EXPLORING TRAINING NEEDS ASSESSMENT

Hawai'i's Solar Industry

December 2011









State of Hawai'i
Department of Labor and Industrial Relations
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DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

Dwight Takamine, Director
Audrey Hidano, Deputy Director

RESEARCH AND STATISTICS OFFICE

Francisco P. Corpuz, Research and Statistics Officer
Phyllis A. Dayao, Labor Market Information Staff Supervisor

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John K. Kontos, Lead Analyst and Writer
Carolyn D. Weygan-Hildebrand, Program Analyst and Supervisor
Maria R. Merry, Program Analyst

Preface

The writing of this report started when the Solar Foundation released "National Solar Jobs Census 2011: A Review of the U.S. Solar Workforce," a research report dated October 2011. The Solar Foundation collected information because the lack of ongoing information about solar industry jobs was presenting difficulties for policy makers and training providers. This study collected information from July to August 2011. The national study went through a rigorous sampling process from a "known universe" of firms across the country and oversampled States that had the highest solar employment (Hawai'i was not one of them). The results shed some light on the nation's solar industry with a focus on the top five States in solar employment.

A Hawai'i study was generated for the same reason. This report presents the results of a Hawai'i study that was motivated by a need to have ongoing data in order to identify training gaps in an environment that was perceived to be rapidly changing and with many uncertainties. It was also motivated by the need to test how pragmatic promising practices were (i.e., online survey, collaboration, and continuous learning) in gathering data in a short project time frame.

The study collected data from October to November 2011. The Hawai'i study made no claim about rigorous sampling. Instead, it sought sources to broaden the list beyond the Hawai'i Solar Energy Association's. The report presents the results in such a way that policy-makers and training providers can "listen" directly to the responses of 79 employers rather than tenuous statistically-driven prognoses.

The analysts of the study encourage a modest use of the findings – to use results as general directions for the development of training and career pathways for the State and to use the statistical data as the best available data regarding the plans of employers who participated in the survey (and not necessarily of all employers in the industry).

Part I of the report covers results and analysis of a survey and four group discussions. It presents the depth and breadth of hiring in the next 12 months, qualifications and desirable training, as well as expected changes that impact hiring decisions. Also included are county summaries that provide readers with a more direct sense of survey answers.

Part II covers methodology and walks readers through the thought process behind a study that was carried out in three months or less. The appendices close the report with tools to help future researchers -- standard occupational classification of reported occupations and national models of career pathways.

Both Part 1 and Part II end with specific recommendations for action.

Executive Summary

Millions of grant dollars and thousands of collaboration-building hours can go down the drain if training and workforce preparation services lead to skills that rapidly changing industries no longer need or will not need in the future.

Rapid changes and uncertainty create a greater need to gather information beyond regularly scheduled labor market data gathering activities. Innovations in labor market intelligence must include flexibility in responding to rapidly changing market dynamics. Labor market information researchers have to expand their abilities to gather information rapidly and frequently. Promising practices include having a culture of continuous learning, tapping networks, and using online tools.

Data and insights from 79 solar employers (or 54 percent of all employers who were asked to participate in the survey) were successfully collected between October 12, 2011 and November 4, 2011. Initial analyses including consensus from small group discussions were completed by December 12, 2011. The results suggested two trajectories for training and workforce development preparation -- ongoing business and transformation.

- *Solar Employers and Industry Make-Up.* Individual employers will continue to see rapid changes and uncertainty but also sense an industry that is normalizing. Individual businesses will enter and exit in response to the interplay of market conditions. Hawai'i's solar energy industry is largely made up of installation businesses and has increasingly been intertwined with construction industry projects. It is expected that solar industry workers will experience employment dislocation and career disruptions.

- *Jobs Core to Solar Businesses and Hiring Outlook.* Surveyed employers expect to hire more workers in the next 12 months just as they did in the last 12 months. Of the 79 employers who answered the survey, 57 percent hired workers in the last 12 months and only four employers let go of the workers they hired due to lack of work. A total of 664 current jobs were identified as core to the solar industry. Employers plan to add a net of 171 - 197 more jobs in the next 12 months. A little over 50 percent of the planned hiring will come from only nine companies. Downsizing of 34 - 39 jobs was expected in eight - nine companies.

- *Finding Qualified Workers.* Employers relied the most on "word-of-mouth" and the least on government-subsidized resources (i.e., HireNetHawaii and One-Stop Centers). Surveyed employers also use private job boards and company websites. The largest number of workers that employers plan to hire will be installers, electricians, and plumbers of different types or levels. Although much smaller in number, the biggest growth in anticipated demand were for sales workers. The most difficult to find were qualified workers for engineering, management, and supervisory (first-line for construction trades) jobs.

- *Job Qualifications and Training Requirements.* On-the-job (OJT) training and/or a high school diploma were the minimum requirements for 72 percent of the jobs that were identified as core to solar businesses. A post-secondary degree (associate, bachelor, or graduate) was the minimum requirement for 22 percent of the jobs. To meet the demands of solar industry jobs, there were at least four areas of training and workforce preparation that had to be met: a) *Certifications that were distinctly "green" or "new"* such as the North American Board of Certified Energy Practitioners (NABCEP) certification; b) *licenses in traditional construction industry jobs*; c) *manufacturer-sponsored training and other means of upgrading knowledge and skills*; and d) *a broader array of essential skills including personal effectiveness, academic, workplace, and occupation-specific skills.*

- *Usefulness of Training.* Relevance, timing, affordability, and quality of training were all factors to consider in determining the usefulness of a training mode. The readiness of a worker was also a factor in whether training could work or not. Employers clearly valued OJT the most, but its affordability could be a barrier. Online training was considered the least useful, but its timing was a valuable asset. Other training modes from university degree programs to manufacturer-sponsored training were useful, each with unique drawbacks.

- *Signals from the Radar Screen*. Big federally-funded projects across the Islands were expected to provide employment and sustain the income of solar industry workers in the short-term, but discussants offered promising channels to future employment. Skills could be applied or transferred to smaller projects like maintenance and repair of installed panels and systems; rehabilitation of faulty ones; installations in smaller properties - both new and old; crossover to other renewable energy projects (e.g., wind, hydro-plants and entrepreneurial endeavors like sustainable farming that combines energy and food production); and small scale manufacturing of installation parts.

- *Analysis of Signals.* Employers faced the most uncertainty from government decisions and actions. Survey results included concerns over loss of incentives and cost of doing business; control over quality of installation, installers, inspectors, electrical codes and other standards, workmanship, public project bidding, and others; and complexity of rules and regulations. Nevertheless, some key sources of uncertainties are being addressed. Public awareness in its broadest sense was viewed as a cornerstone in realizing the transformation to more and better solar installation. Training and education of key players such as homeowners and their bankers are cited as examples.

- *Recommendations.* To realize the highly qualified and globally competitive workforce that Hawai'i's workforce development system envisions, the study concluded that training and workforce preparation for the immediate- and long-term require:

  1. Statewide summit/s alongside local areas task forces to take stock, align, and collaborate on transformational activities and "roadbuilding."

  2. Balance in training and workforce preparation activities between certifications specific to green industries (e.g., NABCEP) and many other competencies that are not new to workforce development stakeholders.

  3. Better job transition and career preparation for workers through closer alignment of ground-level information on opportunities and gaps. (e.g., accuracy in existing online lists of NABCEP certified professionals; up-to-date and accurate data on training opportunities; stronger network between one stop centers, trainees, and employers who prefer "word of mouth"). Alignment of online tools that continue to be created or refined by different stakeholders for purposes of increasing access to information. Actual usage and accuracy

of data are among the key elements that will determine whether these tools will be valued or not.

4. Continuous data gathering including refinement in survey design. Explore the feasibility of establishing the shifting structure of the solar industry, expand search for employers, and implement.



Part I. Results and Analysis

A. BACKGROUND

The decision to study Hawai'i's Solar Industry was based on it being the largest and fastest growing[1] Green industry in the State, in terms of jobs. Likewise, the decision to survey employers was based on a recommendation by the University of Hawai'i Curriculum Research Development Group[2], which identified solar employers as the group most likely to recognize the extent of training gaps in the industry. The main purpose of the report was to gather information about training needs in a rapidly changing and uncertain environment. The study was intended to assist workforce development stakeholders in making decisions on how to address training gaps in the short run. It also aimed to improve labor market information research solutions when rapid changes and uncertainties exist in an industry and economy.

An online survey for solar industry employers was designed with the intent of balancing the need for a good response rate and drawing answers that captured some of the uncertainties and changing conditions that affected training needs. The survey was collaboratively designed in September 2011, launched in October 2011, analyzed for initial results, and presented in small group discussions in November and early December 2011. A total of 146 businesses were surveyed. Of the 79 responses, seven were partial and ten responses were received after the conduction of phone interviews.

1. State of Hawai'i Department of Labor and Industrial Relations Research & Statistics Office, "Hawai'i's Green Workforce: A Baseline Assessment," Honolulu, HI, December 2010, <www.greenjobshawaii.org>.
2. The UH CRDG assisted in gathering data for and reviewing the final report, "Training Gaps Assessment for the Construction Industry."

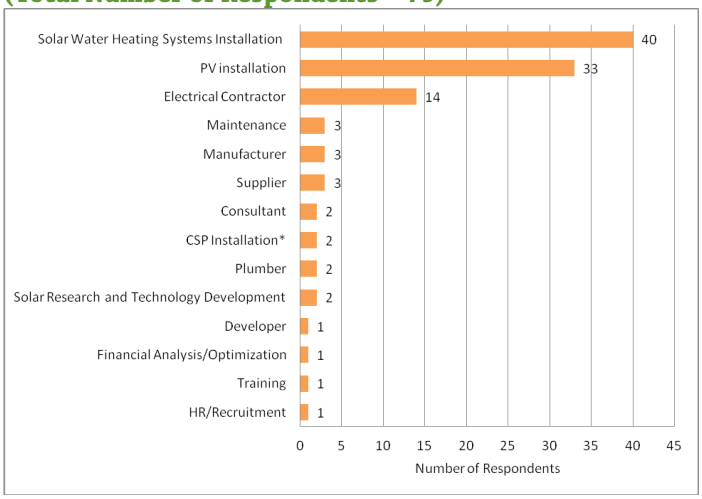
B. FINDINGS

Findings from the survey of employers and small group discussions with stakeholders offered a future industry scenario where individual employers would likely continue to see rapid changes and uncertainty but also an industry that was normalizing. Individual businesses would enter and exit in response to the interplay of market conditions. Some workers could also be expected to dislocate.

1. Solar Employers and Industry Make-Up

In contrast to the national profile where other sub-sectors (i.e. manufacturing, sales and distribution, and others) made up close to half of the businesses, findings from the survey and small group discussions revealed that Hawaii's solar industry was largely made up of installation businesses (Chart 1). Of the 79 respondents, 40 identified themselves as solar water heating system installers, 33 as photovoltaic ("PV") installers, and 14 as electrical contractors. A few more identified themselves in others ways.

Chart 1. Solar Employers By Activity
(Total Number of Respondents = 79)



*Note: CSP Installation is planned rather than actual

Solar Activities. Chart 2 below shows that 14 respondents who were engaged in PV installation were also involved in solar water heating system installation; three who did maintenance were also in solar water heating system installation or PV or both; one was in roofing and reported that they were also in solar heater heating system installation. Discussants noted that this survey finding was informative about interconnections of a variety of activities. However, a comprehensive understanding of the industry's structure was not captured and this will have to be provided by future studies.

Other Activities. A little over 68 percent of solar employers in the survey said that their business operations included other activities beyond solar (Chart 3). Discussants pointed out that the solar industry businesses was increasingly intertwined with construction industry markets. (e.g., the construction industry was a source of solar employment through projects). Further information about actual production activities was not collected in the brief survey. It could be surmised that most were construction-related but only a more rigorous study can establish this.

Chart 2. Solar Employers and Reported Activities (Total Number of Respondents =79)

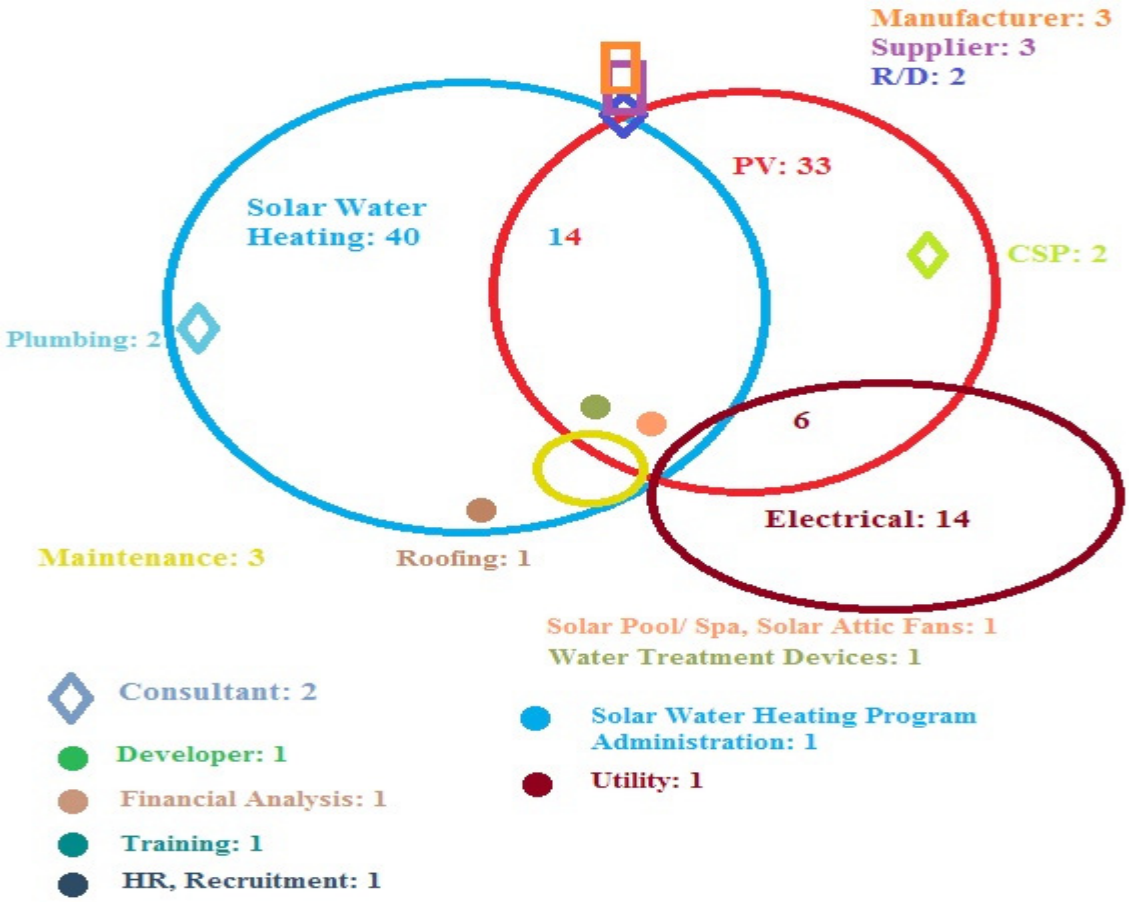
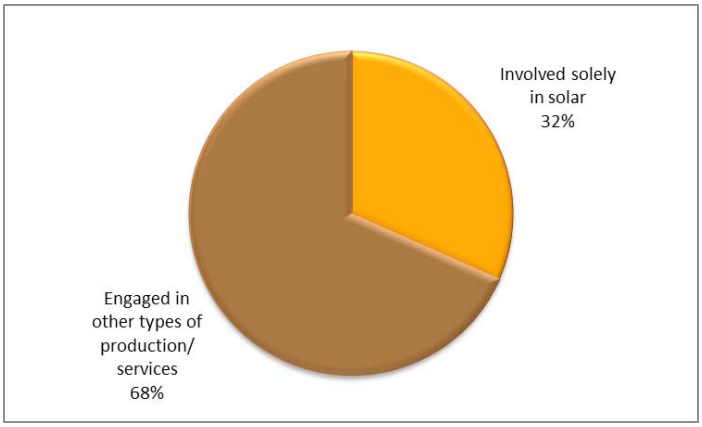
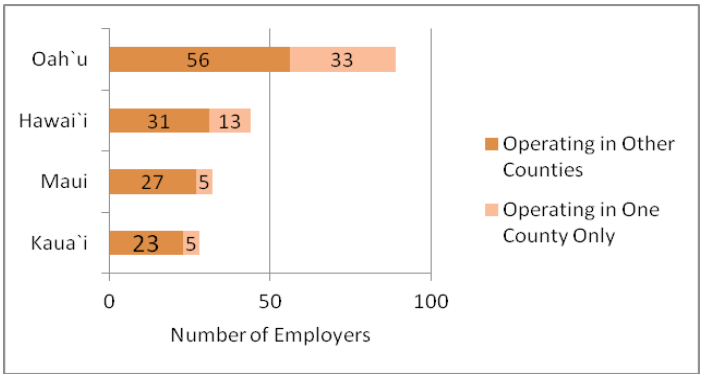


Chart 3. Solar Employers and Involvement in Solar Business (Total Number of Respondents = 79)



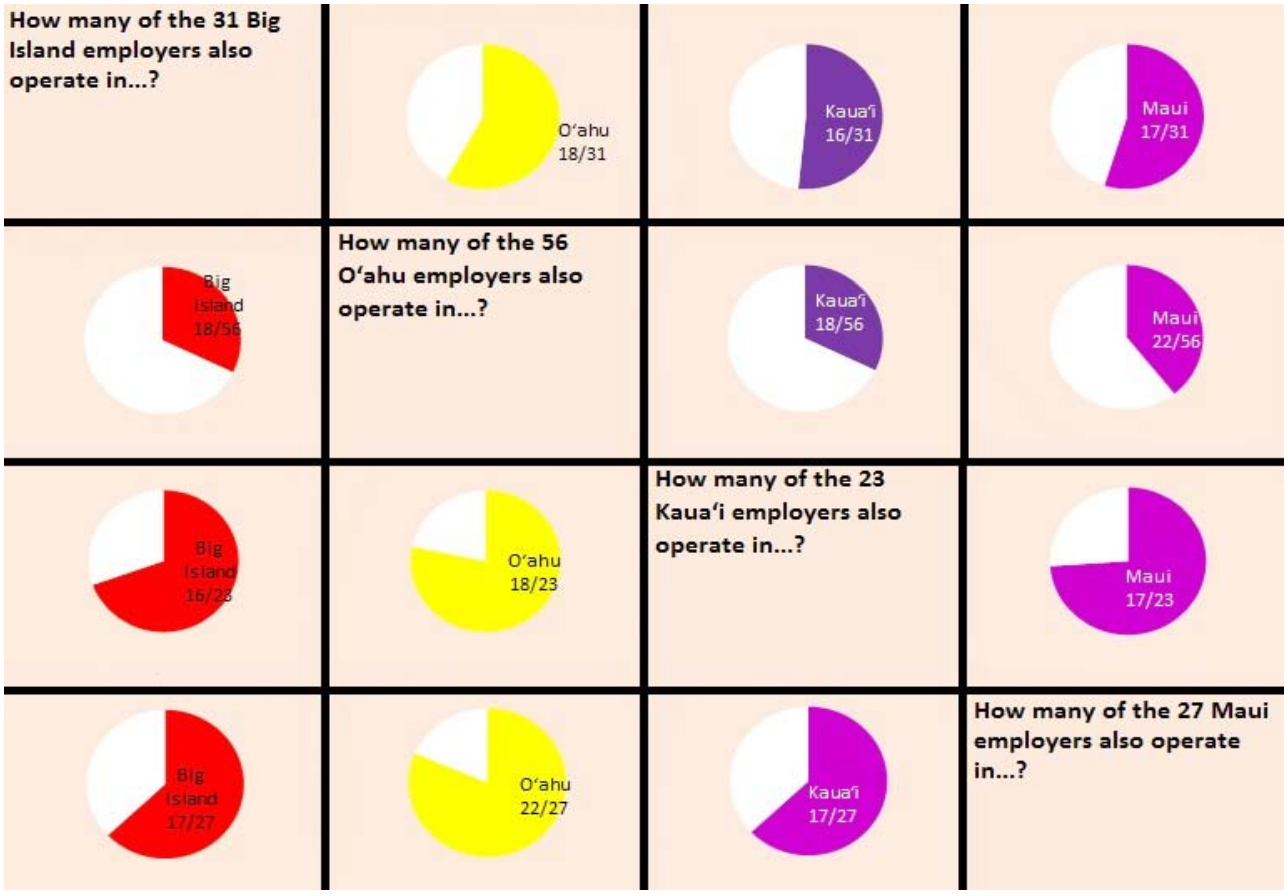
Business Location. All counties had two kinds of employers: employers who only operated in one county and employers who operated in more than one county. A majority of the solar employers in the survey operated their businesses on O'ahu (as expected due to the island's population) and a significant number of them operated on the other islands as well. (Chart 4)

Chart 4. Solar Employers and Location of Business Operations



Relatively speaking, Kaua'i and Maui depended more on businesses that were also operating on other islands (Chart 5).

Chart 5. Location of Businesses that Operate in Multiple Counties



2. Jobs Core to Solar Business and Hiring Outlook

Employers in the survey identified 664 of their current jobs (including one part-time job) as core to their solar business. Fifty-seven percent hired workers in the last 12 months and only four employers let go the workers they hired due to lack of work. Employers planned to add a net of 171 - 197 more jobs in the next 12 months. A little over 50 percent of the planned hiring will come from only nine companies. Downsizing of 34 - 39 jobs was expected in 8 - 9 companies. The largest number of workers that employers planned to hire will be installers, electricians, and plumbers of different types or levels. Although much smaller in number, the biggest growth in anticipated demand will be for sales workers.

Employment. The planned hiring within the next 12 months of 171-197 jobs represented between 26-30 percent growth in the total number of jobs identified as core to the solar business by employers in the survey. The vast majority of the jobs reported fell under the construction jobs category (installers, electricians, plumbers etc.), while a large number of sales representatives were also employed by solar businesses. There was a somewhat smaller number of management and engineering jobs, and an even smaller number of office and administrative support jobs. Chart 6 illuminates with more specific counts and proportions. For example, there were 420 construction jobs or 63 percent of all total jobs that were core to the solar business. Appendix A lists the actual job titles that employers provided.

Chart 6. Number of Jobs and Percentages Identified to be Core to Solar Business By Major Group

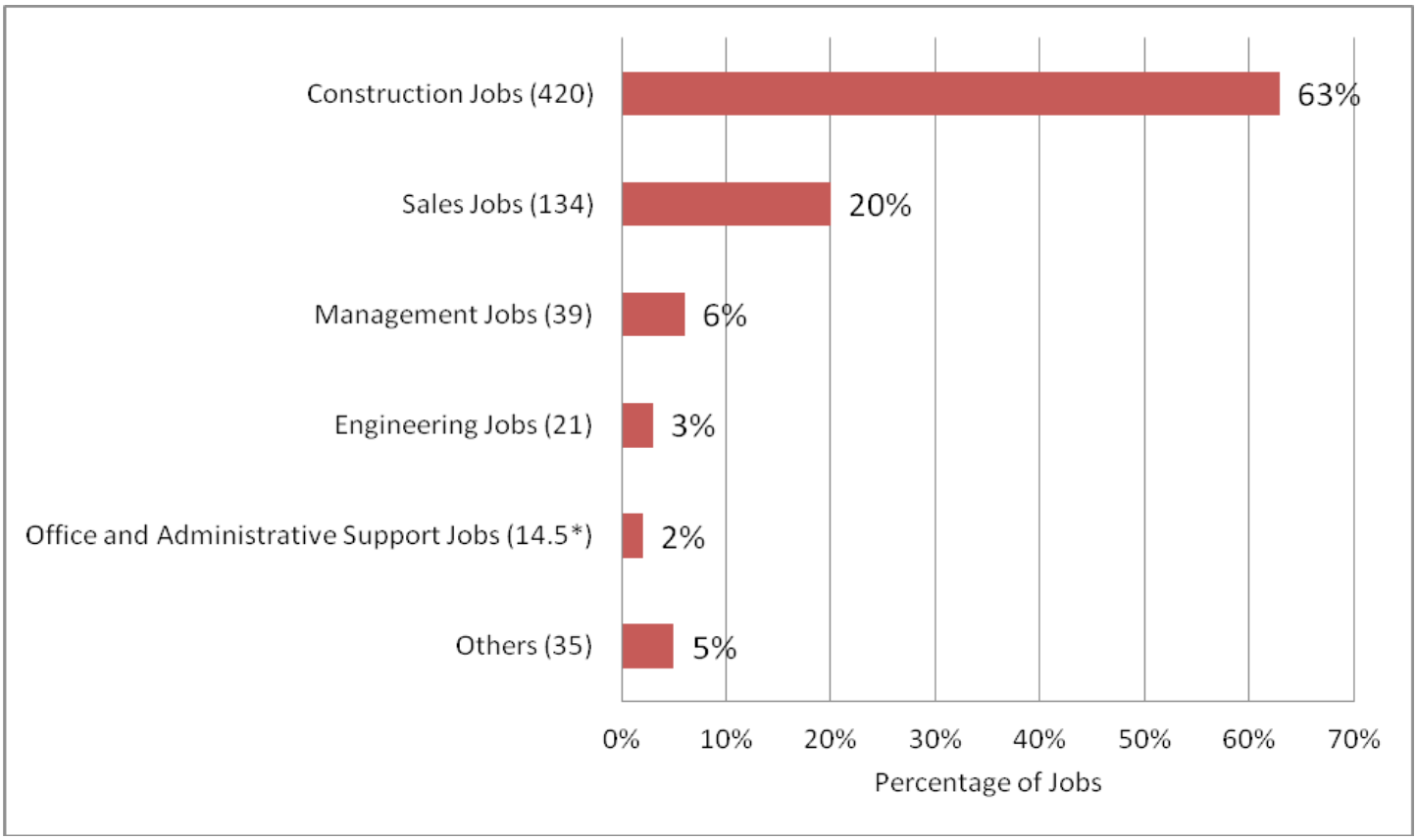
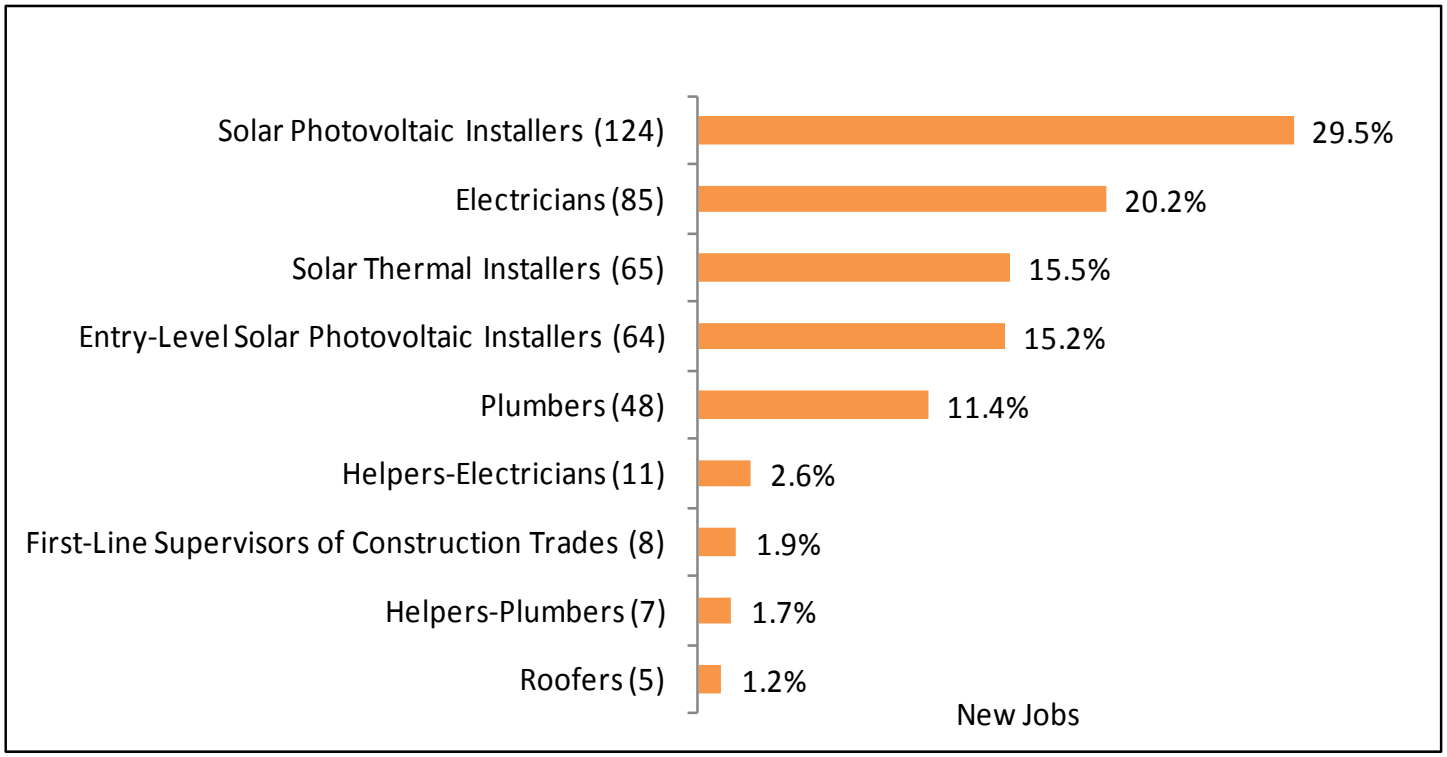


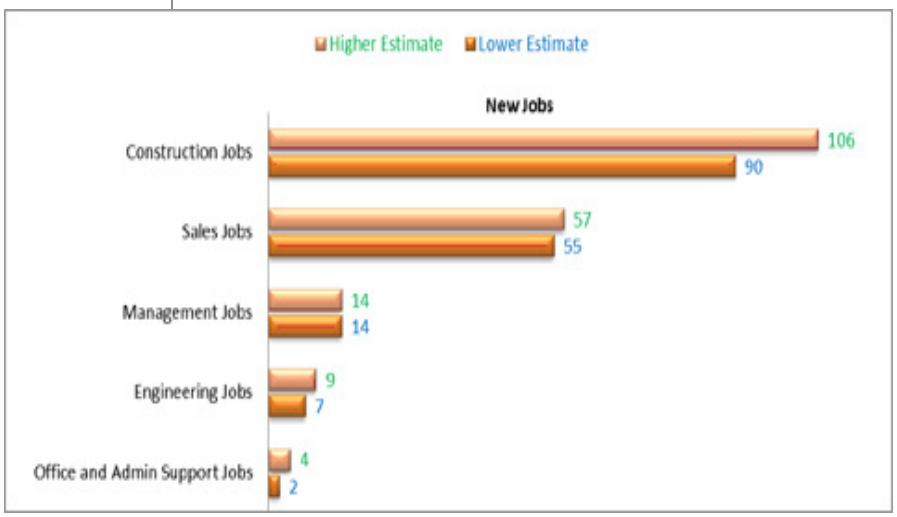
Chart 7. Construction Jobs Core to Solar Business Sub-Group, Count and Percentage



Construction jobs fell under nine different occupations groups. The largest of these was solar photovoltaic installers and electricians (Chart 7). An interesting finding in this particular survey was that, while the number of solar water heating installation businesses was somewhat larger than that of PV installation businesses, there was a significantly larger number of PV installers and electricians than plumbers and solar thermal installers.

Hiring Plans. The reported job growth within the next 12 months was 26-30 percent[3], with construction jobs being expected to have a 21-25 percent increase, smaller than that of sales, management and engineering jobs, but still greater in terms of total new jobs created (construction jobs were expected to increase by 90 to 106, while sales jobs were expected to increase by 55 to 57). Job growth projections for the top five standard occupational classification groups were: construction: 90-106 (21-25 percent); sales: 55-57 (41-43 percent); management: 14 (36 percent); engineering: 7-9 (33-43 percent); and office and administrative support 2-4 (14-28 percent). (Chart 8)

Chart 8. Additional Workers That Employers Plan To Hire In Twelve Months (Jobs Core to Solar Business Only, High and Low Estimates)



3. Employers were asked to provide a range of answers, with 26 being the average of the low estimates and 30 the average of the high estimates.

3. Finding Qualified Workers

For finding qualified workers, employers in the survey relied the most on "word-of-mouth" and the least on government-subsidized resources. The most difficult to find were qualified workers for engineering, management, and supervisory (first-line for construction trades) jobs.

Resources Used to Find Qualified Workers. Employers that hired workers within the last 12 months, used mostly "word of mouth" (29 out of a total of 45 employers), and private job boards such as Craigslist (a total of seven respondents use Craigslist). DLIR resources such as One Stop Centers and HireNet Hawaii were not used as often.[4] (Chart 9)

Difficulty in Finding Qualified Workers. Employers in the survey found engineering and management positions to be the most difficult to fill, while sales and construction positions were easier to fill with qualified workers. They were asked to indicate the degree of difficulty on a scale from 0 to 2 (0: No Difficulty, 1: Some Difficulty, and 2: Great Difficulty). The average rating for all positions was 0.89 and the average for each of the top five occupational groups were: Engineering 1.67; Management 1.22; Office and Administrative Support 0.96; Construction 0.88; and Sales 0.72. (Chart 10)

4. HireNetHawaii, like other third party aggregators, spider jobs from private job boards and corporate websites. Greenjobshawaii.org is an extension of HireNetHawaii and posts jobs that are classified as green jobs. Green jobs include jobs that are core to solar businesses.

Chart 9. Resources Used by Employers To Find Qualified Workers By Number and Proportion of All Respondents

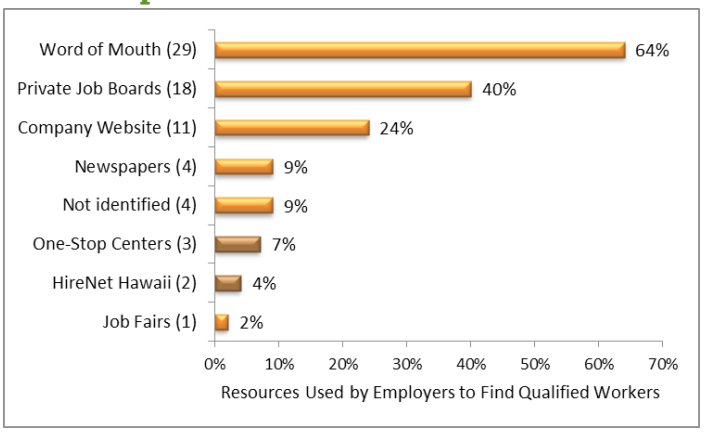
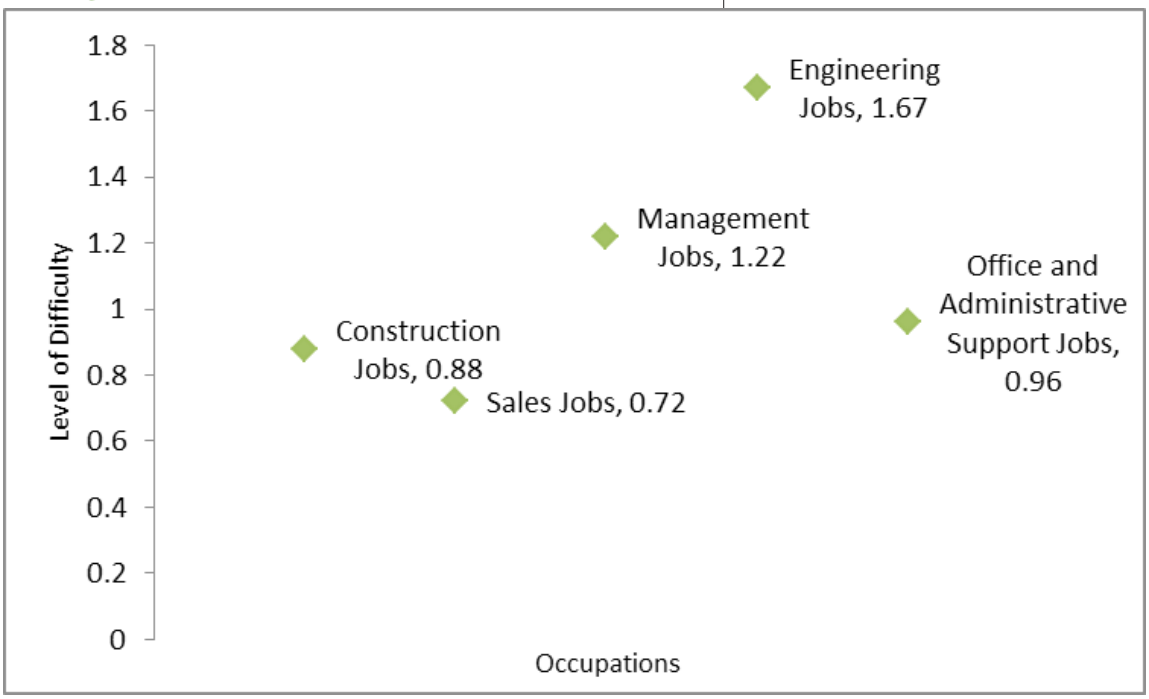
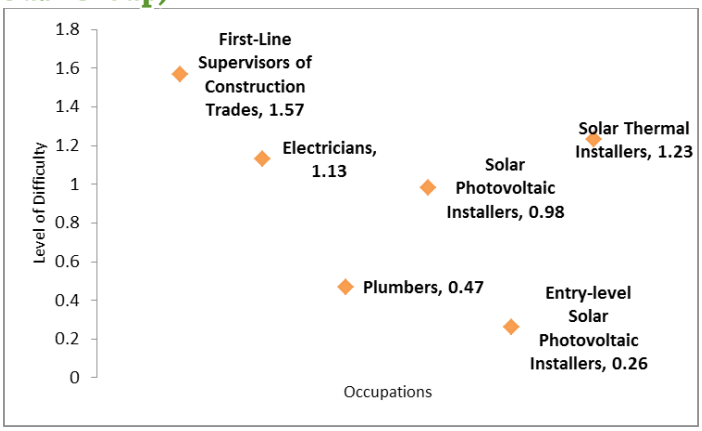


Chart 10. Difficulty in Finding Qualified Workers Ratings for Top Five Occupational Groups



Of construction jobs, first-line supervisors were the most difficult to fill with qualified workers. Solar thermal installers and electricians were two other jobs that employers indicated having at least some difficulty on average in filling with qualified workers. The order of difficulty for sub-groups of construction jobs is presented in Chart 11 below:

Chart 11. Difficulty in Finding Qualified Workers (Ratings by Construction Job Sub-Group)



4. Job Qualifications and Training Requirements

On-the-job (OJT) training and/or a high school diploma were the minimum requirements for 72 percent of the jobs that were core to solar businesses. A post-secondary degree (associate, bachelor, or graduate) was the minimum requirement for 22 percent of the jobs.

To meet the demands for solar industry jobs, there were at least four areas of training and workforce preparation that had to be met:

a) Certifications that were distinctly "green" or "new." Employers required North American Board of Certified Energy Practitioners (NABCEP) certification for106 of the current jobs and Leadership in Energy and Environmental Design (LEED) designated professional for five jobs;

b) Licenses in traditional construction industry jobs. For 74 of the current jobs, employers required different levels of licenses for electricians and plumbers;

c) Manufacturer-sponsored training and other means of upgrading knowledge and skills in new products, technologies, policies, and more; and

d) Broader array of essential skills including:
- personal effectiveness competencies (e.g., integrity, interest).
- academic competencies (e.g., ability to read and communicate, computer skills)
- workplace competencies (e.g., teamwork, supervisory skills)
- industry-wide skills (e.g., project management)
- occupation-specific skills (e.g., Computer-Aided Design, Chinese language).

Ultimately, proper installation and profitability were key and shared objectives for all these employer requirements.

Relevance, timing, affordability, and quality of training were all factors to consider when evaluating the usefulness of a training mode. The readiness of a worker was also a factor in whether training will work or not. Employers clearly valued OJT the most but its affordability could be a barrier. Online training was considered the least useful but its timing was a valuable asset. Other training modes from university degree programs to manufacturer-sponsored training were useful, each with unique drawbacks.

Statistics from the results of the survey provide more details.

Minimum Qualifications and Training Requirements. The majority of the reported jobs (77 percent) required only OJT, minimal training or a high school diploma. Only 22 percent of reported jobs required a college diploma. The educational requirements for all jobs can be seen below:

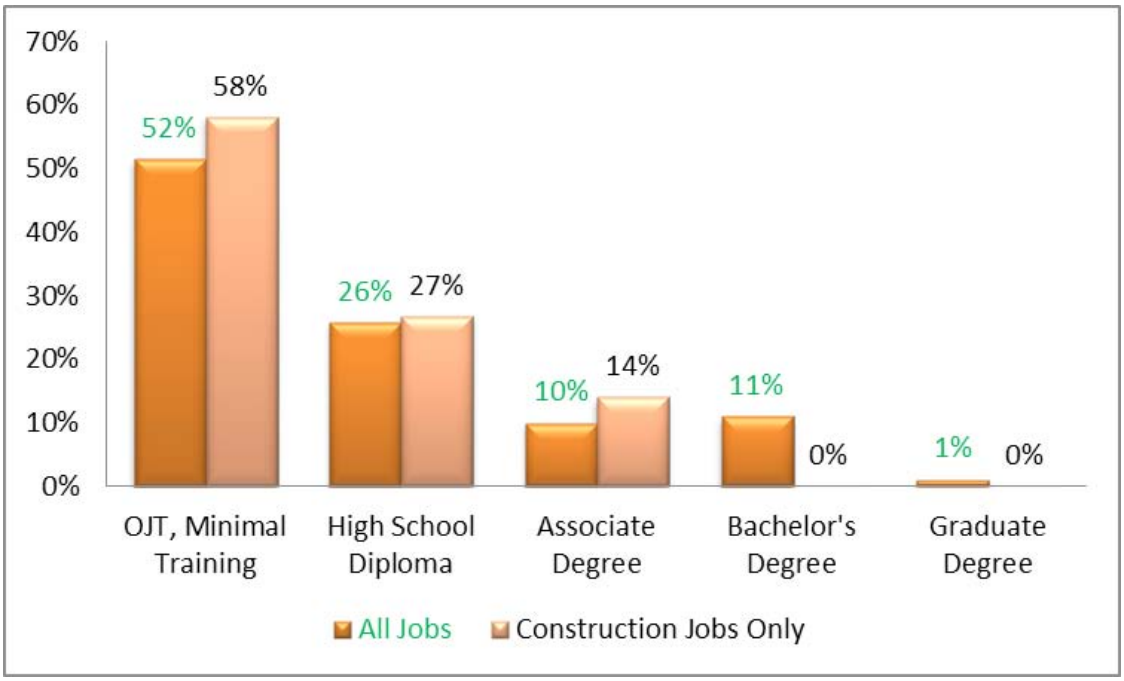
- OJT, Minimal Training: 52 percent of jobs (342 current jobs and planned hiring will add between 70-87 in the next 12 months)
- High School Diploma: 26 percent (171 current jobs including a part-time job and expected to increase by 60-65)
- Associate Degree: 10 percent (66, expected to increase by 8-10)
- Bachelor's Degree: 11 percent (73, expected to increase by 27-28)
- Graduate Degree: less than one percent (5, expected to increase by 1-2)

The percentage of construction jobs requiring only OJT, minimal training or a high school diploma was even bigger (85 percent). Fourteen percent of construction jobs required an associate degree, while only one construction job was listed as requiring a bachelor's degree. The educational requirements for all construction jobs can be seen here:

- OJT, minimal training: 58 percent of Construction jobs (244 jobs, expected to increase by 48-59 in 12 months)
- High School Diploma: 27 percent (112, expected to increase by 37-41)
- Associate Degree: 14 percent (59, expected to increase by 7-8)
- Bachelor's or Graduate Degree: ~0 percent (1 job)

Chart 12 below contrasts the minimum requirements for all jobs that were core to solar businesses and the construction jobs sub-group. The biggest contrast was in the lack of need for a bachelor's degree.

Chart 12. Minimum Training or Educational Requirements for All Jobs Core to Solar Business Vis-a-vis Construction Jobs Only



Of the 342 jobs which required OJT or minimal training only, employers in the survey identified 21 current jobs that did not require any training, 61 that required between one to 12 months of training, and the rest between 2 years to 20 years. (Table 1)

Table 1. Length of Training Required and Number of Jobs Core to Solar Business That Had No Particular Educational Requirements

Length of training required	# of jobs	# of jobs in 12 months
No training	21	24-30
1 month	9	11
2 months	4	6-12
3 months	27	42
6 months	2	2
1 year	19	20-22
2 years	24	40
5 years	32	32-34
10 years	9	8-11
20 years	1	2

Of the jobs listed here, the ones that required anywhere from 1-12 Months of Training are listed below by occupational group, SOC code, number of jobs at present, and expected additional hiring in the next 12 months (Table 2):

Table 2. List of Jobs Core to Solar Business With No Specified Education Requirement that Needs One to Twelve Months Training

Occupations	ONET Code	# of jobs	# of jobs in 12 months
Sales Managers	11-2022.00	1	2
Sales Representatives	41-4011.00	7	12
Secretaries and Admin. Assistants	43-6014.00	4	6
Word Processors and Typists	43-9022.00	3	3
Roofers	47-2181.00	2	3
Solar Photovoltaic Installers	47-2231.00	30	46-52
Helpers-Electricians	47-3013.00	9	15
Construction and Building Inspectors	47-4011.00	3	3
Solar Thermal Installers	47-4099.02	2	2

The average length of training required for jobs with no specific educational requirements is 28 months with a standard deviation of 37 months (the large standard deviation is indicative of the variety in the responses given). The median amount of training is one year.

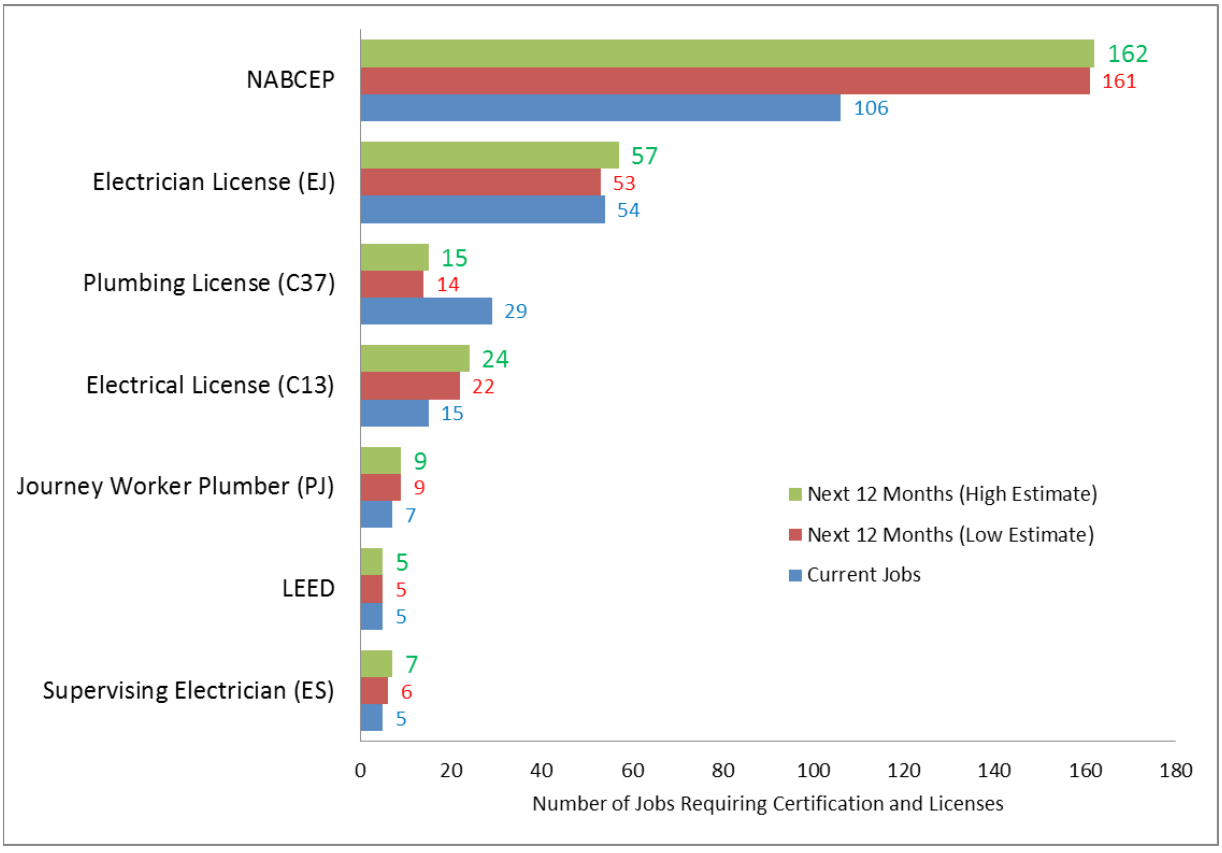
Of the positions that required a college/university education, the majority of the degrees required were in engineering and in finance/ business administration. Engineering and management positions are clearly the ones most in need of a college degree. The following are the degrees required for positions and the associated number of jobs:

- Associate Degree: Marketing (1 job), Information Technology (1)
- Bachelor's Degree: Engineering (9), Economics/ Finance/ Business (3), Electrical Engineering (3), Communications (1), Construction Management (1), Electrical Installation and Maintenance Technology (1)
- Graduate Degree: Engineering (1), Mechanical Engineering (1), MBA/ Finance (1).

Certifications and Licenses. Requirements that were fairly new and emerging were NABCEP[5] and LEED[6]. Requirements that were fairly traditional were electrician and plumber licenses[7]. Chart 13 lists the specific certifications and licenses that were identified by employers in the survey. The related numbers of current jobs as well as low and high total job estimates for the next 12 months offered insights on magnitude of need.

As Chart 13 reflects, NABCEP has become a signal of qualification for many jobs, but the survey fell short in confirming specific NABEP certifications. Survey results and small group discussions suggested though that there was a need for different types of NABCEP certification. A large number of sales representative positions required NABCEP certification (41 jobs, expected to become 67 in 12 months), while PV installers, construction and operation managers, electrical engineers and electricians could also benefit from such certification. Table 3 identifies all the positions and number of jobs attached to the need for NABCEP certification.

Chart 13. Certification and Licenses Identified by Employers and the Number of Current and Future Jobs Requiring Them



5. North American Board of Certified Practitioners, more in www.nabcep.org
6. Leadership in Energy and Environmental Design, more in www.usgbc.org
7. State of Hawaii Department of Labor and Industrial Relations, "Training Gap Assessment for the Construction Industry," Honolulu, HI; May 2011 www.greenjobshawaii.org. See also www.hawaii.gov/dcca for extensive coverage of different licenses.

Table 3. Jobs That Employers Say Require NABCEP Certification With O*NET Code, Number of Jobs (Current and Planned)

Position	ONET Code	# of Jobs	# of Jobs in 12 Months	# of Jobs in 12 Months
General and Operations Managers	11-1021.00	4	5	5
Quality Control Systems Managers	11-3051.01	1	2	2
Construction Managers	11-9021.00	10	13	13
Compliance Managers	11-9199.02	1	1	1
Business Operations Specialists	13-1199.00	1	1	1
Electrical Engineers	17-2071.00	6	8	8
Electrical Engineering Technicians	17-3023.03	1	1	1
Sales Representatives	41-4011.00	41	67	67
First-Line Supervisors of Construction Trades	47-1011.00	4	4	4
Electricians	47-2111.00	7	10	10
Solar Photovoltaic Installers	47-2231.00	28	46	46
First-Line Supervisors of Installers	49-1011.00	4	5	7

Essential Skills and Attitudes. A wide array of skills and attitudes were listed as essential by employers in the survey, skills that varied from personal effectiveness competencies (e.g., integrity, interest) to academic competencies (e.g., ability to read and communicate, computer skills) and workplace competencies (e.g., teamwork, supervisory skills). For the purposes of training providers and career counselors, the raw answers (or close to this) are listed below by position along with the number of jobs associated with each answer. The raw answers included ones that may not be categorically listed as "skills" per se (e.g., No DUI offense).[8]

Management Jobs:
- Attitude and Aptitude (6 jobs)
- Website development (2 jobs)
- Initiative (2 jobs)
- Communication Skills (2 jobs)
- Customer Service (1 job)

Business and Financial Jobs:
- Spreadsheets
- Computer-Aided Design (aka CAD)
- Some PV experience, preferably off-grid
- Computer literate

Engineering Jobs:
- Electrical code
- CAD

Sales Jobs:
- Honesty and Integrity (12 jobs)
- Initiative and Interest (2 jobs)

Office and Administrative Support Jobs:
- Call center experience (4 jobs)
- Good communication skills (4 jobs)
- Flexibility (4 jobs)
- Ability to work under high pressure (4 jobs)
- Advanced Excel skills (3 jobs)

8. Standard Occupational Classifications were again used to categorize the results (results for Construction and Extraction Occupations and Installation, Maintenance, and Repair Occupations were combined). Responses were ranked by the number of jobs in each Occupational Group which required an essential skill. When the number of jobs was not listed next to the essential skill reported, there was only one respondent for whom this was an essential skill.

Construction, Installation, Maintenance and Repair Jobs:

- Ability to use tools (36 jobs)
- Solar experience (22 jobs)
- Ability to measure (21 jobs)
- Follow instructions (21 jobs)
- Ability to read (instructions, plans), write (15 jobs)
- Roofing experience (14 jobs)
- Supervisory/ Leadership skills (12 jobs)
- Being a good person (10 jobs)
- Not be afraid of heights (9 jobs)
- Electrical training (8 jobs)
- Roof water-proofing (2 jobs)
- Solar system Analysis (1 job)
- Ability to Communicate well (1 job)

Production Jobs:

- Ability to do simple Math
- Basic construction skills
- Ability to lift

Transportation and Material Moving Jobs:

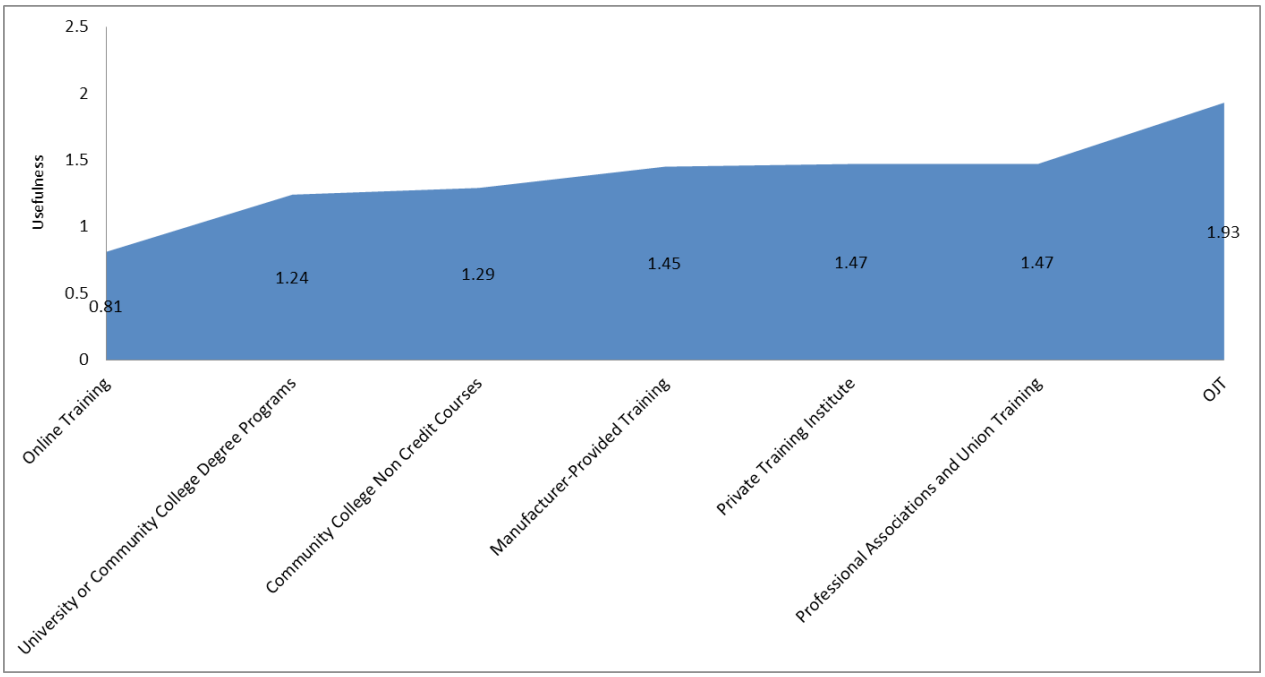
- No "Drinking Under the Influence or DUI" violation record

5. Usefulness of Training Modes

On-the-Job Training (OJT) was clearly the most useful according to the employers in the survey and small-group discussions. Employers were asked to identify the usefulness of different types of training, on a scale from 0 to 2, with 0 meaning "Not very useful," 1 "Somewhat useful" and 2 "Very useful".

Based on the number of responses and results, employers in the survey were most familiar with OJT and rated it the most useful mode ("1.93" average rating of 67 responses). They were also more familiar with manufacturer-provided training, but it was rated lower ("1.47" average of 53 responses). Employers appeared least familiar with online training, and rated it also the least useful ("0.81" average rating of 32 responses). Some employers rated community colleges non-credit courses a little bit more useful than degree programs ("1.29" average of 38 employers and "1.24" average of 34 employers, respectively). Private Training Institutes, and Professional Association & Union Training were deemed both useful with a rating of "1.47," although there were only 30 employers rating the former and

Chart 14. Usefulness of Training Programs (0= not very useful, 2 =very useful)



43 rating the latter. Chart 14 presents the training by order of average usefulness.

Employers who rated a particular type of training to be not very useful were asked to identify inadequacies of that particular type of training[9]. The raw results are provided below to allow training providers to gain more specific insights about each training mode:

On-The-Job Training:
- Level of Training: 2 responses
- Affordability of Training: 1 response

Online Training:
- Level of Training: 2 responses
- Affordability of Training: 3 responses
- Relevancy of Training: 2 responses
- Lack of "Hands on" experience*: 2 responses
- Lack of Motivation to complete Training*: 1 response

University or Community College Degree Programs:
- Level of Training: 1 response
- Affordability of Training: 1 response
- Relevancy of Training: 1 response
- Timing of Training: 2 responses
- Training does not focus on quality*: 1 response

Community College Non-Credit Courses:
- Level of Training: 1 response
- Affordability of Training: 2 response
- Timing of Training: 2 responses
- Training does not focus on quality*: 1 response

Workshops and Certifications provided by Professional Associations and Unions:
- Level of Training: 1 response
- Affordability of Training: 1 response
- Relevancy of Training: 2 response
- Timing of Training: 3 responses
- Availability of Training*: 2 responses
- Workers with such Training had difficulties adapting to the new environment*: 1 response

Manufacturer-Provided Training:
- Level of Training: 1 response
- Timing of Training: 1 response
- Inconvenient to attend due to location* (this response was given by a Big Island-based business): 1 response
- Only basic manuals were provided*: 1 response
- None available*: 1 response
- Limitations of the trainee*: 1 response
- Instructors were not knowledgeable*: 1 response

Private Training Institutes:
- Affordability of Training: 2 responses
- Relevancy of Training: 1 response
- Timing of Training: 2 responses

The above can be summarized in Table 4 on the following page:

9. The options given were "Level of Training", "Affordability of Training", "Relevancy of training" and "Timing of Training". Respondents were also given the option to name a different reason why the training may be different. These responses have been marked with an asterisk (*).

Table 4. Summary of Inadequacies Linked to Different Training Modes

	Were the following listed as inadequacies of this type of training?			
	Affordability	Level of training	Relevancy of training	Timing of training
OJT	**Yes**	**Yes**	No	No
Online training	**Yes**	**Yes**	**Yes**	No
University or Community College degree programs	**Yes**	**Yes**	**Yes**	**Yes**
Community College non-credit courses	**Yes**	**Yes**	No	**Yes**
Professional Associations & Union training	**Yes**	**Yes**	**Yes**	**Yes**
Manufacturer-provided training	No	**Yes**	No	**Yes**
Private Training Institutes	**Yes**	No	**Yes**	**Yes**

6. Signals from the "Radar Screen"

Employers and discussants do not expect the industry to remain as is. Ongoing development that may have an impact on training needs include:

- Very rapid deployment of PV leading to a shortage of licensed electricians, entry of contractors and workers with little field experience or proper training, and concern for the quality of installations. The reasons cited for rapid deployment included rising electrical rates, declining cost of materials for PV installation, and friendly government policies (incentives). NABCEP certification for different types of solar workers were seen to be desirable for quality installation.

- New technologies as well as cheaper sources of installation materials. For example, incorporation of storage systems requires more electrical contractors. Also, as another example, buying cheaper materials from China requires knowledge of the Chinese business practices.

- Changing standards, regulations, policies, and incentive schemes including electrical codes. These were perceived to be teeming with details, not always consistent with each other, and becoming more complex. Workers need to cope and be up-to-date in knowledge and skills.

Beyond current solar industry. Discussants sensed that big solar projects across the islands were expected to provide employment and sustain the income of solar industry workers in the short-term. After six months to a year-and-a-half, these projects were expected to dwindle and workers would have to be picked up by other employers or projects. The discussants' prognosis of future employment were in several areas:

- Construction Industry. The solar industry is being integrated more and more into the construction industry, with construction companies being responsible for many big projects. A key pathway to preparing for solar jobs will be construction industry career pathways.

- Skills of solar workers can be applied or transferred to smaller projects like maintenance and repair of installed panels and systems as well as rehabilitation of faulty ones; Public awareness in its broadest sense is deemed as a cornerstone in realizing the transformation to more and better solar installation.

- Installations in smaller properties - both new and old. Training and education of homeowners and their bankers were cited as examples. The public needs to be educated about systems, warranties, qualified installers, benefits, and more.

- Cross-over to other renewable energy projects (e.g., wind, hydro-plants and entrepreneurial endeavors like sustainable farming that combines energy and food production). Workforce preparation for workers employed in the solar industry should explore these.

- Small-scale manufacturing of installation parts (not panels per se). Cost has been identified as a major challenge in the feasibility of this idea. Pilot projects were recommended.

Employers in the survey and discussants added the following as solutions or additional areas to consider in sensing training needs:

- Workshops on product updates like manufacturer-provided training/ product seminars

- Training of workers and sales professionals in how to inform consumers of their options regarding products and consumer incentives

- Training available on neighbor islands (a specific area mentioned was Plumbing Apprentice and Solar courses on the Big Island for non-union workers)

- Higher level skills in terms of analytics and project management

- Differentiated needs between big and small employers (e.g., smaller companies cannot afford to have sales personnel, in which case installers would also be responsible for sales).

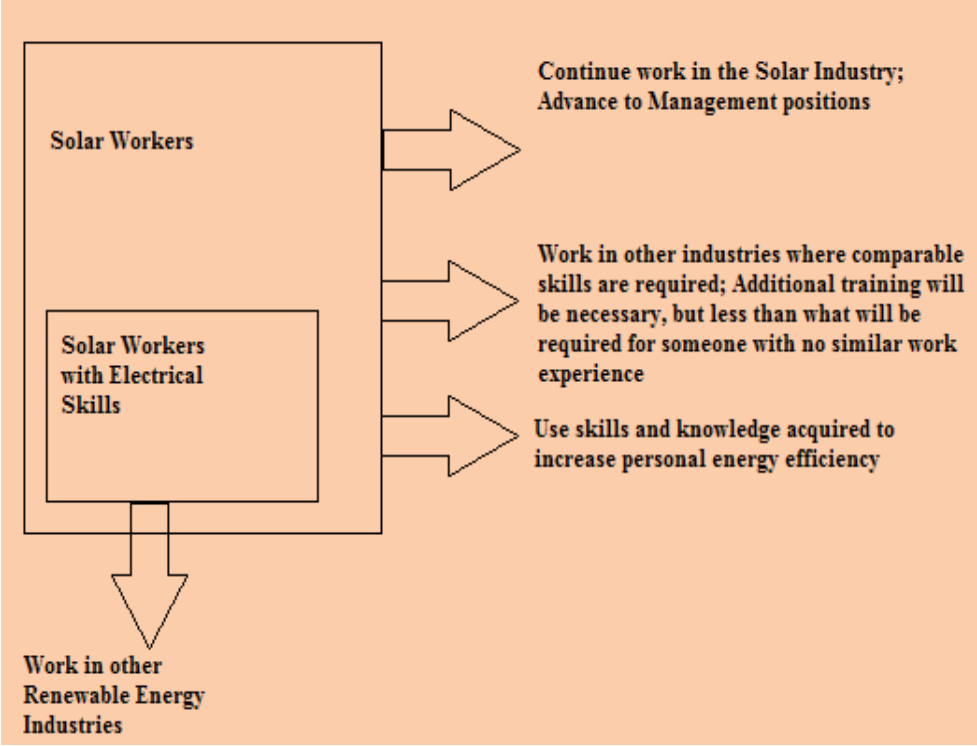
- Training on fire prevention installation practices, safe operations, and appropriate installation techniques

- Pivotal, critical, and in short supply were instructors, inspectors, project managers, and electrical engineers.

Exploring Career Pathways. To explore training needs along career pathways, Appendix B uses a national solar career map to depict theoretical career ladder scenarios for Hawai'i's solar industry workers. Chart 15 below was created to capture scenarios that were offered by discussants.

Uncertainty. Employers faced the most uncertainty from government decisions and actions. Survey results included concerns over loss of incentives and cost of doing business; control over quality of installation, installers, inspectors, electrical codes and

Chart 15. Future Prospects for Workers in Hawaii's Solar Industry



other standards, workmanship, public project bidding, and others; and complexity of rules and regulations. Nevertheless, some key sources of uncertainties were being addressed (e.g., December 6, 2011 Feed-in Tariff rate, schedule and standard interconnection agreements affecting O'ahu, Maui, and Hawai'i counties).

7. Prospects and Priorities for Government Intervention

Consumer incentive programs were clearly a very important issue for the majority of respondents, as much of the demand for solar installations was a direct result of their existence. Public awareness and funding training were very important issues as well. Access to the grid (interconnection standards) was another issue that a significant number of respondents were concerned with. The funding of training (which can also contribute to public awareness, as mentioned during the discussion groups), was also something employers appreciated, but it was relatively lower on the lists, due to urgency of Consumer Incentives.

When ranked in order of importance, the listed areas of government intervention were[10]:

1. Provide different consumer incentives (e.g., remove curtailment clauses from Feed-in Tariff)
2. Provide more consistent incentives
3. Change interconnection standards
4. Maintain consumers incentives of any kind
5. Increase public awareness (e.g. how solar energy works, difference between PV and solar water heating)
6. Fund training (community colleges, HPU, UH, training of electrical inspectors on solar)
7. Enforce rules and regulations (licensed plumbers and electricians must do the installations; inspectors must fine those who do not follow rules)
8. Fund research/innovations
9. Inspectors teaching courses
10. Loosen requirements (don't require the usage of plumbers or electricians)
11. Develop certification program that would increase consumer confidence
12. Ease permit process

Analysis of Signals. Employers faced the most uncertainty from government decisions and actions. Survey results included concerns over loss of incentives and cost of doing business; control over quality of installation, installers, inspectors, electrical codes and other standards, workmanship, public project bidding, and others; and complexity of rules and regulations. Nevertheless, some key sources of uncertainties were being addressed. Public awareness in its broadest sense was viewed as a cornerstone in realizing the transformation to more and better solar installation. Training and education of homeowners and their bankers were cited as examples.

To support planning efforts, survey results for each county were presented so that analysts and researchers had a better sense of actual counts and magnitudes.

10. Respondents were given 6 options, but also had the option of providing their own answer. Answers provided by the respondents have been italicized.

C. LOCAL AREA SURVEY RESULTS

1. Hawai'i County (Big Island)

A total of 31 responding businesses operated on the Big Island. Of the thirteen businesses that operated on the Big Island, only six operated on both sides of the island, three only on the East Side (Hilo) and four only on the West Side (Kona). Big Island-only employers, in general, appeared to have a greater difficulty in finding qualified workers than businesses operating on other islands. Big Island-only employers also expected a reduction in the number of jobs, unlike their counterparts in the other three counties. Finally, the majority of jobs listed by Big Island-only employers only required OJT and Minimal Training.

a. Business Operations and Hiring Practices

Of the 13 responding businesses that operated on the Big Island only, two did PV Installations and 10 did Solar Water Heating Installations. None of the Big Island businesses that responded were involved in Manufacturing.

When including all businesses that operate on the Big Island, the results were somewhat different. Thirteen businesses did Solar Water Heating Systems Installations, 11 did PV Installations, two were Consultants and one administered a Solar Water Heating Program.

Of the Big Island-only businesses, only one was exclusively Solar. Five of them hired new workers within the last 12 months, but two did not keep the workers they hired due to lack of work. Three hired new workers based on "word of mouth", two used private job boards (one of which was Craigslist), and one used other sources.

Of all Big Island businesses, eight of 31 were exclusively engaged in the solar business. Nineteen businesses hired new workers within the last 12 months, but two of them did not keep the workers they hired.

b. Solar Occupations of Big Island-Only Businesses

Big Island-only businesses reported 47 solar positions, with the number decreasing by eight in the next 12 months (17 percent decrease). This presented a slightly different picture than what was encountered in the other three counties, where the total number of jobs was expected to increase in the next 12 months. Table 5 shows the number and type of solar positions after being classified using Standard Occupational Classifications (O*NET-SOC codes)[11]:

Table 5. Big Island Solar Jobs

Occupation	ONET-SOC Code	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
Administrative Service Managers	11-3011.00	0	1	1
Sales Representatives	41-4011.00	5	6	6
Electricians	47-2111.00	5	1	1
Plumbers	47-2152.02	5	8	8
Solar Photovoltaic Installers	47-2231.00	6	0	0
Entry-Level Solar Photovoltaic Installers	47-2231.01	3	1	1
Helpers-Pipelayers, Plumbers, Pipefitters, and Seamfitters	47-3015.00	3	2	2
Solar Thermal Installers and Technicians	47-4099.02	20	20	20
TOTAL		47	39	39
Occupational Groups				
Management	11	0	1	1
Sales	41	5	6	6
Construction and Extraction	47	42	32	32

11. The same was done for all four county analyses.

The reason there were two answers to the question "How many workers do you expect to have 12 months from now?" was because respondents were asked to provide a range of answers[12].

The vast majority of jobs listed by Big Island-only businesses required only "OJT, Minimal Training." The educational requirements for all jobs listed by Big Island-only businesses were (Table 6):

Table 6. Education requirements of Big Island Solar Jobs

Educational Requirements	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
OJT, Minimal Training	32	28	28
HS Degree	6	6	6
AA Degree	8	2	2
BA Degree	1	3	3

When asked to indicate the degree of difficulty in finding qualified workers (0: No Difficulty, 1: Some Difficulty, 2: Great Difficulty), Big Island-only businesses had an average of 1.44, quite higher than the average for all jobs reported (0.89).

c. Usefulness of Training Programs

The average usefulness of different training programs as identified by the respondents is depicted in Table 7 (0: Not Very Useful, 1: Somewhat Useful, 2: Very Useful).

One of the Big Island-only respondents that found online training "Not very useful" explained that the reason was the affordability of training, while another one claimed that the lack of hands-on training was the main reason why online training was "not very useful."

One of the Big Island-only respondents that rated manufacturer-provided training to be "not very useful" explained that it was inconvenient to attend due to location, while another one claimed the instructors were not very knowledgeable.

Table 7. Usefulness of Training Programs

Training Programs	Big Island-only	Big Island-all
On-The-Job Training	2.00 (13 responses)	1.97 (29 responses)
Professional Associations and Unions (Workshops and Certifications)	1.50 (6 responses)	1.57 (14 responses)
Private Training Institutes	1.50 (4 responses)	1.36 (11 responses)
Community College Non-Credit Courses	1.25 (4 responses)	1.08 (13 responses)
University or Community College Degree Programs	1.14 (7 responses)	1.20 (15 responses)
Manufacturer-Provided Training	1.11 (9 responses)	1.29 (21 responses)
Online Training	0.50 (4 responses)	0.93 (14 responses)

d. Anticipated Developments and New Training

Big Island-only employers provided the following answers when asked about anticipated developments that may affect training needs: fluctuations in the overall economic situation; consumers going off the grid; installers who have the knowledge in some cases do not have a journeyman electrician license.

New training that were identified as possibly being required due to the above developments were: safety training and additional solar-specific training.

e. Priority areas for Government Intervention

The responses given by Big Island-only businesses to the question regarding government interventions were as follows:

- Different consumer incentives (e.g., rebates instead of tax credit) (2 responses)
- Change interconnection standards, open up circuit (2 responses)

12. The same was true for all county analyses.

- Easier permit process
- Continue providing consumer incentives
- Have inspectors teach courses, not union members
- Increase tax credits for consumers
- Increase public awareness
- Provide more consistent consumer incentives
- Fund research/innovations
- Fund training

2. Honolulu County (O'ahu)

Fifty-six of the businesses that responded to the survey operated on O'ahu and 33 of them operated on the Island of O'ahu only. O'ahu-only employers offered a greater variety of jobs than their counterparts in the other three counties. Consumer incentives were the greatest concern of O'ahu businesses.

a. Business Operations & Hiring Practices
Eighteen Oahu-only businesses were Solar Water Heating Systems Contractors, 13 were PV Installation Contractors and 2 were Manufacturers. The following graph shows the number and type of Oahu-only businesses.

Twenty-six O'ahu businesses were PV Installation Contractors, 25 were Solar Water Heating Systems Contractors, 3 were Manufacturers, 2 were Consultants and 2 were Distributors. The following graph shows the business operations of all O'ahu companies, including the ones that operate on other islands.

Twelve of the 33 O'ahu-only businesses were exclusively solar. 22 of all 56 O'ahu businesses were exclusively solar.

Eighteen of 33 O'ahu-only businesses had hired new workers within the last 12 months, while 1 of the 18 did not keep those workers due to lack of work. Of the O'ahu-only businesses that hired workers within the last 12 months, 11 used Word of Mouth, 8 Private Job Boards (4 of which used Craigslist), 5 their Company Website, 3 Unions and Professional Associations, and 2 used Newspapers.

b. Solar Occupations of O'ahu-only businesses
About 230 jobs were listed by O'ahu-only businesses with an expected increase within the next twelve months of 52-57 workers (23-25 percent increase).

Chart 16. Business Operations of Oahu-only Respondents

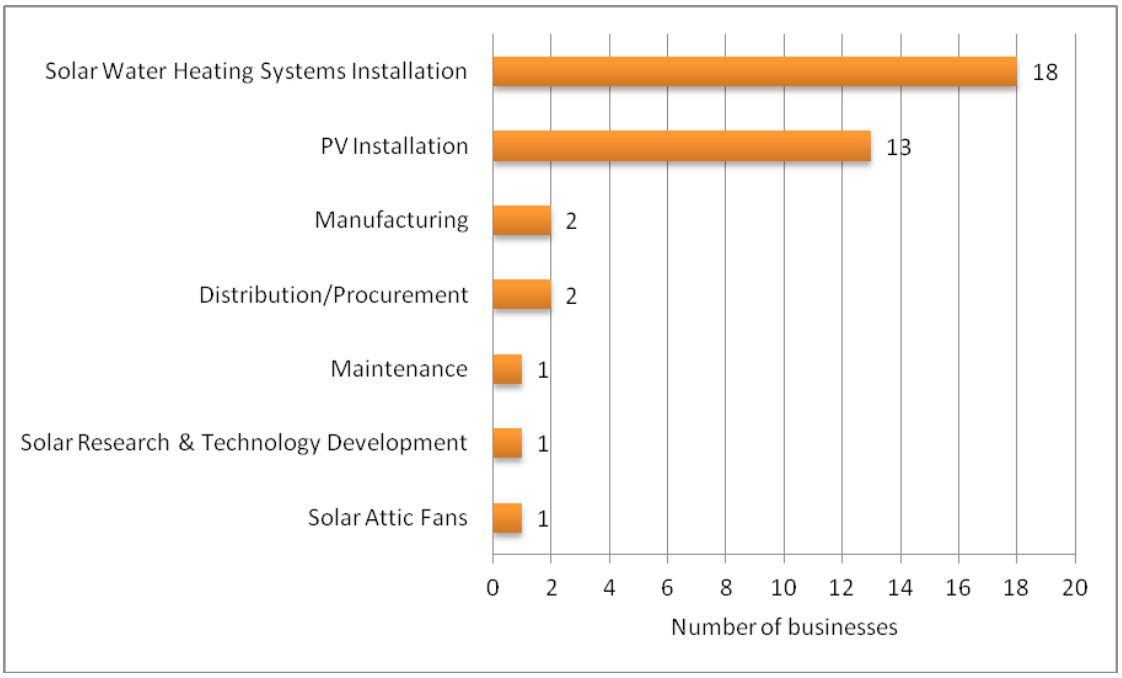


Table 8. O'ahu Solar Jobs

Occupation	ONET-SOC Code	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
General and Operations Managers	11-1021.00	6	7	7
Green Marketers	11-2011.01	4	6	6
Marketing Managers	11-2021.00	1	1	1
Sales Managers	11-2022.00	2	2	2
Administrative Service Managers	11-3011.00	1	1	1
Quality Control Systems Managers	11-3051.01	1	2	2
Construction Managers	11-9021.00	2	2	2
Compliance Managers	11-9199.02	1	1	1
Purchasing Agents	13-1023.00	2	2	2
Cost Estimators	13-1051.00	3	4	4
Business Operations Specialists	13-1199.00	1	1	1
Business Intelligence Analysts	15-1199.08	1	2	2
Electrical Engineers	17-2071.00	3	3	3
Mechanical Engineers	17-2141.00	1	1	2
Engineers, All Other	17-2199.00	4	6	6
Electrical & Electronics Drafters	17-3012.00	1	2	2
Electrical Engineering Technicians	17-3023.03	1	1	1
Sales Representatives	41-4011.00	26	42	42
Secretaries & Administrative Assistants	43-6014.00	2.5	2.5	2.5
Office Clerks	43-9061.00	1	2	2
First-Line Supervisors of Construction Trades & Extraction Workers	47-1011.00	2	5	5
Construction Laborers	47-2061.00	0	1	1
Electricians	47-2111.00	51.5	79.5	79.5
Plumbers	47-2152.02	43	28	29
Roofers	47-2181.00	3	4	4
Solar Photovoltaic Installers	47-2231.00	12	14	14
Helpers-Pipelayers, Plumbers, Pipefitters, & Seamfitters	47-3015.00	3	3	3
Solar Thermal Installers & Technicians	47-4099.02	32	37	37
First-Line Supervisors of Mechanics, Installers, & Repairers	49-1011.00	2	3	4
Helpers-Installation, Maintenance, and Repair Workers	49-9098.00	5	5	5
Assemblers and Fabricators	51-2099.00	10	10	12
Heavy & Tractor-Trailer Truck Drivers	53-3032.00	2	2	2
Total		230	282	287
Occupational Groups				
Management	11	18	22	22
Business & Financial Operations	13	6	7	7
Computer & Mathematics	15	1	2	2
Engineering	17	10	13	14
Sales	41	26	42	42
Office & Administrative Support	43	3.5	4.5	4.5
Construction	47	146.5	171.5	172.5
Installation, Maintenance & Repair	49	7	8	9
Production	51	10	10	12
Transportation & Material Moving	53	2	2	2

When asked about the educational requirements of their workers O'ahu-only businesses gave the following answers:

Table 9. Educational requirements of O'ahu Solar Jobs

Educational Requirements	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
OJT, Minimal Training	56	60	60
HS Degree	66.5	103.5	103.5
AA Degree	27	41	51
BA Degree	21	25	26
Graduate Degree	3	4	5

When asked to indicate the degree of difficulty in finding qualified workers (0: No Difficulty, 1: Some Difficulty, 2: Great Difficulty) Oahu-only businesses had an average rating of 0.73, slightly lower than the average for all jobs reported (0.89).

c. Usefulness of Training Programs

The average usefulness of different training programs as identified by the respondents was (0: Not Very Useful, 1: Somewhat Useful, 2: Very Useful):

Of the O'ahu-only businesses which found On-The-Job Training "Not Very Useful", 2 mentioned the Level of Training as the reason why, and 1 the Affordability of Training.

For Online Training, the following were mentioned as reasons why the training was "Not Very Useful" (all of them once): No hands on experience, Uselessness, No motivation to follow through, Relevancy of Training, Level of Training and Affordability of Training.

For University or Community College Degree Programs, their Relevancy, Affordability, Level and Timing of Training were all mentioned once as reasons why the training was not very useful.

For Community College Noncredit courses Affordability of Training was found "Not Very Useful" by 2 respondents, while Timing and Level of Training were found "Not Very Useful" by 1 respondent each.

For Training provided by Professional Associations and Unions, 2 respondents explained that the Timing of Training was the reason it was "Not Very Useful," while Affordability, Relevancy and Level of Training were mentioned by 1 respondent each.

Table 10. Usefulness of Training Programs

Training Programs	O'ahu-only	O'ahu-all
On-The-Job Training	1.86 (28 responses)	1.90 (49 responses)
Manufacturer-Provided Training	1.61 (23 responses)	1.51 (39 responses)
Professional Associations and Unions (Workshops and Certifications)	1.58 (19 responses)	1.47 (32 responses)
Private Training Institutes	1.57 (14 responses)	1.52 (23 responses)
Community College Non-Credit Courses	1.35 (17 responses)	1.24 (29 responses)
University or Community College Degree Programs	1.25 (16 responses)	1.27 (26 responses)
Online Training	0.79 (14 responses)	0.85 (27 responses)

One respondent claimed that the inadequacy of Manufacturer-Provided Training was the Timing of Training.

Finally, of the respondents who found Private Training Institutes "Not Very Useful", 2 claimed that the reason was the Affordability of Training, 2 the Timing of Training, and 1 the Relevancy of Training.

d. Anticipated Developments and New Training
Anticipated developments according to O'ahu-only businesses included: Technological developments of solar panels; Electrical code developments; Rising electrical rates; Lower material costs; Tax credits and incentive programs; New products that are more user-friendly; Growth of federal work and "free" systems have grown the field so fast that licensed electricians are not available to hire; PV is growing fast; Different manufacturers have different standards as far as installation of their equipment; Policy changes quickly and greatly affects the industry; As most suppliers are in China, sourcing/procurement personnel should have experience doing business there as well as willingness to travel.

In identifying training that might become required due to anticipated developments, answers to the open-ended question yielded the following : Electrical training (2 responses); Learn how to climb off the roof without damaging it; Workshops on product updates; and PV Training.

e. Priority Areas for Government Interventions
Priority areas for Government Intervention as identified by O'ahu-only businesses were: More consistent consumer incentives (9 responses); Different consumer incentives (8 responses); Keep consumer incentives (3 responses); Enforce regulations for all contractors (2 responses); Fund training (UH, Community Colleges and HPU) (2 responses); Change interconnection standards (2 responses); Increase public awareness; Loosen requirements regarding Installation Process; Educate electrical inspectors about PV; Fine installers not complying to the code; and Fund research/ innovations.

3. Kaua'i County

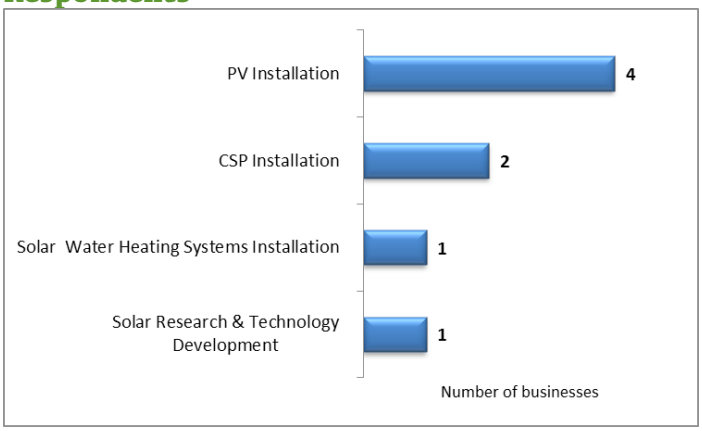
Five respondents operated on Kaua'i exclusively, while a total of 23 operated on Kaua'i (leaving 18 that operated in other counties as well). Of the 18 businesses which operated in Kaua'i, among other places, all 18 also operated in Honolulu County (O'ahu), 17 operated in Maui County and 16 operated in Hawai'i County (Big Island).

a. Business Operations and Hiring Practices
Of the 5 businesses which responded and operated only in Kaua'i, four did PV Installations, two were capable of doing CSP Installations (if needed), one did Solar Water Heating Systems Installations, and one did Solar Research & Technology Development.

Of the five Kaua'i-only businesses, only one was exclusively solar, two hired workers within the last 12 months and the workers were still with the company, while one1 had hired workers, but they were no longer employed by the company due to lack of work (although they were still employed with the Union and may be working with other companies).

Of the five Kaua'i-only businesses, one had used the Company Website to advertise job opportunities, one had used "word of mouth", one had used HireNetHawaii, and one had used other sources.

Chart 17. Business Operations of Kaua'i-only Respondents



Of all 23 businesses that operated in Kaua'i, 14 did PV Installations, five did Solar Water Heating Systems Installations and some were involved in other solar activities (two did CSP Installations, two were Consultants, one did Solar Research and Technology Development, one did Manufacturing, one was a Supplier, one was a Developer and one did Financial Analysis/Optimization/ Structuring).

Of all 23 Kaua'i businesses, eight were exclusively Solar, and 15 had hired workers within the last 12 months and the workers were still employed by the company, while one had hired workers, but they were not with the company anymore.

Of the 23 Kaua'i businesses, 11 had used "word of mouth", five had used the company website, five had used Private Job Boards (two of which used Craigslist), three have used Labor Unions/Industry Associations, three used HireNetHawaii, two used One-Stop Career Centers, one used job fairs, one used recruitment firms, and one used other sources.

b. Solar Occupations of Kaua'i-only businesses

Kaua'i-only businesses reported a total of 33 Solar positions, with a projected growth of 6-15 positions within the next 12 months (18-45 percent increase).

The following table shows the number and type of Solar positions:

Table 11. Kaua'i Solar Jobs

Occupation	ONET-SOC Code	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
Sales Managers	11-2022.00	1	2	2
Electrical Engineers	17-2071.00	1	1	1
Sales Representatives	41-4011.00	1	1	2
First-Line Supervisors of Office & Administrative Support Workers	43-1011.00	1	1	1
First-Line Supervisors of Construction Trades	47-1011.00	2	2	2
Electricians	47-2111.00	11	8	12
Solar Photovoltaic Installers	47-2231.00	7	14	15
Entry-Level Solar Photovoltaic Installers	47-2231.01	3	3	5
Helpers-Electricians	47-3013.00	4	5	5
First-Line Supervisors of Mechanics, Installers, and Repairers	49-1011.00	2	2	3
TOTAL		33	39	48
Occupational Groups				
Management	11	1	2	2
Engineering	17	1	1	1
Sales	41	1	1	2
Office & Administrative Support	43	1	1	1
Construction and Extraction	47	27	32	39
Installation, Maintenance, & Repair	49	2	2	3

When asked about the educational requirements of their workers, Kaua'i-only businesses provided the following answers:

Table 12. Educational Requirements of Kaua'i Solar Jobs

Educational Requirements	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
OJT, Minimal Training	14	22	27
HS Degree	15	11	15
AA Degree	3	5	5
BA Degree	1	1	1

When asked to indicate the degree of difficulty in finding qualified workers (0: No Difficulty, 1: Some Difficulty, 2: Great Difficulty), Kaua'i-only businesses had an average of 1.03, which was slightly higher than the average for all positions (0.89).

c. Usefulness of Training Programs
The average usefulness of different training programs as identified by the respondents was (0: Not Very Useful, 1: Somewhat Useful, 2: Very Useful):

Table 13. Usefulness of Training Programs

Training Programs	Kaua'i-only	Kaua'i-all
On-The-Job Training	2.00 (4 responses)	1.95 (20 responses)
Manufacturer-Provided Training	1.50 (4 responses)	1.46 (13 responses)
Professional Associations and Unions (Workshops and Certifications)	1.50 (4 responses)	1.40 (15 responses)
Private Training Institutes	1.50 (2 responses)	1.30 (10 responses)
Community College Non-Credit Courses	1.00 (3 responses)	1.27 (11 responses)
University or Community College Degree Programs	1.00 (2 responses)	1.00 (11 responses)
Online Training	1.00 (1 response)	1.00 (10 responses)

One of the Kaua'i respondents who found Workshops and Certifications provided by Professional Associations and Unions, as well as Manufacturer-Provided training "Not very useful" explained that the reason it was not useful was the unavailability of such training.

d. Anticipated Developments and New Training
Kaua'i-only businesses gave the following responses when asked of anticipated developments that may affect training needs: anticipation of new state requirements such as needing a licensed electrical journeyman on-site; incorporation of storage systems will create a need for greater reliance on electrical contractors; incorporation of storage systems was also discussed as a possibility during the Kaua'i small discussion.

Identified new training that might be required, in light of the above anticipated developments include: CDL licensing; training/testing in basic electrical fields; training pertaining to sales/information about solar; More OJT from management as new products and processes come online; New code requirements.

Priority Areas for Government Intervention
The responses given by Kaua'i-only businesses were as follows: Different Consumer Incentives (e.g., rebates instead of tax credit) (2 responses); Make consumers more aware of how solar energy works, and the difference between PV and Water Heating Solar Systems; Keep the local contractors working.

4. Maui County

Only five of the businesses which responded operated in Maui County only (one of the five operated in Moloka'i only). A total of 27 businesses operated in Maui, 22 of which operated in other counties as well. All 22 of the above mentioned businesses operated on O'ahu too, 17 on Kaua'i, and 17 on the Big Island. While respondents were not asked to provide an address, it was safe to assume that a large number of Maui Solar businesses were based on O'ahu and operated statewide.

a. Business Operations and Hiring Practices
Of Maui-only businesses, four did Solar Water Heating Systems Installations, while one did PV Installations. The one Molokai only business that responded was a Solar Water Heating Installer. The businesses operations of Maui-only respondents were as follows:

Of the five Maui-only businesses, only one was exclusively solar, while of the 27 businesses that operated in Maui, 11 were exclusively solar.

Of the Maui-only businesses, only one of five hired new workers within the last twelve months. Of the 27 Maui businesses 18 had hired workers within the last 12 months.

Of the Maui-only businesses, one used Word of Mouth to find new workers. Of all 27 Maui businesses, 13 used Word of Mouth, eight used Private Job Boards (two of which used Craigslist), five used the Company Website, three used One-Stop Centers, three used Unions/Professional Associations, two used HireNetHawaii, two used Newspapers, one used Career Fairs, one used Temporary Help Services, and one used Recruitment Firms.

Of all 27 Maui businesses, 14 did PV Installations, 11 did Solar Water Heating Systems Installations, one did Solar Water Heating Program Administration, one was a Utility, one was in Manufacturing, one was a Supplier, and one did Financial Analysis.

b. Solar Occupations of Maui-only businesses
A total of 19 solar positions were listed with an expected increase within the next 12 months of 2-4 workers (11-21 percent increase). The following table shows the number and type of jobs listed:

Table 14. Maui Solar Jobs

Occupation	ONET-SOC Code	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
Sales Representatives	41-4011.00	1	2	3
Secretaries & Administrative Assistants, Except Legal, Medical, & Executive	43-6014.00	2	2	2
Electricians	47-2111.00	15	15	15
Solar Thermal Installers & Technicians	47-4099.02	1	2	3

When asked about the educational requirements of their workers, Maui-only businesses provided the following answers:

Table 15. Educational Requirements of Maui Solar Jobs

Educational Requirements	# of Workers	# of Workers in 12 Mo.	# of Workers in 12 Mo.
OJT, Minimal Training	3	4	5
HS Degree	1	2	3
AA Degree	15	15	15

Finally when asked about the degree of difficulty of finding qualified workers, all businesses indicated that they had "No difficulty" in finding qualified workers.

c. Usefulness of Training Programs
The average usefulness of different training programs as identified by the respondents was (0: Not Very Useful, 1: Somewhat Useful, 2: Very Useful)[13]:

Table 16. Usefulness of Training Programs

Training Programs	Maui-only	Maui-all
Community College Non-Credit Courses	2.00 (2 responses)	1.21 (14 responses)
On-The-Job Training	2.00 (1 response)	1.95 (21 responses)
Manufacturer-Provided Training	2.00 (1 response)	1.41 (17 responses)
Professional Associations and Unions (Workshops and Certifications)	1.00 (1 response)	1.29 (14 responses)
Online Training		0.92 (13 responses)
University or Community College Degree Programs		1.44 (9 responses)
Private Training Institutes		1.44 (9 responses)

d. Anticipated Developments and New Training
Anticipated developments listed by Maui-only employers included only new products and applications, which will require additional skillset training.

The new training that might become required due to anticipated developments was Manufacturer-provided training/product seminars.

e. Priority Areas for Government Interventions
Priority areas for Government Intervention as identified by Maui-only employers were 1) different consumer incentives (e.g. rebates instead of tax credit) and 2) change interconnection standards.

13. There were no responses from Maui-only businesses for Online Training, University or Community College Degree Programs and Private Training Institutes.

D. CONCLUSION AND RECOMMENDATIONS

Due to the relatively small number of solar workers listed by the 79 employers, training may not be able to take advantage of economies-of-scale larger States are enjoying. Hawai'i training resources, therefore, will likely continue to face challenges as they have to be stretched to meet a depth and breadth of training needs.

To realize the highly qualified and globally competitive workforce that Hawai'i's workforce development system envisions, the study concluded that training and workforce preparation for the immediate-term and long-term required:

- Statewide summit/s alongside local area task forces to take stock, align, and collaborate on transformational activities and "road building."
- Balance in training and workforce preparation activities between certifications specific to green industries (e.g., NABCEP) and many other competencies that are not new to workforce development stakeholders.
- Better job transition and career preparation for workers through better alignment of ground-level information on opportunities and gaps (e.g., accuracy in existing online lists of NABCEP certified professionals; up-to-date and accurate data on training opportunities; stronger network between one stop centers, trainees, and employers who prefer "word of mouth"). First, there is a special need to pay attention to information that is not captured by online tools. Second, Hawai'i needs to align the online tools that different stakeholders create or refine for information dissemination.
- Continuous data gathering including refinement in survey design. Explore the feasibility of establishing the shifting structure of the solar industry, expand search for employers, and implement.



Part II. Methodology

A. INTRODUCTION

In 2009, Hawai‘i’s Department of Labor and Industry Relations (DLIR) as the State’s labor market entity was awarded a $1.247M U.S. Department of Labor’s Education and Training Administration American Recovery and Reinvestment Act (US DOLETA ARRA) grant for labor market information improvement. Information resources were produced including a 2011 training gap assessment study of the construction industry. Readers of the exploratory assessment pointed out the need to asking employers directly about their training needs. An opportunity for further improvement arose when the grant project period was extended for six months, a time that was sufficient enough to negotiate and pilot a solution to directly find out about employers training needs.

A study of solar industry employers training needs was carried out by DLIR analysts whose tasks focused on *green* labor market information improvement. An online survey questionnaire was designed and launched in collaboration with the State Workforce Development Council (WDC), the Hawai‘i Solar Energy Association (HSEA), and Hawai‘i Energy (HE). Survey responses were analyzed and interpreted further with the help of four small group discussions among green workforce development stakeholders on Kaua‘i, the Big Island, and O‘ahu.

The decision to study Hawai‘i’s Solar Industry was based on it being the largest and fastest growing[14] green industry in the state, in terms of jobs. The decision to survey employers was based on a recommendation by the University of Hawai‘i Curriculum Research Development Group[15], which identified solar employers as the group most likely to recognize the extent of training gaps in the industry. An online survey was pursued as a promising solution for rapidly gathering real-time data. Collecting more narratives through small group discussions were added and specific make-up of the small groups was finalized with the help of grant project advisers who heard initial presentations of survey results.

14. Hawai‘i’s Green Workforce: A Baseline Assessment, December 2010, State of Hawai‘i Department of Labor and Industrial Relations Research & Statistics Office: https://greenjobshawaii.hirenethawaii.com/admin/gsipub/htmlarea/uploads/HawaiisGreen-Workforce_BaselineAssessment.pdf
15. The UH CRDG assisted in gathering data for and reviewing the final report on “Training Gaps Assessment for the Construction Industry.”

B. ONLINE SURVEY

An online survey for solar industry employers was designed with the intent of balancing the need for a good response rate and drawing answers that would capture some of the uncertainties and changing conditions that would affect training needs. The survey was collaboratively designed in September 2011, launched in October 2011, analyzed for initial results and presented in small group discussions in November and early December 2011. A total of 146 businesses were surveyed. Of the 79 responses, 7 were partial responses and 10 were received after conducting phone interviews.

1. Respondents

The ideal target was all solar employers in the State of Hawai'i and if that was not possible, a sample representative of the industry. One of the greatest challenges faced when conducting a study of a relatively new industry such as the solar industry was the definition of the solar employer. Studies of solar industries elsewhere, as well as the recommendation of industry experts, provided useful information on the types of businesses that should be contacted. In the end, it was decided to survey PV Installation, CSP Installation & Solar Water Heating Systems Installation contractors, Manufacturers, and Solar Research & Technology Development companies. The lack of a comprehensive list of Hawai'i's solar employers, led to a process which required the support of the State government, as well as agencies such as the Hawai'i Solar Energy Association[16], and Hawai'i Energy[17].

The first step in building a list was to contact the Department of Commerce and Consumer Affairs - Professional and Vocational Certification Division (DCCA-PVC) and request a list of contractors with licenses C13 (Electrical), C37 (Plumbing), C60 (Solar Power Systems), C61 (Solar Energy Systems), C61A (Solar Hot Water Systems) and C61B (Solar Heating & Cooling Systems). A secondary issue that posed as much of a challenge as the initial one was obtaining e-mail addresses of the targeted businesses that were not included in the DCCA-PVC list of contractors. An internet search for e-mail addresses of the respondents proved to be extremely time-consuming and not particularly successful.

The next step in the process was to get in touch with Hawai'i's Solar Energy Association (HSEA)[18] and Hawai'i Energy[19], and request the usage of their members' e-mail addresses, as well as information on the type and number of businesses that fell under Hawai'i's Solar Industry. HSEA offered a list of their members' e-mail addresses, which included a variety of companies, but not the entirety of Hawai'i's solar businesses. Hawai'i Energy provided a list (e-mails included in most cases) of the qualified Solar Water Heating Installers in the State of Hawai'i. The lack of a list of e-mail addresses of PV Installers, led to a request of e-mail addresses of electricians that do PV Installations from the International Brotherhood of Electrical Workers (IBEW). After a series of phone calls, some of the electricians on the list explained that they did not do PV installations and were therefore removed from the list. Finally, a small number of solar research companies (the only ones that were known to have operated in Hawai'i) were added after the recommendation of industry experts.

The final list included a total of 146 businesses. While the list of businesses contacted did not include all of Hawai'i's solar businesses, it was fairly representative of the majority of businesses and those with e-mail addresses were contacted.

16. See www.hsea.org
17. Hawai'i Energy is the state energy conservation and efficiency program implemented to help reduce Hawai'i's dependence on foreign oil. See: www.hawaiienergy.com
18. Christy Imata and Mark Duda
19. Larry Newman

2. Rationale of Online Survey

The decision to use an online survey was the result of a number of different factors. The lack of financial resources and sufficient time required the usage of solutions that could provide results quickly and at a low cost. A second reason was to test the viability of online surveys as a tool that could provide quick and accurate results. The most important reason however for using an online survey was the need for real time data, due to the fact that green industries were constantly changing and are extremely sensitive to changes in legislative policy, market trends, and other factors.

The usage of an online survey made it possible to conduct the study in a brief time period and also made results available immediately. However the fact that not all employers had an e-mail addresses, made it impossible to draw statistical inferences, as not all employers had an equal chance of responding to the survey. It must also be pointed out that there was a significant number of survey participants who appeared to have difficulties using the internet in order to answer the questions asked. In addition, there were many survey participants who informed survey implementers only when called, that the invitation to participate in the study was blocked by Spam or Junk filters. Finally, many survey participants deleted the e-mail invitation immediately, which might be indicative of the credibility (or lack thereof) an e-mail invitation has, as opposed to an invitation received by mail. Further research may be required to draw the above conclusion.

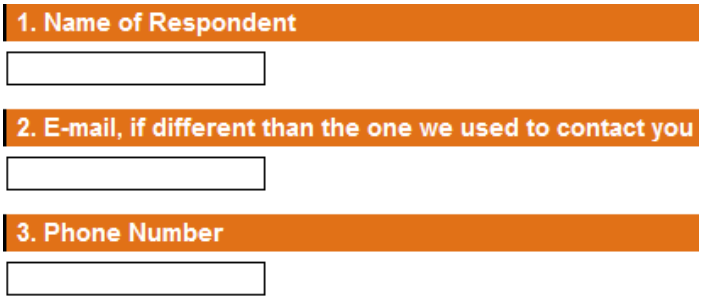
The web application used to conduct the online survey was CreateSurvey. The application had some limitations, but was chosen after a review of a number of online survey tools due to its Tablex feature, which allowed users to list positions in Question 10 (see Section F below) and then answer a number of different questions for each position. The application however was not ideal, as the answers provided by survey respondents had to be analyzed in a spreadsheet.

3. Questionnaire

To answer the questions asked, the survey was divided in to the following 6 sections:

- Location and profile of businesses: Location and businesses operations
- Plans to hire: Information on whether businesses have recently hired workers, and how they chose to advertise positions
- Jobs and qualifications: The types and number of solar jobs, educational/ certification/ skill requirements for each job, projected job growth and the difficulties employers had in finding qualified workers
- Usefulness of training programs
- Anticipated developments affecting training needs
- Areas of government intervention

The survey was created on createsurvey.com, using the CreateSurvey web application and included a total of 21 questions. Participants were initially asked to provide some information about themselves (Name, e-mail if different than the one used to contact them, and phone number). The above information was optional and would be used only if more information was required by the participants.



In Question 4, participants were asked to name the locations at which their business operated (see below). Respondents were allowed to provide more than one answer, the possible answers being O'ahu, Kaua'i, Maui, Lāna'i, Moloka'i, Big Island-Hilo, Big Island-Kona, and All Islands. Responses to question 4 made the County-by-County analyses possible.

In Question 5 participants were asked to describe their business operations (see below). Respondents were given the option to select more than one of the following answers: PV Installation, CSP Installation, Solar Water Heating System Installation, Manufacturing, Solar Research and Technology Development or provide their own answer. Answers, different than the ones provided by the survey, were analyzed and added to the tally for each type of business operation. In Question 6, employers were asked whether their business was solely solar.

4. * Where does your business operate? Please check all that apply.

- ☐ 1. Oahu
- ☐ 2. Kauai
- ☐ 3. Maui
- ☐ 4. Lanai
- ☐ 5. Molokai
- ☐ 6. Hawaii (Big Island) - East Side (Hilo)
- ☐ 7. Hawaii (Big Island) - West Side (Kona)
- ☐ 8. All Islands

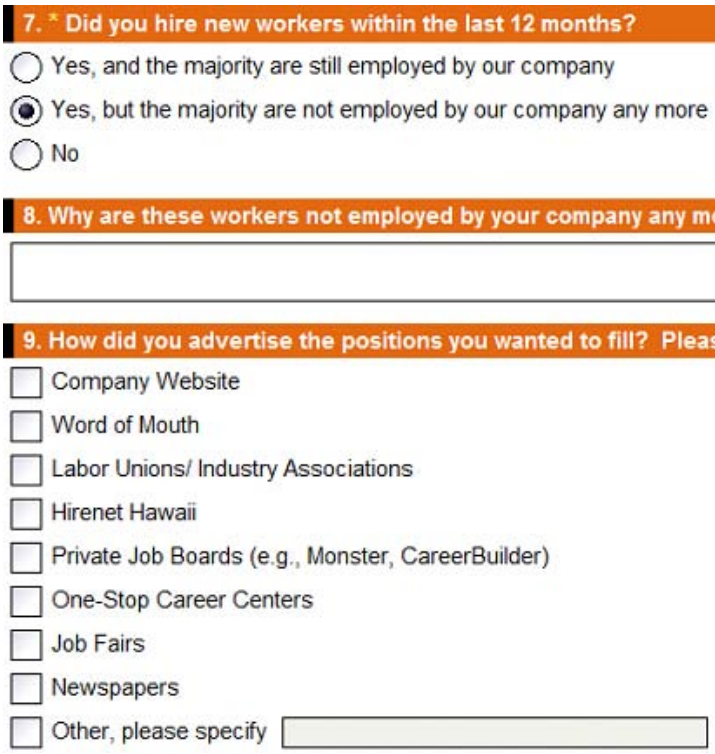
5. * How would you describe your business operation? Please check all that apply.

- ☐ PV Installation
- ☐ CSP Installation
- ☐ Solar Water Heating Systems Installation
- ☐ Manufacturing
- ☐ Solar Research and Technology Development
- ☐ Other, please specify: _____

6. * Is your business solely involved in the solar industry?

- ◯ Yes
- ◯ No, we engage in other types of production/services as well

In Question 7, respondents were asked if they hired new workers within the last 12 months. If they said they did hire new workers, they were asked in Question 9 what methods they used to advertise the positions. If they said they hired new workers, but the workers were not with the company anymore, they were asked why in Question 8. The purpose of Questions 7-9 was to gain information on the practices of firms in the solar industry when hiring new employees. In Question 9, options given to respondents were: Company Website, Word of Mouth, Labor Unions/Industry Associations, Hirenet Hawaii, Private Job Boards, One-Stop Career Centers, Job Fairs, and Newspapers. Respondents were also given the option to provide their own answer. Answers provided by the employers themselves were analyzed and added to the results (the response "Craigslist", for example, was added to "Private Job Boards").


7. * Did you hire new workers within the last 12 months?

- ◯ Yes, and the majority are still employed by our company
- ◉ Yes, but the majority are not employed by our company any more
- ◯ No

8. Why are these workers not employed by your company any more?

9. How did you advertise the positions you wanted to fill? Please check all that apply.

- ☐ Company Website
- ☐ Word of Mouth
- ☐ Labor Unions/ Industry Associations
- ☐ Hirenet Hawaii
- ☐ Private Job Boards (e.g., Monster, CareerBuilder)
- ☐ One-Stop Career Centers
- ☐ Job Fairs
- ☐ Newspapers
- ☐ Other, please specify

Questions 3-7 were the only ones in the questionnaire that required an answer, as this information was vital in order to analyze responses by different demographic groups.

In Question 10 employers were asked to provide a list of positions that were core to their solar business. Positions listed were classified using Standard Occupational Classifications[20]. Businesses were then asked what number of workers was employed in each position. The classification of listed jobs was done using the job titles, as listed by the respondents, in addition to information regarding business operations (Question 5) and educational/certification/ skill requirements for that particular position. In many cases where the information provided was not adequate to classify the jobs, it became necessary to ask respondents for more information, either by e-mail or phone. See Appendix C for more information on how jobs were classified.

Employers were then asked how many workers were expected to be employed by the company in exactly 12 months from the day of the response. The phrase "12 months from now" was used so that responses would not be influenced by seasonal or other factors. A range of answers was requested due to the belief that if asked to provide only one answer, employers might be overly optimistic. The two job growth projections were the averages of the respondents' low estimate and high estimate. The next four questions asked employers to identify requirements in terms of educational qualifications (possible answers being "OJT, Minimal Training", "High School Degree", "Associate Degree/ Apprenticeship", "Bachelor's Degree" and "Graduate Degree"), and Field of study/ amount of training, certifications and skills. Businesses were asked to explain the degree of difficulty in finding qualified workers for each position listed (possible answers being "No difficulty", "Some difficulty" and "Great difficulty"). When computing the results "No difficulty" equaled 0, "Some difficulty" equaled 1, and "Great difficulty" equaled 2. The formula used to compute the averages was:

Summation of {"number of jobs listed by employer in position" multiplied by "degree of difficulty"}.

The purpose of this question was to identify the type of workers employed by the solar industry, the projected job growth in the solar industry, and the characteristics of the ideal worker. The latter would provide information on training needs.

20. The Standard Occupational Classification (SOC) system is used by federal statistical agencies to classify workers into occupational categories for the purpose of collecting, calculating or disseminating data. For more information see: http://www.bls.gov/SOC/

10. List job titles of workers your solar business requires, then answer all questions for each position listed.

	Please list positions that are core to your solar business. If more than one, list Field position/s first, then Office position/s. *(e.g., Entry-level Solar Installer or Marketing/Sales Specialist, but not Receptionist)*	**Number of workers by position.** You may use your latest available payroll.	**How many workers do you expect to have 12 months from now in each position?** Please provide a range of answers. *(e.g., 5-9 workers)*	**What is required of your workers in terms of educational qualifications?**	**Please specify Field of Study/Amount of Training.** *(e.g., Engineering Degree or 2 months training)*	**Identify certifications current workers need, but do not have.** Please list by position. Skip if not applicable.	**Identify essential skills current workers need, but do not have.** Please list by position. Skip if not applicable.	**How difficult has it been to find qualified workers in each of these positions?**
1.				Choose...				Choose...
2.				Choose...				Choose...
3.				Choose...				Choose...
4.				Choose...				Choose...
5.				Choose...				Choose...
6.				Choose...				Choose...
7.				Choose...				Choose...
8.				Choose...				Choose...
9.				Choose...				Choose...
10.				Choose...				Choose...

Question 11 had a similar goal as businesses were asked to rate different types of training, while in Questions 12-18, respondents were asked to identify inadequacies of the aforementioned types of training. The options given were "Level of Training", "Affordability of Training", "Relevancy of Training" and "Timing of Training". Respondents were also given the option to name a different reason why the training may be inadequate. When computing averages, "Very useful" equaled 2, "Somewhat useful" equaled 1, and "Not very useful" equaled 0.

11. How useful have the following been in increasing your employees' skills?

	Very useful	Somewhat useful	Not very useful	Haven't Done Such Training
On-the-Job Training	○	○	○	○
Online Training	○	○	○	○
University or Community College Degree Programs	○	○	○	○
Community College Non-Credit Courses	○	○	○	○
Professional Associations & Unions (Workshops and Certification)	○	○	○	○
Manufacturer-Provided Training	○	○	○	○
Private Training Institutes	○	○	○	○

In Question 19, respondents were asked to identify new developments in the industry that would affect training requirements of their workers, while in Question 20, they were asked to describe the additional training required once the developments listed in question 19 had taken place. The two questions aimed at providing an understanding of developments that were expected to occur, and to prepare training institutes, if possible, for these developments.

19. Describe new developments, if any, in the solar industry that will likely affect skill requirements of your workers.

20. In light of anticipated developments in the solar industry, please identify advanced or new training that your workers will need.

Finally in Question 21, respondents were asked what the State of Hawaii could do to support the solar industry. Respondents were allowed to provide only one answer to the above question, in order to identify the most important problem employers faced.

21. What can the State of Hawaii do to support the solar industry?

- ◯ Fund training of workers
- ◯ Fund research/ innovations
- ◯ Change interconnection standards
- ◯ Increase public awareness
- ◯ Provide different consumer incentive programs (e.g., rebates instead of tax credit)
- ◯ Provide more consistent consumer incentive programs
- ◯ Other, please specify

The options given to respondents were:

- Fund training of workers
- Fund research/ innovations
- Change interconnection standards
- Increase public awareness
- Provide different consumer incentive programs
- Provide more consistent incentive programs

Respondents were also given the option to provide their own answer, if none of the above satisfied them. Many respondents made use of the above option (22 out of a total of 70 respondents chose to provide their own answer). Answers provided by the employers themselves were analyzed and tallied.

4. Response Rate

The survey was launched on October 12, 2011 and was closed on November 4, 2011. Of the 146 employers or employer representatives the survey was sent to, a total of 79 chose to participate, with a response rate of 54 percent. Partial responses were received from seven (meaning that the respondent only completed part of the survey or may have saved their answers and did not return to answer the remaining questions) and 10 responses were received after conducting phone interviews. Responses initially were rare, which resulted in the usage of an aggressive follow-up policy, with 3 reminder e-mails (sent on October 17, October 24 and October 31, respectively), and 3 rounds of phone calls to companies that had not responded. Follow-up phone calls led to the 10 aforementioned phone interviews. The goal of the phone interviews was the reduction (but not elimination) of non-response bias as a result of employers either being too busy to complete the online survey or having difficulties responding to web surveys.

C. SMALL GROUP DISCUSSIONS

In order to fully understand the survey results, a series of small group discussions was held after responses had been collected and analyzed. The goal of the discussions was to gain information on the following two subjects: 1) county-specific needs and 2) relation of training needs to other industry issues.

To provide an answer to first subject, a discussion was held in each of the four Hawai'i counties. Ultimately, discussions were only held on Kaua'i, the Big Island and O'ahu (two discussions), as the lack of time to establish a network of contacts on Maui made it difficult to organize a discussion group. Two discussions were held on O'ahu to accommodate the schedule of invited discussants.

To answer Question (2), the participants in each group included an employer, a policymaker, a training provider, and a consumer advocate. This make-up of discussants was formulated based on an earlier feedback by grant project advisers or partners.

Usually the discussion began with a brief presentation of the results, and then the participants were asked to give their opinion about the results based on their experiences and knowledge of the industry. In some cases invitees did not attend, and the discussions did not have all four intended perspectives (Employer, Policy, Training, Consumers). Overall however, the insights provided proved to be extremely valuable in analyzing the results.

The discussions in more detail:

Kauai Discussion

When: November 29, 2011
Where: Kaua'i Community College, Līhu'e, HI
Participants: Robert Conti, Kaua'i Community College Instructor - Implementer of Renewable Energy training programs; Charlie Cowden, Hanalei Solar; Jan Miyamoto, Workforce Investment Board Chief Staff; Ed Nakaya, KIUC Public Affairs & incoming President of Kaua'i Economic Development Board; Steven Rymsha, KIUC Senior Energy

Solutions Engineer; Glenn Sato, Kaua'i Sustainability Coordinator; Nathan Wood, Kaua'i Workforce Investment Board Member, General Contractor and Electrical Engineer

Big Island Discussion

When: November 30, 2011
Where: Big Island Workplace Connection, Hilo, HI
Participants: Raj Budhabhatti, President of Greenpower Solutions LLC; Tony Kent, Hawai'i Community College Rural Development Project; Debbie Shigehara, Hawai'i Community College Office of Continuing Education and Training

O'ahu Discussion I

When: December 7, 2011
Where: Department of Labor and Industrial Relations, Honolulu, HI
Participants: Stephen Allen, Hawai'i Pacific University; Tamara Armstrong, Kya Sustainability Studio; Mike Hamnett, Hawai'i Energy Policy Forum; Preshess Willett-Vaquilar, Honolulu Community College; Jillian Yasutake, Workforce Development Council

O'ahu Discussion II

When: December 12, 2011
Where: Department of Labor and Industrial Relations, Honolulu, HI
Participants: Mark Duda, President of Hawai'i Solar Energy Association; David Mittelstadt, Hawai'i Energy; Sharon Moriwaki, Hawai'i Energy Policy Forum; Larry Newman, Hawai'i Energy

D. RECOMMENDATIONS

Future study on training needs assessment in the solar industry can likely be implemented faster or better by learning:

1. *Solar Industry Structure:* It is recommended that future surveys explore the feasibility of establishing the structure of the industry in the State and establish framed population and sampling designs accordingly.

2. *More Inclusive Group of Participants:* In many cases the quality of the work provided to consumers, as well as the development of the industry depends on the proper training of instructors or inspectors. A characteristic example of this was the observation made by one of the respondents regarding the PV-specific training required of electrical inspectors, in order to be able to evaluate the quality of a PV installation. In order to accomplish this, training providers and utilities could have been contacted, as their input would have been extremely useful.

3. *Request for more information on positions that require training*: The list of solar jobs formed by the survey participants proved to be very useful in producing results that could benefit training providers and workforce development. In order to analyze the results, it became necessary to classify jobs using the Standard Occupational Classifications. While in most cases, the job title, information on the company's business operations, as well as educational/certification/skill requirements made it possible to classify jobs, in others more information was necessary (and was acquired by contacting the respondent and asking for a job description). For future studies, a request for a job description, along with the job title might be useful. As with all surveys, however, when considering the addition of a question, the effect it will have

on the response rate must also be taken into account.

4. *Request for workers' location*: A recommendation for similar future studies would be to request the location (Island or County) at which the workers were based, especially in industries such as this one, where a large number of businesses operate on multiple islands.

5. *Alternative methods of contacting participants:* Due to the fact that many participants may have difficulties responding to an online survey (for various reasons) researchers should consider using phonecalls, fax or mail to contact some participants.



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Appendix A: Jobs and Standard Occupational Classification

In order to produce data that can be analyzed, positions listed by employers were classified using Standard Occupational Classifications.

The 2010 Standard Occupational Classification (SOC) system is used by Federal statistical agencies to classify workers into occupational categories for the purpose of collecting, calculating, or one of 840 detailed occupations according to their occupational definition. To facilitate classification, detailed occupations are combined to form 461 broad occupations, 97 minor groups, and 23 major groups. Detailed occupations in the SOC with similar job duties, and in some cases skills, education, and/or training, are grouped together.

The classification of listed jobs was done using the Job Titles, as listed by the respondents, in addition to information regarding business operations and educational/ certification/ skill requirements for that particular position. In many cases where the information provided was not adequate to classify jobs, it became necessary to ask respondents for more information, either by e-mail or phone. What follows is a list of SOC job titles and codes, and the list of positions (as provided by the employers) that were classified as such:

- Chief Executives (11-1011): *Regional Executive*
- General and Operations Managers (11-1021): *Manager; Manager (sales, operations, business, install); Operations Manager;*
- Green Marketers (11-2011.01): *Admin.; Admin./ Marketing; Marketing Assistant*
- Marketing Managers (11-2021): *Marketing Director*
- Sales Managers (11-2022): *Sales Executives; Sales Manager*
- Administrative Services Managers (11-3011): *Office Manager*
- Quality Control Systems Managers (11-3051.01): *Quality Control on Install*
- Construction Managers (11-9021): *Management; Project Coordinator(s); Project Manager(s); Tech Manager*
- Compliance Manager (11-9199.02): *Quality Director*
- Purchasing Agents, Except Wholesale, Retail, and Farm Products (13-1023): *Procurement Specialist; Sourcing/ Procurement*
- Cost Estimators (13-1051): *Estimator(s)/ ES Elect; PV Estimator*
- Business Operations Specialists, All Other (13-1199): *Technical Director*
- Accountants (13-2011.01): *Accountant*
- Financial Analysts (13-2051): *Sr. Financial Analysts*
- Business Financial Analysts (15-1199.08): *Finance/ Business Development*
- Electrical Engineers (17-2071): *Electrical Design & Source; Engineer/ Design; Project Engineer(s)*
- Mechanical Engineers (17-2141): *Mechanical Engineer*
- Engineers, All Other (17-2199): *Project Managers; Technical Support/ Contractor Interface; Analyst*
- Electrical and Electronics Drafters (17-3012): *CAD Designers; Permitting, NEM Agent*
- Electrical Engineering Technicians (17-3023.03): *Engineer*
- Electrical Engineering Technologists (17-3029.02): *Building Technologist*
- Urban and Regional Planners (19-3051): *Development Manager*
- Sales Representative, Wholesale and Manufacturing, Technical and Scientific Products (41-4011): *Field Representatives; Marketing/ Sales; Sales; Sales Associate; Salesperson; Sales Representative; Sales Specialist; Solar Sales; Solar Sales Specialist*

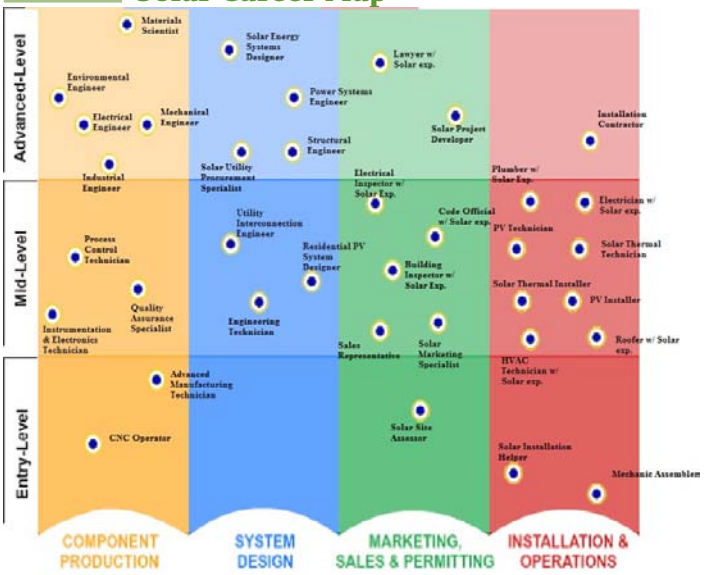
- First-Line Supervisors of Office and Administrative Support Workers (43-1011): *Office Administrator*
- Receptionists and Information Clerks (43-4171): *Receptionist*
- Secretaries and Administrative Assistants, Except Legal, Medical, and Executive (43-6014): *Administrative; Administrative Assistant; Office*
- Word Processors and Typists (43-9022): *Application Processor*
- Office Clerks, General (43-9061): *Office Clerk; Permitting Specialist*
- First-Line Supervisors of Construction Trades and Extraction Workers (47-1011): *Construction Superintendent; Foreman; General Foreman*
- Construction Laborers (47-2061): *Laborer*
- Electricians (47-2111): *Elec. Journeyman; Electrician(s); Foreman Electrician; General Contractor; Journey person Electrician; Journeyman; Journeyman Electrician(s); Journeyman Electrician, PV Installer*
- Plumbers (47-2152.02): *Journey Man Plumber; Plumber(s); Solar Installers/ Plumbers*
- Roofers (47-2181): *Roof Tech.; Roofer*
- Solar Photovoltaic Installers (47-2231): *Experienced Installer; Installation Technicians; Installer(s); Installer of PV; Installer PV; Lead Installer; Lead PV Installers; Lead Solar Installer; PV Installers; Rooftop Solar Installer; Solar Installer(s)*
- Entry-Level Solar Photovoltaic Installers[21] (47-2231.01): *Entry-level Installer; Entry-level Solar Installer; PV Installer*
- Helpers-Electricians (47-3013): *Apprentice; Apprentice Electrician;*
- Helpers-Pipelayers, Plumbers, Pipefitters, and Steamfitters (47-3015): *Field Worker; Helper(s); Laborers; Plumber Assistant; Tank Preper*
- Construction and Building Inspectors (47-4011): *Field Inspector*
- Solar Thermal Installers and Technicians (47-4099.02): *Entry-level Solar Installer(s); Field Installers; Installer(s); Installer of Solar Water; Installer Thermal; Solar Installer; Solar Water Heating Installers; Technician*
- First-Line Supervisors of Mechanics, Installers, and Repairers (49-1011): *Crew supervisor; Installer Supervisor; Lead off Mechanic*
- Helpers-Installation, Maintenance, and Repair Workers (49-9098): *Field Workers*
- Assemblers and Fabricators, All Other (51-2099): *Assemblers/ Drivers*
- Heavy and Tractor-Trailer Truck Drivers (53-3032): *Truck Driver/ Laborers*

21. This SOC job title does not exist anymore.

Appendix B: Career Ladders

Career ladders or directions for Hawai'i's solar workers are explored in the next few charts. The Sunspot Initiative's Solar Career Map is used as a reference, with adjustments made to reflect the specific characteristics of Hawai'i's industry. Hawai'i's solar workers were mostly in Installation & Operations (red column). A large numbers of workers could be found in Marketing, Sales & Permitting, with Permitting being handled in smaller businesses by Office personnel. Engineers (a total of 21) were all employed in System Design.

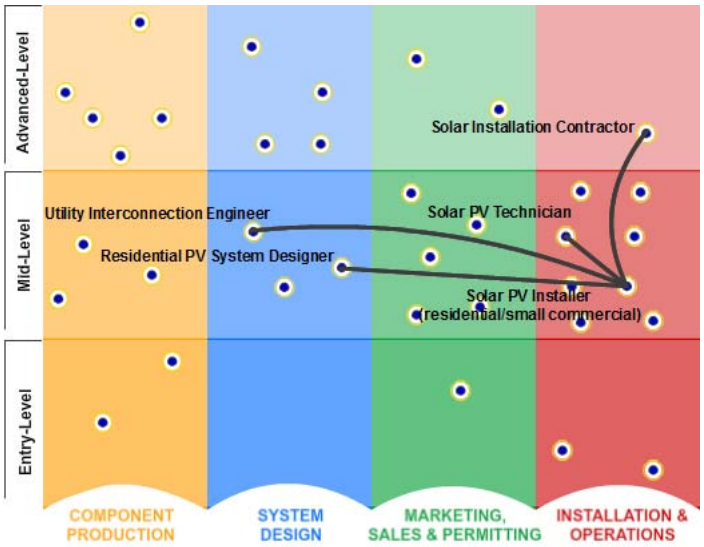
Chart 18. Solar Career Map



When analyzing the top five Solar Positions (PV Installers, Solar Thermal Installers, Sales Representatives, Electricians with Solar Expertise, and Plumbers with Solar Expertise) the Solar Career Map's suggested career paths (Chart 19) were as follows:

PV Installers

Chart 19. Career Advancement Options for PV Installers



PV Installers career advancement options included:

- *Solar PV Technician: Solar PV Technicians must hold a Journeyman Electrician license or a Journey Power Plant Electrician license. To advance, certification or a Master level electrician's license is encouraged.*[22]

- *Solar Installation Contractor: Solar Installation Contractors must possess an approved state or local license. A Master-level license may also be required. Can install solar without a specialty license or certification, depending on the jurisdiction. Solar certification and specific training in construction project management is ideal.*

- *Residential PV System Designer: Applied associates programs that combine green*

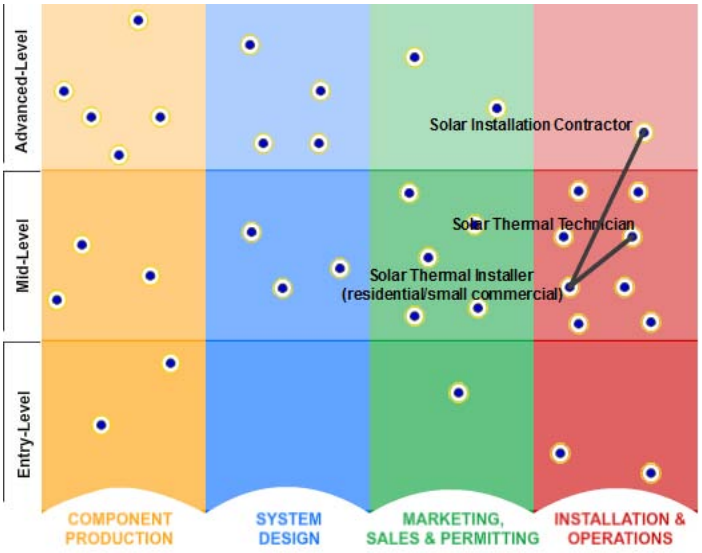
22. All Education and Training Requirements are provided by the Sunspot Initiative. See http://www1.eere.energy.gov/solar/careermap/details.aspx?jid=28

building and residential PV system design provide excellent entry. Technical- and design-minded solar professionals can move into this area with supplemental training. To advance a B.S. in Engineering Technology is recommended.

- *Utility Interconnection Engineer: Utility interconnection engineers have at least an Associate's degree and significant experience; they may promote from the skilled trades, particularly as electricians familiar with grid infrastructure, and advance into management. A B.S. in engineering is becoming the expected entry-level degree.*

Solar Thermal Installers

Chart 20. Career Advancement Options for Solar Thermal Installers

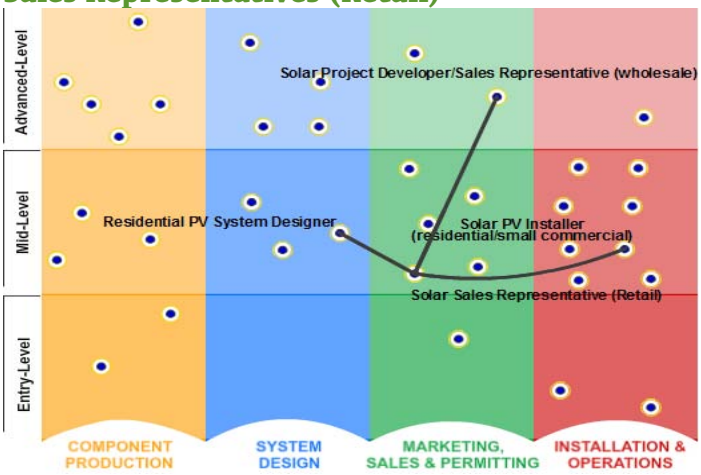


Career advancement options include:

- *Solar Installation Contractor (see above)*
- *Solar Thermal Technician: Entrants into this occupation usually transfer into solar from related construction jobs. Many have come up through apprenticeship programs. To advance in the solar industry, certification, master-level licensing, or a BS in Engineering may be sought.*

Sales Representatives

Chart 21. Career Advancement Options for Solar Sales Representatives (Retail)

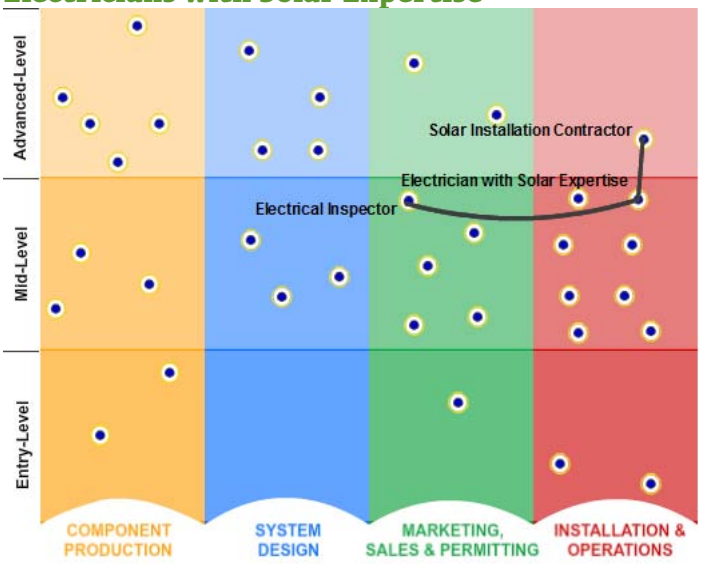


Career advancement options include:

- *Solar PV Installer: Entry-level installers typically have a high-school degree or equivalent and construction experience. To advance, PV installers should complete a 2-year degree or an apprenticeship in the construction trades, as well as solar training at an industry-recognized institution.*
- *Residential PV System Designer (see above)*
- *Solar Project Developer: Ideally the Solar Project Developer has a Bachelor's degree in engineering, science or finance, and an MBA.*

Electricians with Solar Expertise

Chart 22. Career Advancement Options for Electricians with Solar Expertise

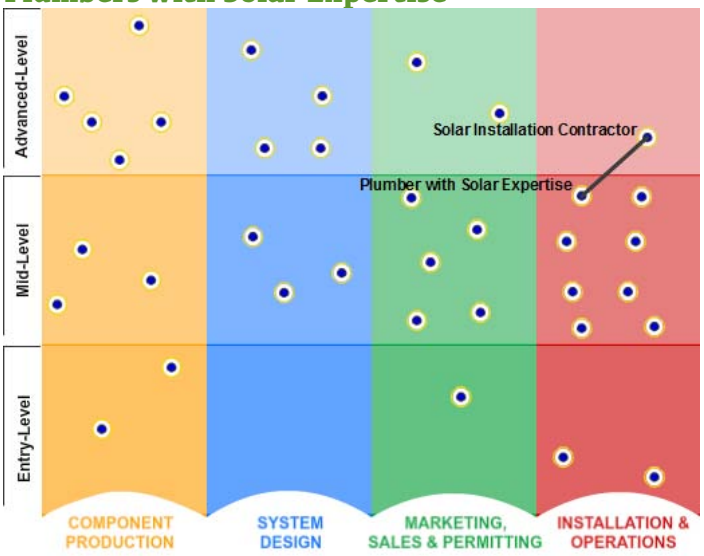


Career advancement options include:

- *Solar Installation Contractor: (see above)*
- *Electrical Inspector with Solar Expertise: Electrical Inspectors usually have journey-level electrical construction training. Specific solar training is critical for quality inspections, even if only a small portion of the typical inspector's job involves solar installations.*

Plumbers with Solar Expertise

Chart 23. Career Advancement Options for Plumbers with Solar Expertise



Career advancement options include:

- *Solar Installation Contractor: (see above)*

Hawai'i's Solar Industry

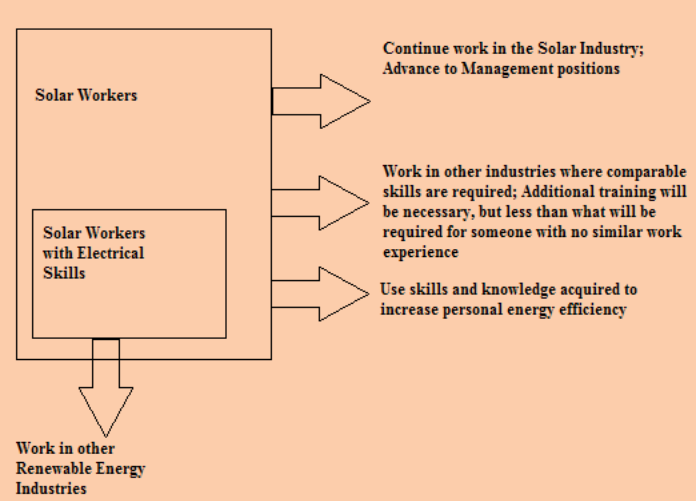
The question one could ask is, will the above career advancement options be available for workers in Hawai'i's Solar Industry? The answer is not clear and will depend on the further development of the System Design and Component Production sectors. The need for Solar Installation Contractors and Solar Project Developers will depend on the demand for solar energy. A need for Electrical Inspectors with Solar Expertise was mentioned in the responses received and the small group discussions, and is a career path Electricians with Solar expertise might want to consider.

To draw a broader picture of the career advancement options of Hawai'i's solar workers, a number of factors should be considered:

- Capable solar workers, will be in demand based on word of mouth, as long as there is work available.
- For workers with electrical knowledge, the development of other renewable energy industries could provide an additional career path.
- The development of a Manufacturing industry could provide more options to displaced workers and could also offer opportunities to the existing Electrical, Mechanical, Environmental and Industrial Engineers (which could also provide a solution to the problem of STEM students exiting the State[23]).

It must also be noted, that even when training does not lead to a new career, it may help trainees make more informed decisions on how to address their own energy needs and become more energy-efficient consumers.

An attempt to draw a broader picture of career options would lead to the following:



Ultimately, career advancement options will depend on: a) the workers' skills and willingness to further their education/training, and b) the existence of entrepreneurs willing to invest in innovations, and c) government support as a result of the increasing need for renewable energy.

23. See "Innovation and Technology in Hawai'i: An Economic and Workforce Profile" prepared by the Center for Regional Economic Competitiveness, October 2008.



www.greenjobshawaii.org

Hawai'i Green Jobs Initiative
Research & Statistics Office
Department of Labor & Industrial Relations
830 Punchbowl Street, Room 304
Honolulu, HI 96814

Phone: 808-586-9013
Fax: 808-586-9022
Email: dlir.rs.greenjobshawaii@hawaii.gov



hawai‘i green jobs initiative

Department of Labor and Industrial Relations