper uses two data sources on entry-level workers in renewable energy construction. First, we use data provided by the California Division of Apprenticeship Standards (DAS) on enrollment in the apprenticeship programs of three principal skilled trades unions (Electricians, Ironworkers, and Operating Engineers) that have built renewable power plants in California from 2002 through part of 2017. The second set of data comes from Local 428 of the International Brotherhood of Electrical Workers (IBEW) and concerns workers who built 27 solar farms in Kern County, totaling almost 2,000 megawatts (MW) of capacity between 2013 and 2017, which amounts to about 25 percent of the solar PV power plants installed in the state during this period.

## Our key findings include the following:

- There is considerable ethnic and racial diversity, and improvement over time, in enrollments in apprenticeship programs of the 16 union locals of electricians, ironworkers, and operators that have built most of the renewable energy power plants in California. The share of people of color (all non-white categories) entering an apprenticeship in these three trades reached 60 percent in 2017, compared to 56 percent for the state's workforce as a whole.
- New apprentices' racial and ethnic diversity varies significantly among the three trades. Latinos are 53 percent of ironworkers, 35 percent of electrical workers, and 23 percent of operators, compared with their 34 percent share of the statewide labor force. African Americans comprised 4 percent of electricians, 6 percent of ironworkers, and 9 percent of operators, compared with 6 percent in the statewide labor force.
- As with the rest of California's construction industry, gender diversity in these apprenticeships remains minimal, with women comprising 2 percent to 6 percent among the three trades.
- The presence of veterans in these programs is higher in all three trades than in the state's workforce as a whole, with veterans comprising 9 percent of new electrical apprentices, 6 percent of new ironworkers, and 12 percent of new operators, compared with only 4 percent in the overall California workforce.

- On the 27 solar projects in Kern County, starting pay for entry-level panel installers was $16.12 per hour in 2016, plus $50 per day for travel, paid to all workers including local residents. First-year apprentices started at $16.49 plus full benefits, and receive wage increases as they move through their five-year training program and obtain their journey card, with journey electricians earning over $40 per hour.
- Entry-level jobs on these Kern County projects have largely been filled by workers from disadvantaged communities. Data for 1,862 entry-level workers show that 43 percent lived in communities that are designated as disadvantaged by the California Environmental Protection Agency (CalEPA), a rate much higher than the 25 percent rate for the general population. 47 percent of the workers lived in communities with unemployment rates of at least 13 percent, showing the importance of solar development for these communities.

California has an opportunity to build on this important track record of inclusion in the clean energy economy. The examples presented in this report show that project labor agreements and state-certified apprenticeship programs together can provide a vehicle for inclusion that produces results. The positive outcomes we detail are due to recruitment efforts by unions in local communities and the location of the projects: Kern County and the other areas where large-scale renewables are built happen to be in areas with high concentrations of disadvantaged communities. More complete data collection on worker outcomes could provide information for policymakers to build on the successful efforts of the unions and contractors, and, where needed, to help improve them via support for publicly funded pre-apprenticeship and/or local hire provisions.

# Introduction

This report presents information about the racial and ethnic background, residence patterns, and wages of entry-level workers who have been hired to construct renewable energy power plants in California over the past 15 years. The growth of renewable energy has largely been driven by the state's Renewables Portfolio Standard (RPS) policies, first passed in 2002, which mandated that progressively higher shares of electricity be procured from renewable sources. The Legislature is now considering SB 100, which would require that 100 percent of electricity be procured from zero carbon sources by 2045.

The impact of California's climate policies on jobs has been an important concern in policy discussions. Advocates concerned about equity have emphasized the importance of job quality (wages, benefits, and career ladders) and job access (inclusion of workers from underrepresented communities), not just the net number of jobs created or lost.[1]

Previous reports on job creation and job quality in the solar industry have documented that the construction of large-scale renewable energy plants has produced good jobs, with middle-class wages and full health and retirement benefits, due to the fact that most have been built under project labor agreements, which require union wage and benefit standards.[2]

Previous research has also shown that training through the state-certified apprenticeship system, which all unionized construction firms in California use, provides the best outcomes for trainees in the construction sector in terms of job placement rates, wages, benefits, the depth and breadth of training, and career ladders.[3] However, this is the first quantitative analysis of who is getting into apprentice training programs and jobs on renewables. Documenting job access will shed light on the extent to which projects built under project labor agreements provide training and career-track job opportunities to underrepresented populations and local residents, particularly residents of the communities hardest hit by environmental, health, and socio-economic stressors.

In this report, we use two data sources to examine the characteristics of apprentices and other entry-level workers employed and trained on renewable energy construction projects. Data from the California Division of Apprenticeship Standards (DAS), which regulates state-certified apprenticeship programs, allowed us to identify by ethnicity and other demographic characteristics all apprentices in the 16 union locals that have built the majority of renewable energy power plants in California. As detailed below, we find that these apprentices reflect the diversity of the California workforce to a significant degree, although there is variation by both trade and ethnicity. However, because apprentices work on many different kinds of projects as part of their broad occupational training, we were not able with this data set to specifically identify which apprentices worked on renewable projects. Therefore we also present a case study of the 27 solar projects carried out in Kern County beginning in 2012, using workforce data from one union, the International Brotherhood of Electrical Workers (IBEW) Local 428 in Bakersfield, which built these projects under project labor agreements. With this case study we are able to present information specifically on solar farm electrical workers, who built 1990 MW in solar capacity during this period, amounting to about 25 percent of the total California build-out from 2012 to 2016.[4] The data does not include race or ethnicity, but it does contain the home addresses of all workers; this allowed us to determine that many of these entry-level workers reside in disadvantaged communities of California, as defined by CalEPA, and as explained more fully below.

# Apprenticeship Explained

In the construction sector, state- or federally-registered apprenticeships are the gold standard in workforce training and certification.[5] Intended to prepare apprentices for a career in a particular trade, those who complete the program graduate with an industry-recognized credential and can progress to a journey-level position as a union member.[6] In California, registered apprenticeship programs are regulated by the state Division of Apprenticeship Standards and must meet specific minimum training benchmarks and other criteria to ensure quality and accountability.[7] The programs can either be joint, i.e., a partnership between a local union and the employers with whom it has collective bargaining contracts, or unilateral, i.e., run solely by the employer(s) in a non-union work environment. For the past five years, 89 percent of graduates of state-certified apprenticeship programs were from joint programs, and only 11 percent were from unilateral (non-union) programs.[8]

State-approved apprenticeship programs are almost completely privately funded by contractors and workers, who make small payments into a training trust fund for every hour worked. The state government helps fund the classroom portion of the training, which is administered by the community college system and carried out by each apprenticeship's local public educational partner. Requirements for the attainment of the journey card credential vary by trade. For the electrical apprenticeship, the minimum state requirements are 8,000 hours of on-the-job training, 640 hours of classroom learning, and competency tests for each level of advancement.[9] In practice, all IBEW apprenticeship programs in California exceed this minimum, requiring between 800 and 900 hours of classroom training.[10]

The yearly number of openings in each apprenticeship program is determined according to the labor contracts that each local union currently has and to expectations about future work. Such demand-driven training ensures that people are trained only if jobs exist for them; unions will not sponsor new apprentices unless there will be enough work for them to finish their three- to five-year training program. Apprenticeship openings, therefore, tend to track cycles in the construction sector,[11] with the number of program openings increasing only when the construction industry expands or unions' share of it grows. By limiting the number of new slots to the capacity of the unionized construction sector, this model avoids the common problem of low job placement rates that has plagued many training programs.[12]

Apprenticeship provides clear benefits to workers and is one of few pathways to a middle-class career without higher education credentialing.[13] Apprentices receive the same health, pension, and other benefits as journey-level workers, and their training is free. During an apprenticeship, workers receive pay increases on a periodic basis as they acquire new skills, and upon graduation obtain their journey card and receive journey level wages.[14] Apprentice wages vary by trade and sometimes by county. For example, first-year apprentices in the Ironworkers start at $18.00 per hour plus benefits, and after completion of their four-year apprentice program will be paid the journey wage, currently at $36.00 per hour.[15] Workers who complete an apprenticeship see a lifetime earnings gain of almost $270,000. This is a greater income premium than community college or alternative technical education training.[16]

Employers also benefit from apprenticeship programs. Because of these direct, strategic investments in their workforce, employers are able to access skilled workers and upgrade their skills quickly as technologies change. Union apprenticeship programs also have been shown to retain skilled workers, amid the ups and downs of an extremely cyclical industry.[17] The programs also provide a clear safety benefit: apprenticeship includes comprehensive safety training, and workers are less likely to experience injuries[18] in an occupation that has very high injury rates and the highest number of fatalities of all industries in California.[19]

## Pathways into Apprenticeship for Workers of Color and/or Residing in Disadvantaged Communities

Racial, ethnic, and gender diversity has been a focus of ongoing efforts within and outside of unions to reverse the legacy of exclusionary hiring preferences practiced historically by contractors and unions.[20] Improving diversity in apprenticeship programs requires both increasing the pool of qualified workers from underrepresented communities and influencing hiring practices to ensure that underrepresented applicants actually are hired on jobs.

Each union sets its own criteria for admission to an apprenticeship program. Generally, applicants must be 18 years of age or older and physically capable of performing construction labor. Some programs also require a high school diploma or GED, a driver's license, the ability to read, write, and speak English, minimum math qualifications, a color perception test, and/or a drug test.[21] Pre-apprenticeship training programs in high schools, community colleges, and community-based organizations have grown in recent years and fill gaps in knowledge and skills to help prepare underrepresented workers to be successful apprentices. The most effective pre-apprenticeships usually combine close partnerships with local building trades councils and/or individual trades unions, a multi-craft curriculum designed by the national building trades to expose students to multiple crafts and help them determine which they are most suited for, and hands-on training.[22] Recently, some trades have also created new job classifications that allow very entry-level workers to gain work experience, which helps them then be successful applicants to apprenticeship programs. These entry-level classifications provide an on-the-job alternative or complement to pre-apprenticeship training, and when combined with recruitment by unions of underrepresented workers, offer another way to promote diversity.

To help ensure that qualified applicants from underrepresented groups are actually hired by contractors and enroll in state-certified apprenticeship programs, unions and allies may negotiate "targeted hire" requirements. These oblige contractors to make a good faith effort to hire an agreed-upon percentage of new workers from a targeted group. As the market share for union construction work increases, so does the number of apprenticeship openings, thereby providing more opportunities for collaboration between the trades and community groups to increase the number of good union jobs while also broadening access. In California, numerous cities, public agencies, and even private developers have also adopted targeted hire provisions in response to community and labor advocacy.[23] Due to legal limitations on race-based hiring in California, the targets include other measures of disadvantage such as residence in a local community and/or communities with high unemployment or other socio-economic disadvantage, or other specific metrics of disadvantage such as individuals who are low-income, formerly incarcerated, have low educational attainment, are veterans, are women or have other barriers to employment. Targeted hire provisions are designed to bring economic benefits to underserved communities, offering a pathway for socially and economically disadvantaged individuals to access quality jobs with family-sustaining wages and benefits. Workforce goals vary but are often in the range of 25 percent to 50 percent of new hires from local or disadvantaged communities.[24]

## Definitions of Disadvantage in California Climate Policy

Advocacy by environmental justice organizations has led to the development and use of specific criteria in California climate policy, designed to identify communities that have been the hardest hit by environmental and economic disadvantage. The California Environmental Protection Agency's tool, CalEnviroScreen 3.0, ranks census tracts to identify the most disadvantaged communities in California.[25] It takes into account several factors: pollution and hazardous exposure that can lead to neg-

ative health effects; sensitive population indicators that confer increased vulnerability to pollutants, such as incidence of asthma; and socio-economic factors including poverty, unemployment, language barriers, low educational attainment, and housing burden. CalEPA defines as "disadvantaged" those census tracts that fall in the worst-off 25 percent, and the state uses this data to help determine the allocation of cap and trade funding. As of December 2015, 51 percent of the $912 million in total cap and trade expenditures had been targeted to the census tracts identified as disadvantaged by CalEnviroScreen 3.0.[26]

# Data

The data analyzed in this report comes from two sources. The first source is the detailed information that the California Division of Apprenticeship Standards collects on enrollment in apprenticeship programs,[27] which we used to analyze racial and ethnic diversity in the construction of renewable energy plants. Based on an industry expert's review of project labor agreements for renewable energy power plant construction, we identified three skilled trades that have been most involved in this work: the International Brotherhood of Electrical Workers (IBEW), the International Union of Operating Engineers (Operators), and the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers Union (Ironworkers).[28] About 80 percent of the workers on renewables come from these three unions, with the IBEW alone comprising about 60 percent of the total work hours. Our analysis starts with data from 2002 when the Renewables Portfolio Standard was adopted, but the majority of utility-scale solar projects were built starting in 2010.[29] In total, 16 union locals have built the majority of utility-scale solar arrays in California—nine from the IBEW, five from the Ironworkers, and two from the Operators.[30, 31] The 16 local unions comprise these three trades in the central and southern California counties where most of the new solar projects have been built.

The workers enrolled in these apprenticeship programs likely worked on renewable energy projects but none work exclusively in renewables. Rather, apprentices get their training on many different projects, including renewable energy power plants, to learn the myriad occupational skills necessary for proficiency in their trade.

### Exhibit 1. Summary of Workforce Data Sets

| | DAS data | IBEW Local 428 data |
|---|---|---|
| **Workers** | Apprentices in the 16 unions that built most of the renewable energy power plants in CA | All IBEW workers who constructed 27 solar farms in Kern County, identified by job classification |
| **Trades** | IBEW, Operating Engineers, and Ironworkers | IBEW Local 428 |
| **Data on workers employed on renewable projects only?** | No | Yes |
| **Demographics** | Race/Ethnicity, gender, age, education, veteran status, county | Street address |
| **Wages** | Wage scales by trade and region | Actual wages |
| **Dates** | 2002–April 2017 | June 2012–July 2017 |
| **Number of workers** | 21,207 | 2,894 (3,664 jobs) |

The second data set was acquired from IBEW Local 428, which is located in Kern County and is one of the IBEW locals included in the DAS data we analyzed. The data set provides information on the electrical workers employed to build 27 large-scale solar farms in Kern County between June 2012 and July 2017. Electrical workers perform about 60 percent of the work on solar projects. This data includes residential addresses, job classifications, and wage rates. We mapped this information against the 25 percent threshold in CalEnviroScreen 3.0 to determine how many workers lived in communities designated as disadvantaged.

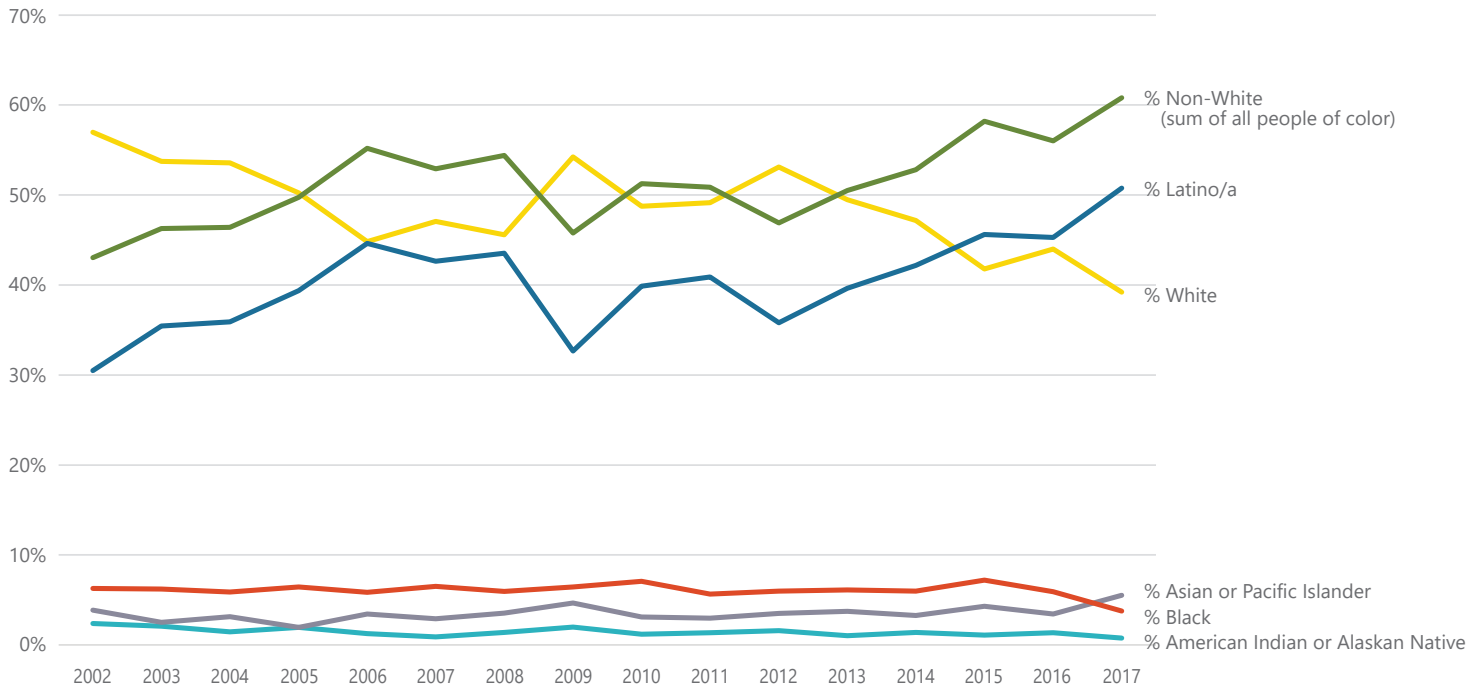
These two data sources together provide the most complete picture currently available of inclusion of workers from disadvantaged communities on renewable energy plant construction projects. More complete data collection could provide information for policymakers to build on successful programs of the unions and contractors, and, where needed, to help improve them via support for publicly funded pre-apprenticeship and/or local hire provisions.

# Results

## Apprenticeship Data for Three Skilled Trades in Renewable Energy Projects

We first present the DAS apprenticeship data on the 16 union locals that have supplied about 80 percent of the workers on large-scale renewable energy construction in California since 2002, when the first renewable portfolio standard was passed. This data set is our only source of information on the race/ethnicity of apprentices, but it does not specifically identify which apprentices worked on renewables projects. However, because apprentices are deployed on a wide variety of projects during their training, the data likely reflects the diversity of apprentices working on renewables projects as

Exhibit 2. Ethnic Composition of Apprentices in Renewable Energy Trades, 2002–2017



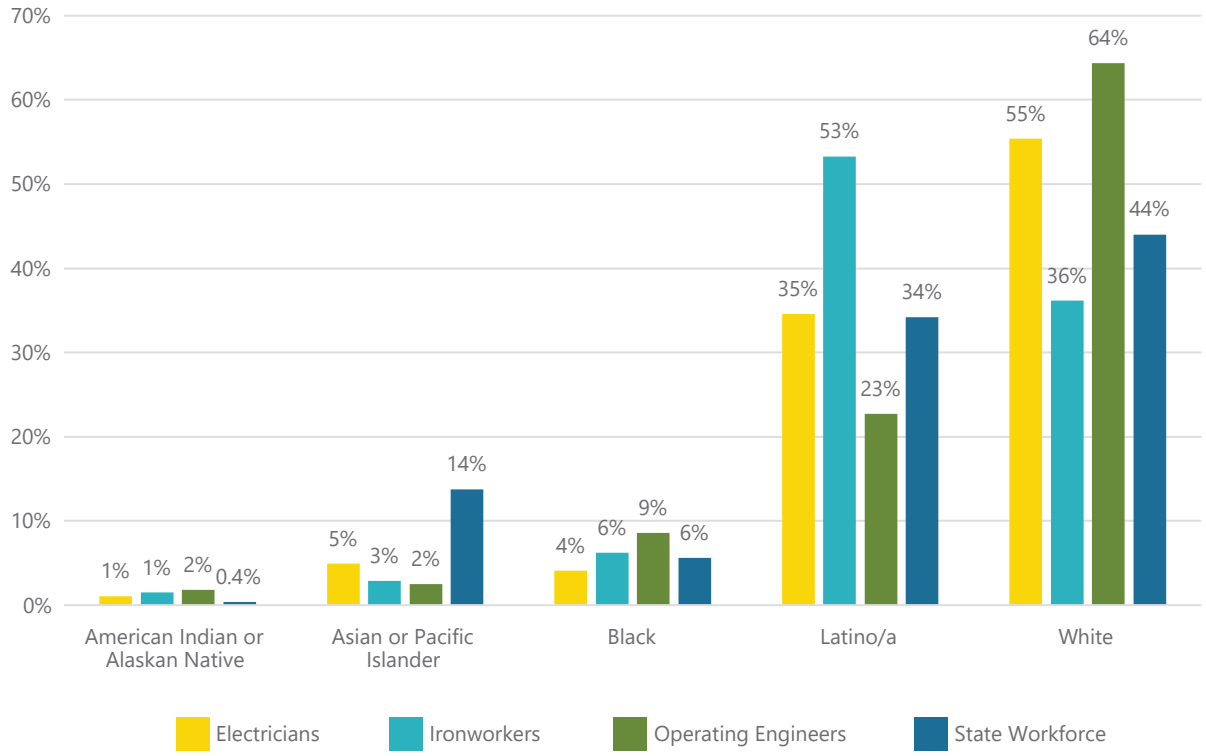
well as the diversity of the apprentices overall. Between 2002 and 2017, new apprentices in these 16 locals came from 21 different racial and ethnic backgrounds, which we grouped into five categories: White, Black, Latino/a, American Indian or Alaskan Native, and Asian or Pacific Islander.[32] Finally, it should be underscored that this analysis is limited to enrollment in apprenticeship, and does not include retention or graduation rates. Further analysis is needed to assess retention and graduation rates by race/ethnicity and trade, particularly because other research has shown lower retention rates for non-white apprentices.[33]

Exhibit 2 (page 9) shows that since 2002 the share of White apprentices has decreased while the share of non-Whites has increased. This pattern slowed during the recession, but is trending upward again. Latino workers account for most of the increase in non-White enrollments, with little change for Blacks, Asians or Pacific Islanders, or American Indians or Alaskan Natives.

Exhibit 2 shows that apprentices in these trades collectively reflect the fact that California is now a majority minority state. However, as shown in Exhibit 3, there is notable variation in ethnic diversity by trade. The Ironworkers are significantly more non-White than the other two unions, with a high percentage of Latinos and the same percentage of African Americans as in the California workforce as a whole. The IBEW has strong representation of Latinos, but lower representation of African Americans, while the Operators have strong representation of African Americans but low representation of Latinos in the apprenticeship enrollment. Asians and Pacific Islanders along with American Indians and Alaskan Natives are underrepresented in all three unions.

In the California economy as a whole, Black and Latino workers are overrepresented in low-wage occupations and underrepresented in family-supporting occupations. Ideally, the ethnic and racial

## Exhibit 3. Apprenticeship Starts by Race/Ethnicity and Trade, 2002–2017



diversity in apprenticeships should be compared with such diversity in comparable career paths—meaning occupations that provide middle-class wages and full benefits. Such an analysis is beyond the scope of this project, but would provide important insight into how the unionized construction trades compare with other middle-class occupations in providing opportunities for members of disadvantaged groups. Still, our finding of increasing percentages of people of color in apprenticeship reveals an important and widening pathway to a middle-class career with full benefits for workers who have heretofore had limited opportunities for upward mobility.

Apprenticeship programs also show high levels of inclusion for veterans in comparison with the California workforce as a whole, as shown in Exhibit 4.[34] However, one area in which apprenticeships are not inclusive is their share of women workers, ranging from a mere 2 percent for the IBEW and Ironworkers to just 6 percent for the Operators. This underrepresentation mirrors the data for the state's construction industry overall, in which women represent only 2 percent of the workforce.

Exhibit 4. Apprenticeship Starts by Trade, Gender, and Veteran Status, 2002–2017

| | Electricians | Ironworkers | Operators | State Labor Force |
|---|---|---|---|---|
| **Percent Female** | 2 | 2 | 6 | 46[35] |
| **Percent Veterans** | 9 | 6 | 12 | 4[36] |

## Electrical Workers on 27 Solar Farms, 2012-2017

Information about electrical workers on 27 solar PV power plant construction projects provides a second view on the issue of inclusion in unionized, clean energy construction jobs. We obtained data on workers with IBEW 428 who worked on renewable energy projects between 2013 and 2017 in Kern County under project labor agreements. More than 2,700 IBEW workers were employed on these utility-scale solar projects, constructing almost 2000 MW over this period.

These workers include apprentices, journeyman, and two entry-level job classifications for workers who have not yet entered apprenticeship: "panel installers" and "un-indentured" apprentices. Workers under the panel installer classification install panels and un-indentured apprentices perform low-skilled electrical work. Anyone who passes a drug test can be hired as a panel installer; there are no other requirements. Un-indentured apprentices are those who are working their way through the apprenticeship testing and interview processes. Once they successfully complete those steps, they can become regular apprentices, counting the work hours they have already performed. The project labor agreements for these 27 solar projects mostly stipulate a staffing ratio of one journeyman to one apprentice to four panel installers (1:1:4). This shows the much higher proportion of entry-level work in solar projects compared to most electrical construction projects, which often do not include entry-level classifications at all. It also reflects the fact that the solar boom in Kern County happened very quickly, exhausting the existing pool of apprentices and opening up new opportunities for on-the-job training in entry-level classifications, including both panel installation and low-skilled electrical work.

All workers are dispatched to the jobs through the IBEW hiring hall. Recruitment efforts by the union included doing job fairs for local residents and giving those applicants the first opportunity to be hired, partnering with several Kern County supervisors, the local workforce investment board, and community organizations, including a veterans group and an organization supporting at-risk youth.[37]

The classifications of panel installer and un-indentured apprentice help workers prepare for entry into an apprenticeship, thus serving a similar function as pre-apprenticeship training programs, which typically provide beginning training for multiple crafts. According to IBEW 428, 85 percent of the apprentices that they have accepted in the last three years worked either as panel installers or un-indentured apprentices on solar projects. Because panel installer work is not a formal training program, no information is available currently on the percentage of panel installers who enter an apprenticeship. Tracking the work trajectories of panel installers would provide information on the extent to which apprenticeship programs can absorb the growth in entry-level workers, and whether or not this informal on-the-job training is as effective as pre-apprenticeship programs and local hire provisions in helping disadvantaged workers access apprenticeship and good jobs in the skilled construction trades.

These jobs clearly provide good wages for unskilled work, and wages increase as skills are acquired. Exhibit 5 shows the wages for workers on the 27 solar projects.[38] Panel installers and un-indentured apprentices are paid about the same as first-year apprentices. However, panel installers do not receive full union benefits while un-indentured apprentices receive the same benefits as first-year apprentices. In 2016, starting pay for entry-level panel installers was $16.12 per hour plus $50 per day for travel. First-year apprentices started at $16.49 plus full benefits. In addition to wages, the project labor agreements all stipulate an additional a $50 per day travel stipend to all workers, no matter where they live, providing a substantial pay boost to local workers who also have first priority in the dispatch system according to the PLA.

Exhibit 6 (page 13) traces the wage gains of the 100 individuals IBEW workers who worked on these renewable energy installations during four or more years. There were significant wage gains for these workers, who started out earning about $15 per hour in 2012. In addition to the wages shown in Exhibit 6, workers moving from installer to apprentice classifications also receive health care, pension, and other employee benefits which would further swell their compensation packages.

Exhibit 5. Number of Workers by Wage and Skill Level on 27 Solar Projects, 2012-2017

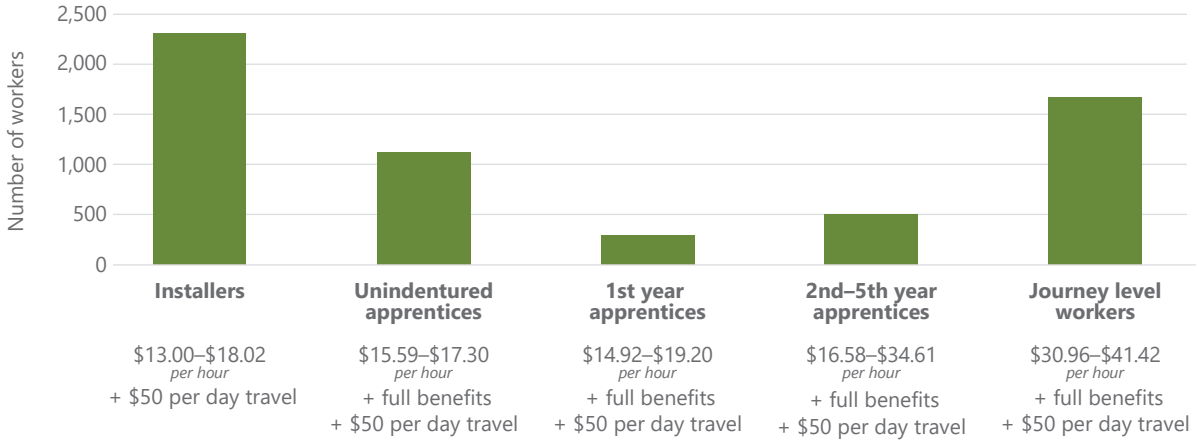
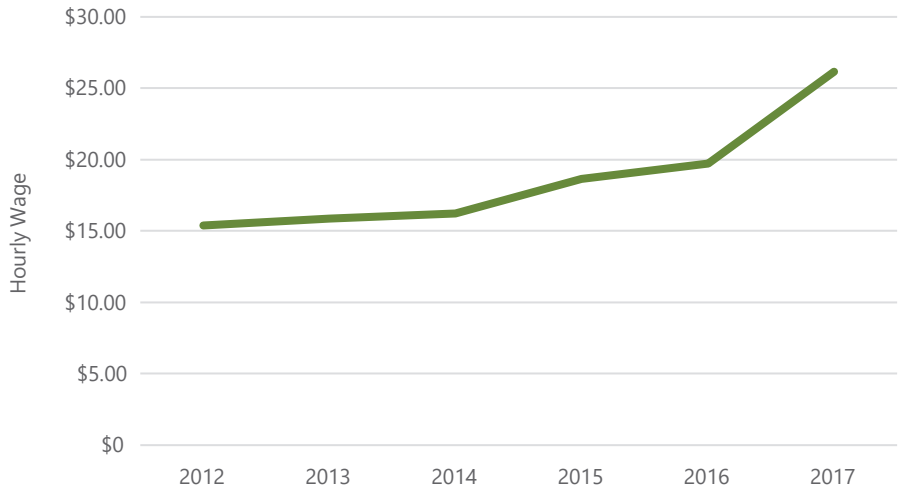


Exhibit 6. Increase in Wages for Entry-Level Workers on Renewable Energy Projects who worked over 4+ Years during 2012-2017[39]



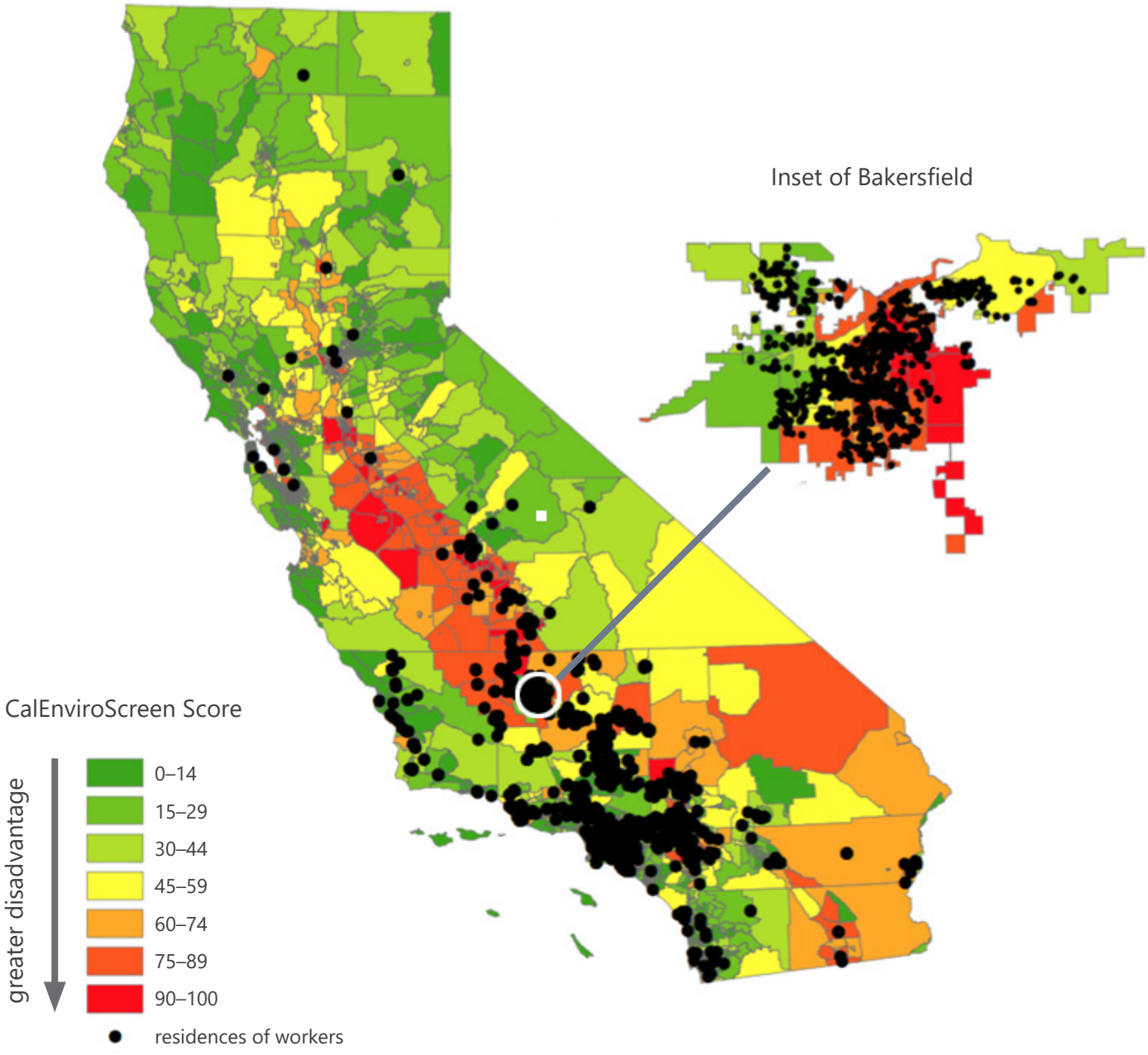

## Inclusion

The IBEW Local 428 data contains workers' residential addresses, which, combined with the California EPA's CalEnviroScreen 3.0 tool, allowed us to determine the extent to which renewable energy jobs are being directed toward workers in disadvantaged communities. As described above in "Definitions of Disadvantage in California Climate Policy," CalEnviroScreen identifies "disadvantaged communities" as the worst-off 25 percent of all state census tracts, on the basis of environmental and socio-economic indicators.[40] We mapped the residences of the IBEW renewables construction project workers onto the CalEnviroScreen 3.0 map to determine the proportion of these workers living in disadvantaged communities.

The black dots in Exhibit 7 (page 14) represent the home addresses of workers on IBEW 428 renewables projects. Nearly half live in Bakersfield, so this section of the map was pulled out and enlarged. The data show 38 percent of all workers (including entry level, apprentice, and journeyman) live in disadvantaged communities. 43 percent of entry-level workers (panel installers, un-indentured apprentices and first year apprentices) live in disadvantaged communities, indicating that large-scale renewable energy construction in the state is creating good jobs for the people who most need them.[41] The percentage of entry-level workers from disadvantaged communities in these renewable projects is on the high end of goals for inclusion in local and targeted hire programs in California, which generally range from 25 to 50 percent.[42]

While this information corresponds only to 27 projects--which are located in Kern County, a poor county in rural California--the concentration of renewable power plants in the San Joaquin Valley and the Inland Empire, both regions with disproportionate shares of disadvantaged communities, suggests that a similar demographic profile of entry-level workers is likely elsewhere.[43]

Exhibit 7. Map of Worker Residences with CalEnviroScreen 3.0 Scores for Kern County Solar Projects



# Conclusion

The climate is changing, and California has emerged as a national and international leader in taking decisive action to lower greenhouse gas emissions. As the state transitions to a greener economy, an important challenge has been to ensure that new "green jobs" are good jobs and that they are equitably distributed across California's diverse labor force. In the construction of renewable energy power plants, California has made clear progress toward this goal. Our study found that these workers are racially and ethnically representative of the state's population and include workers from its most disadvantaged communities.

Providing disadvantaged and underrepresented workers with access to high-quality career track clean energy jobs is not automatic. Rather, the project labor agreements used on these projects ensure union wage and benefit standards and provide free training through state-certified apprenticeship programs, creating the possibility of inclusion into high-quality career track jobs. This possibility has been realized in the case of renewables construction, presumably due both to recruitment efforts by the IBEW and due to the location of the projects: Kern County and other areas where large-scale renewables are built happen to be in poor areas of rural California, with a high concentration of workers from disadvantaged communities. To build on success in these regions and to broaden this success to other areas where inclusion and diversity may be harder to achieve, additional tools are available, including local hire provisions in PLAs and publicly-funded pre-apprenticeships.

Going forward, it will be important to more systematically track worker outcomes on green energy construction projects, so policymakers and others can better assess the workforce development programs unions and contractors are using, how these programs can be expanded, and what needs improvement. A critical unanswered question is to what degree workers hired as entry-level panel installers are able to enter an apprenticeship, and to what degree they are retained and graduate. Retention and graduation rates in apprenticeship, not just starts, need to be thoroughly analyzed.

The Renewables Portfolio Standard has played a crucial role in driving the growth of renewable energy projects in California.[44] Further progress is likely if policymakers approve SB 100. This and other clean energy policies have the potential to significantly expand enrollment in state-certified apprenticeship programs, which in turn will advance the state's goals of broadening access to middle-class jobs while resolutely addressing climate change.

# Endnotes

[1] Carol Zabin et al., "Advancing Equity in California Climate Policy: A New Social Contract for Low-Carbon Transition" (Center for Labor Research and Education, University of California, Berkeley, September 13, 2016), http://laborcenter.berkeley.edu/advancing-equity/. Berkeley: Center for Labor Research and Education, Donald Vial Center on Employment in the Green Economy, September 13, 2016

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[28] The identification of the three crafts and 16 local unions was provided by Marc Joseph of Adams, Broadwell, Joseph and Cardozo, a law firm that has negotiated many PLAs on behalf of the construction trades unions.

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[30] IBEW training committees included: Central Valley Electrical JATC; Fresno, Madera, Kings & Tulare Counties Electrical Industries JATC; Kern County Electrical Joint Apprenticeship & Training Committee; Orange County Electrical JAC; San Bernardino, Mono and Inyo Counties Electrical JAC; San Diego Electrical JATC; San Luis Obispo Electrical Workers JAC; Santa Clara County Electrical Trades JATC; and Tri-County Electrical JATC.

Ironworkers training committees included: International Association of Bridge, Structural, Ornamental, & Reinforcing Ironworkers Local 155 JATC; International Association of Bridge, Structural, Ornamental & Reinforcing Ironworkers Local Union 229 JATC; International Association of Bridge, Structural, Ornamental & Reinforcing Ironworkers Local 416 JATC;

International Association of Bridge, Structural, Ornamental & Reinforcing Ironworkers Local 433 JATC; and International Association of Bridge, Structural, Ornamental & Reinforcing Ironworkers Local 378 Oakland JATC.

Operating Engineers training committees included: Joint Apprenticeship Committee for Operating Engineers for the 46 Northern Counties in California; and Southern California Operating Engineers JAC.

[31] Operating engineers are heavy machine operators and are involved in different parts of each step of the construction process, including surveying, making cuts, hoisting steel, and completing grading on a finished site among other activities. Ironworkers, among their many functions on construction sites, erect the steel supports on which solar panels rest. After the ironworkers finish, electricians install the panels, wire any electrical controls, and in conjunction with operating engineers, continue maintenance of the site after completion.

[32] We include under Asian or Pacific Islander those individuals who reported their ethnicity as Asian Indian, Asian or Pacific Islander, Cambodian, Chinese, Fijian, Filipino, Guamanian, Hawaiian, Hmong, Japanese, Korean, Laotian, Malaysian, Samoan, Taiwanese, Thai, Tongan, and Vietnamese. We use the term Latino to replace the DAS's term Hispanic, and White instead of DAS's term Caucasian.

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[34] The program Helmets to Hardhats, a national non-profit started by the building trades unions and unionized contractor associations, provides pre-apprenticeship training and hiring commitments for veterans and is an example of the concerted effort by the industry to recruit from a targeted group. See http://www.helmetstohardhats.org.

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[37] Information provided by Jim Elrod, Business Manager, IBEW Local 428.

[38] This figure counts the number of workers on the 27 projects, not the hours worked, and for this reason, does not correspond to the staffing ratios of panel installers to apprentices and journeyman stipulated in the contract.

[39] Not adjusted for inflation.

[40] CalEnviroScreen 3.0 identifies communities as disadvantaged based on census tract. Census tracts are geographical subdivisions of counties, which are identified as part of the U.S. Census Bureau's Participant Statistical Area Program and standardized to include a certain number of people. The geographical size of a census tract can vary based on population density, with the census tracts in California in the 2010 Census averaging 6,300 people. By designating areas by census tract, CalEnviroScreen 3.0 fairly evenly apportions the state population according to their vulnerability on economic, environmental, health, and social indicators. See: Faust et al., "CalEnviroScreen 3.0: Update to the California Communities Environmental Health Screening Tool"; U.S. Census Bureau, "2010 Geographic Terms and Concepts - Census Tract" (December 2012), https://www.census.gov/geo/reference/gtc/gtc_ct.html.

[41] We excluded the several hundred workers from Nevada for this analysis as we had no way to determine whether or not they reside in disadvantaged communities.

[42] Waheed and Herrera, "Exploring Targeted Hire: An Assessment of Best Practices in the Construction Industry."

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