

## OCCUPATIONAL PROFILES FOR THE SOLAR INDUSTRY

This memo is part of IREC's focus on workforce development and setting competency and content standards for practitioners and training programs. The memo presents a review of the occupational areas for the solar industry focusing primarily on photovoltaics (PV) or solar electricity.

### Solar Energy Market Growth

The solar industry reports that solar electric installations grew by over 20% in 2006 to 120 MW-dc. Utilities have recently announced contracts to build over 2,000 MW of new concentrating solar over the next decade.<sup>i</sup> If the goals of the Photovoltaic (solar electric) Industry Road Map are met, total installed capacity could increase to 9,600 MW by 2015. Direct employment would increase from 20,000 now to 62,000 by 2015.<sup>ii</sup>

The US Department of Energy estimates that as many as 5,000 trained installers may be needed by 2015 to accomplish their new Solar America Initiative.<sup>iii</sup>

A survey conducted by the investment bank Jefferies & Company in February 2007 said that among renewable energy sources, solar power is viewed as likely to contribute most to the world's primary energy supplies by 2020. Solar was selected by 40% of respondents, followed by wind (33%), hydropower (22%) and geothermal (5%).<sup>iv</sup>

According to a report released in March 2007 by Clean Edge, global clean-energy markets are ready to quadruple in the next decade, growing from \$55.4 billion in revenues in 2006 to more than \$226.5 billion by 2016 for four technologies -- biofuels, wind power, solar photovoltaics and the fuel cell and distributed hydrogen market.<sup>v</sup>

Add to these facts and market-based predictions rising retail electric grid prices, volatile pump prices, climate change, the increasing value of energy independence, and new and expanded state and federal policies. All of these influences result in new "green-collar" jobs.

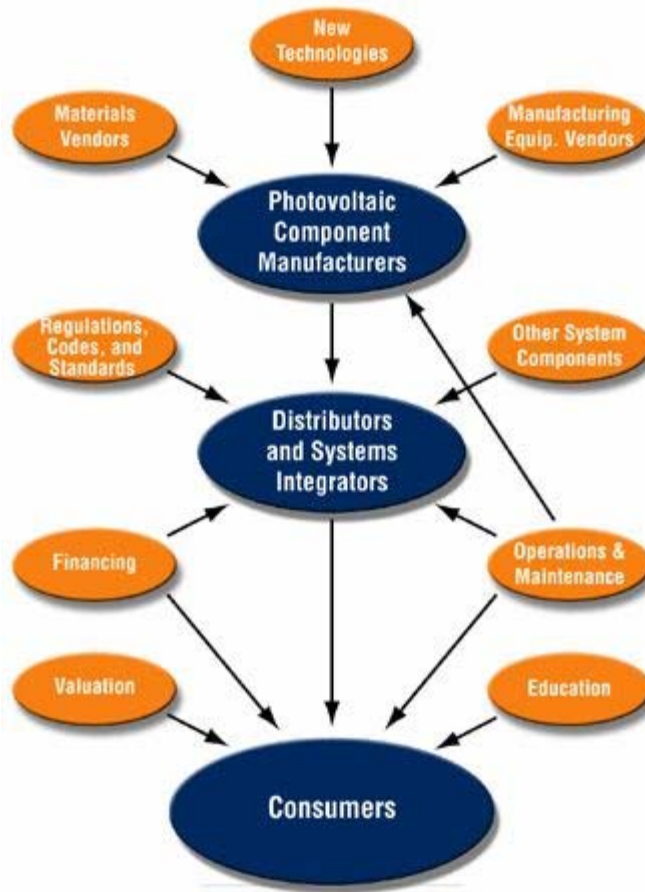
## Primary & Indirect Occupations with Industry Description

The United States Photovoltaic Industry Roadmap (May 2001) defines the scope of the industry as follows:

- **Solar Cell and Module Manufacturers.** Technologies includes crystalline, thin-film, and concentrator products.
- **Photovoltaic Equipment Manufactures.** Design and supply of the equipment needed to fabricate devices, assemble modules, and test products.
- **Balance of Systems (BOS) Manufacturers and Supplies.** Design, develop and fabricate equipment, electronics, and devices to monitor, control, ensure quality, store, and provide a utility interface to the electrical power produced by photovoltaic modules.
- **System Integrators, Packagers, & Installers.** Work with consumers, groups for microgrids and power parks, utilities for central-station and distributed-generation applications. Skilled labor to mount, monitor and maintain systems.
- **Researchers & Scientists**
- **Engineers**
- **Technicians**

### Indirect Occupations

- **Architects**
- **Builders**
- **Skilled Laborers** – roofers, electrical and metal workers, machinists, transportation engineers
- **Commodity Suppliers** – glass industry, electronic device manufacturers, plastics and polymer industries, equipment suppliers, wire and cable makers, and steel, aluminum, and other metal industries.
- **Electric Power Utility Workers**



### Solar Electric Industry Profile

Wide variety of manufacturers, businesses, regulatory bodies, and educational organizations  
*Source: Solar Electric Power – the US Photovoltaic Industry Roadmap*

### Occupational Tasks for Solar Installers

The best source that defines a general set of knowledge, skills and abilities typically required of solar electric installers is the North American Board of Certified Energy Practitioners (NABCEP) Task or Job Analysis.

[www.nabcep.org/Monticello/userfiles/File/PVTaskAnalysisFinal06.pdf](http://www.nabcep.org/Monticello/userfiles/File/PVTaskAnalysisFinal06.pdf)

NABCEP-Certified Solar PV installers are required to specify, configure, install, inspect and maintain a solar electric system that meets the performance and reliability needs of customers, incorporates quality craftsmanship, and complies with all applicable safety codes and standards.

For the purposes of developing training curricula, assessment mechanisms and certification criteria, specific tasks are classified as either cognitive or psychomotor skills.

The NABCEP PV Task Analysis covers 8 major areas:

1. Working Safely with PV Systems
2. Conducting a Site Assessment
3. Selecting a System Design
4. Adapting the Mechanical Design
5. Adapting the Electrical Design
6. Installing Subsystems and Components at the Site
7. Performing a System Checkout and Inspection
8. Maintaining and Troubleshooting a System

The July 2003 report prepared for the Massachusetts Technology Collaborative titled "Needs Assessment for Training and Certification within the Photovoltaic Industry," further discusses training needs for photovoltaic installers. The report states, "The type of training that is unique to the solar industry extends beyond the normal craft of building trades ... [and includes] considerations of system design and execution for performance. The following is a partial list of training needs which are unique to photovoltaic installers:

- Training site assessment as it pertains to system performance (assessing the effects of shading obstructions, tilt and azimuth angles, etc.)
- Training in photovoltaic cell and module characteristics as they apply to the design and performance of integrated systems
- Training in calculating system characteristics, such as wire sizes, to minimize power losses and maximize energy production
- Training in applicable wiring methods and technologies
- Training in mounting techniques and technologies
- Training in PV system maintenance, diagnostic and troubleshooting techniques
- Training in customer education practices."

In addition to the tasks listed above, training should also include fundamental electrical skills, understanding of the electrical grid, and understanding of roof applications and ceilings.

For solar thermal, the best source that defines a general set of knowledge, skills and abilities typically required of practitioners who install and maintain solar hot water or pool heating systems is the North American Board of Certified Energy Practitioners Task or Job Analysis.

[www.nabcep.org/Monticello/userfiles/File/SolarThermalTaskAnalysisApr05.pdf](http://www.nabcep.org/Monticello/userfiles/File/SolarThermalTaskAnalysisApr05.pdf)

The NABCEP Solar Thermal Task Analysis covers 12 major areas:

1. Working safely with solar hot water and pool heating systems
2. Identifying systems and their components
3. Adapting a system design
4. Conducting a site assessment
5. Installing solar collectors
6. Installing water heater and storage tanks
7. Installing piping, pipe insulation and connecting system piping
8. Installing mechanical/plumbing equipment and other components
9. Installing electrical control systems
10. Installing operation and identification tags and labels

11. Performing a system checkout
12. Maintaining and troubleshooting a solar thermal system

This task list assumes the installation contractor starts with an approved solar system design package, complete with major components, manufacturer installation manual, system schematics, and assembly and troubleshooting instructions. While the solar installation contractor may not design the system, in many cases they must be knowledgeable about many aspects of systems design, and may be required to adapt certain designs to fit a particular application or customer need.

## Job Descriptions

Here are sample skills and experience requirements of some recently posted jobs. For a job listing, see Renewable Energy Access at [www.renewableenergyaccess.com/rea/jobs/home](http://www.renewableenergyaccess.com/rea/jobs/home)

### **Job Title: Entry Level Solar Installer**

We are seeking a well-organized PV installer to work with a team in the field installing both residential and commercial grid-tied PV systems.

**Requirements.** Applicants with construction and electrical backgrounds are preferred. Applicants must be able to show they meet the following qualifications: A successful candidate for this position has these qualifications: 1-2 years of construction background is PREFERRED. Disciplined, self-motivated work style. Knowledge of the RE marketplace and industry. Desire to stay on the leading edge of the RE industry. Knowledge of electrical wiring in residential or commercial applications preferred. Experience in mechanical installations, general construction and ladder work. Good communication and customer service skills and experience MUST have reliable transportation. Good at problem solving and implementing ideas. Experience with all types of hand-held and power tools, as well as small machinery (trenchers and bobcats). Experience working with and mounting to all types of building materials - various roof types, stucco, wood, concrete, Uni-strut, etc. H.S. Diploma, two-year degree in technology/industrial arts preferred Proficiency on a PC computer (MS Word, Excel) a PLUS. Knowledge of solar thermal systems a plus. Has been employed by a well known contractor a PLUS.

### **Job Title: Solar Installation Operations Manager**

**Project scope:** This individual will be providing project management for the installations, the oversight of the installation services, and the training of the project management team going forward. The individual will also be providing guidance and contribute to the development of the supply chain strategy and system design activities.

**Knowledge, Skills And Abilities:** Minimum 5 years experience designing and installing residential and commercial solar electric systems (minimum of 50 systems installed). Extensive experience leading installation teams. Licensed C-10 contractors license [California] (additional C-46 license will be favorably considered). NABCEP certification preferred. Experience developing processes, leading organizations/teams, and training installers. Familiarity with photovoltaic technologies, manufacturers, and suppliers. Experience with electrical wiring in

residential applications. Experience with photovoltaic system designs and AC and DC electrical systems. Experience in construction management. Knowledge of NEC Code, Universal and local Building Codes. Experience securing permits and working with building inspectors. Basic PC and Windows skills.

**Education:** Bachelor's Degree in Construction Mgmt or Electrical Engineering preferred. Computer Knowledge Requirements: Microsoft Excel, Microsoft Word, and Microsoft Outlook required. Knowledge of CAD and Siebel, or other CRM system, as a sales management planning tool is a plus.

### **PV Foreperson**

**Specific Qualifications:** Must have at least 2 years of experience installing Photovoltaic systems, both ground mount and on roofs. Must have at least 1 year of experience leading crews in building Photovoltaic systems. NABCEP Certified or preparing to take the test preferred. Solar Energy International (SEI) and Solar Living Institute (SLI) alumni resumes with less experience are also encouraged to apply. Ability to build and troubleshoot an entire system start to finish. Familiarity with electrical code, especially section 690, conduit fill table, ampacity de-rating tables. Ability to manage a small to medium sized team (1-8 people) of varying personalities and skill levels. Ability to assess crew member ability and assign tasks appropriately, both to maximize efficiency and provide training, depending on the specifics of the job. Ability to assess a job: recognize potential problems, bottle neck tasks, length of task times, materials needed, tools needed, engineering issues, electrical issues (both future and pre-existing problems i.e. room for breakers, main upgrades, code violations). Familiarity with different roof structures (steel, concrete, wood framing), attachment and waterproofing options. Ability to interface with all PV departments in order to prepare and build a job and to solve and report any problems with a job (with an eye towards preventing the repeat of past problems).

### **Solar PV System Designer**

We are seeking a well-organized experienced designer. The primary responsibilities will be to design and draft mechanical and electrical plans of photovoltaic systems and submit permit applications to the Building/Planning departments of the appropriate City/County offices.

#### **Required Qualifications:**

Four year college degree in a technology or engineering related field.

Proficiency with a PC computer, AutoCAD, and Microsoft Office

Strong math skills

High degree of attention to detail and follow-through

Disciplined, self-motivated work style

Excellent communication skills

Ability to read and understand architectural plans and schematics

#### **Desired Qualifications:**

Familiarity with the NEC Code and the ability to reference the code as required

Knowledge of Uniform Building Code and construction materials and techniques (i.e. lumber, roofing materials, etc.)

#### **Job Responsibilities (including but not limited to):**

Design - Design of residential and commercial photovoltaic installations, including production of plans for building permit application and construction. Includes specification of components, design of system and mechanical and electrical points of connection.

Drafting - production of plans for building permit application and construction. Plans will include site plans, layouts, mechanical details and electrical schematics. Work with a multi-disciplined team to design and produce construction plans as above for large photovoltaic

projects. Includes co-ordination with Energy Consultants, Design Engineers and with Project Management. Provide design support to Project Management and Onsite Foreman as required. Conduct site inspections with Energy Consultant or Project Manager as required. Coordinate the design of multiple projects simultaneously. Maintain complicated schedules, develop project timelines, and manage people and materials to complete jobs on schedule.

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<sup>i</sup> US Solar Industry Year in Review 2006. Solar Energy Industries Association and Prometheus Institute. [www.seia.org](http://www.seia.org)

<sup>ii</sup> Our Solar Power Future. PV Energy Road Map. [www.seia.org](http://www.seia.org)

<sup>iii</sup> DOE Solar America Initiative (SAI) Funding Opportunity Announcement, October 11, 2006. The goal of the SAI is to reduce the cost of solar photovoltaic technologies so that they become cost-competitive by 2015.

<sup>iv</sup> March 7, 2007. RenewableEnergyAccess.com

<sup>v</sup> Clean Energy Trends 2007. Authors: Joel Makower, Ron Pernick and Clint Wilder, Clean Edge.

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