

Harnessing the Sun

Installing solar energy systems requires a variety of skills and a willingness to get your hands dirty.

With the growth of renewable energy, jobs in this field are becoming increasingly mainstream and sought after. Wind turbine technician and solar panel installer might seem like straightforward occupations, but these jobs have aspects that span multiple industries, making it difficult to gather reliable labor market data.

Solar energy technologies have been evolving since the 1800s, but the contemporary solar movement has gained traction recently with the increasing cost of energy, the federal push for alternative energy and weatherization advances.

But how do the sun's rays translate into jobs? Many jobs go into engineering, producing and installing solar energy systems for homes or businesses. The Interstate Renewable Energy Council identified 10 categories of jobs that complete the solar energy industry value chain (see Figure 1).¹

Many jobs related to solar, such as engineering and production, use similar skill sets

as some other industries. Other occupations related to solar, such as installation, operations and maintenance, require new or enhanced skills. This profile focuses on this second group of occupations.

The Many Shades of Solar

Solar energy can be collected and used for a variety of purposes. Solar photovoltaic (solar PV) uses solar energy to produce electricity. Solar thermal energy collects energy from the sun for heating air or water for a home or business.

In solar PV, when sunlight hits the solar photovoltaic panel

or module, some of the sun's energy is transferred into the semiconductors within the panel, freeing electrons and creating transferable energy. This energy is then guided to an inverter, which turns direct currents into alternating currents and passes the electricity on to its desired use in the home or business.

Solar thermal panels capture the sun's heat and use it to heat water or air. In solar hot water systems, water or antifreeze circulates through the solar panel or heat collector, where it is warmed and then returned to the home's hot water tank (in the case of antifreeze, used to heat the water in the tank). The resulting hot water can be used for radiant

FIGURE 1

Jobs in Solar Energy

- Solar cell and module manufacturers
- Balance of systems manufacturers and supplies
- System integrators and packagers
- Distributors
- Installers and service and repair technicians
- Sales representatives, marketers and estimators
- Site surveyors and assessors
- Researchers and scientists
- Engineers and designers
- Trainers/educators

heat in the home and for hot showers or washing dishes. Solar hot air systems operate like a forced air system, pulling cool air from the home into the solar collector, heating the air and pushing it back into the home. A solar thermal installer generally is qualified to install either solar hot water or hot air systems.

Solar energy installers often specialize in either PV or thermal solar installations and can be certified as professionals in either area. The National Association of Board Certified Energy Professionals (NABCEP) is the largest and most common certifier of solar energy professionals in the country. NABCEP-certification is not intended for new technicians, but rather for practitioners who are experienced with installations, supervisory roles, and knowledge of the industry practices and standards. NABCEP also offers an entry-level exam.

Last spring, 29 Minnesotans took the NABCEP certification exam. At the start of 2010, there were 25 certified solar PV installers, three certified solar thermal installers and two installers certified in both in Minnesota.² About two-thirds of the installers are located in the seven-county Twin Cities area, while one-third serve Greater Minnesota.

Solar Energy Installers

At a basic level, both solar PV and solar thermal installers operate in similar ways. Solar installers need to be comfortable spending significant time working at heights and outdoors. Their work also takes them indoors into potentially small, confined spaces in basements or utility rooms. The ability to do physical work in both settings is an important aspect of the job. The work schedule is similar to that of the construction industry. The installation team operates on a project-by-project basis, working long hours and occasional weekends, with periods of down time between installations.

Jason Edens, founder and executive director of the Rural Renewable Energy Alliance (RREAL), based in the central



PHOTO BY KATE AITCHISON

JASON EDENS

Minnesota community of Pine River, said solar industry professionals “often need a slightly larger tool kit, because you encounter so much from the point of installing the equipment to delivering the energy.”

“With a solar electric installation, you’re potentially going from roof to mechanical room. You pass through a variety of boundaries,” he said.



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Counting Solar Energy Installers

In 2009 the Occupational Information Network (O*NET) identified new and emerging careers in the green economy in a report entitled “Greening the World of Work: Implications for O*NET-SOC and New & Emerging Occupations.”

Two of the identified new and emerging occupations were solar PV installers, and solar thermal installers and technicians. Solar PV installers also have been incorporated into the 2010 Standard Occupational Classification (SOC) structure, but data on the size and wages of these occupations will not be available for several years.

Traditionally, it has been difficult to measure the size and dynamics of this field, because solar energy installers have, in the past, been categorized in labor market information under various SOCs. Two of these categories are “all other” categories, where many types of specialty installation and construction professionals are also classified. The third category would include solar thermal installers, along with installers of all other heating, ventilation and air conditioning systems. The basic overview of these occupations in Minnesota (see below) provides some sense of the field, but is far too imprecise to represent the solar energy industry alone.

Occupational Categories Inclusive of Solar Energy Installers

Minnesota, Second Quarter 2008

SOC Code and Description	Average Employment	Median Hourly Wage	Projected Employment Growth 2006-2016	Top Industries
47-4099: Construction and Related Workers, all other	730	\$14.74	+ 7.4%	<ul style="list-style-type: none"> • Construction • Public Administration • Manufacturing
49-9099: Installation, Maintenance and Repair Workers, all other	4,430	\$18.33	+ 5.5%	<ul style="list-style-type: none"> • Trade, Transportation and Utilities • Manufacturing • Professional and Business Services
49-9021: Heating, Air Conditioning, Refrigeration Mechanics and Installers	2,330	\$24.34	+ 8.5%	<ul style="list-style-type: none"> • Construction • Trade, Transportation and Utilities • Manufacturing

Source: Occupation Employment Statistics, 2009, Third Quarter; Employment Data from 2008, Second Quarter

An installer needs the ability to utilize the tools of a plumber, electrician and general contractor, while at the same time understanding how the various components of a renewable energy system work within a home or business.

The mission of RREAL is to use renewable energy to solve heat and fuel poverty in rural Minnesota. While Edens works more as a leader these days, he has completed many solar PV and solar thermal installations himself.

His interest in the field was piqued as a young adult experiencing his own heat and fuel poverty, and he wanted to find a long-term, renewable solution to the high cost of winter heating. After attending workshops and conducting research on solar energy, Edens eventually secured funding and installed his own solar heating system, reducing his carbon footprint and winter heating costs.

“That was the ‘ah-ha’ moment where we realized we could provide a similar service for many people,” Edens said.

Now, the organization offers low-income families and individuals the opportunity to address their own heat poverty issues through increased energy efficiency and solar heating systems. RREAL also offers market-rate solar PV

and solar thermal energy systems for consumers in the northern part of the state.

Edens said the process of installing a solar energy system can vary, depending on the type, size and complexity of the project. The panels or collectors can be installed on roofs, the sides of buildings, on poles or on the ground, making each project unique. Subcontractors or specialists might be needed for some types of projects, while others can be completed almost entirely by the installation team.

Edens' installation team consists of people with backgrounds in mechanical engineering, construction, environmental studies and electrical work.

"People who have been in the trades for a long time have the misconception that they can easily understand what's involved with a solar energy installation ... without the understanding that solar energy is an oscillating resource, [and] requires some rigorous math and other skills that might not have been part of their regular skill set," he said.

He generally does not hire people who have specific experience in the solar field, but instead hopes to find people with technical skills and experience who are willing to work the long hours and put in the time and research to learn about these technologies.



Project Development and Preparation

Before installation begins, an experienced installer or project manager typically completes a site assessment. The installers meet with clients to determine their objectives and hopes for the system, followed by calculations to determine a performance estimate for the system. The performance estimate can provide a reasonable estimate of how long it will take to recoup the costs of the system. Once the calculations and assessments are done, a proposal is submitted to the client.

If the proposal is accepted, the team begins developing the

schematics and details of the system and orders the materials. In the case of Edens' team, solar hot air and hot water systems are manufactured at RREAL's workshop.

Solar PV system components, however, are ordered from an outside source. It's important to make sure the full system is ordered and shipped before an installation date is set. The typical lead time for a solar energy project depends on size and scale, but it usually runs about two to three months for residential projects and three to six months for commercial projects.

"There's a lot of prep that's associated with doing and



PHOTO COURTESY OF POWERFULLY GREEN

managing solar energy installations, so it's important that we're not out in the field every day," Edens said.

He said it's necessary to spend time at the company's headquarters to manage inventory, maintain tools and plan for future projects.

Solar Panel Installation

Installing either a solar PV panel or solar heat collector for hot water or air is a fairly similar process. For a roof installation, the first step is a structural



analysis of the site and preparing the roof for the added weight of the panel or collector. The installers then install the hardware to hold the panel or collector to the roof. The mounting rack is then installed, and the module is finally placed onto the rack and secured to the roof. From here, the tasks of the solar energy installer differ depending on the type of system being installed — solar electric, solar hot water or solar hot air.

Solar PV Installation

Solar electric systems require a lot of wiring in order to get the power generated from the solar panel on the roof to its final use in the house or business or onto the power grid. This generally requires the skills of a master electrician.

At RREAL, the master electrician is a NABCEP-certified solar PV installer. The electrician installs the inverter, the battery and

other components. While the master electrician completes the intricate wiring, the installers typically help by tightening components of the wiring and performing diagnostic work on the system.

Solar Hot Water Installation

For a solar hot water system, after the solar collector is placed on the roof, the tubing and piping are installed to create the solar loop from the rooftop collector to the hot water heater or boiler. A master plumber is sometimes needed for parts of the installation and to check the work and oversee the other plumbing and piping components of the system. A power-limited technician (PLT) is also needed to help install sensor wires and other electrical components. A PLT is an electrical technician authorized and licensed to supervise or complete electrical wiring, apparatus and equipment for technology circuits or systems.

Solar Hot Air Installation

For solar air heat, warm air from the solar collector is forced into the home through a network of ducts and air-handling components. The collectors are typically mounted vertically against the wall of the building. The mounting of the hardware, rack and panel or


collector can be done off-site and then installed as a unit on the home. The duct work is often subcontracted to a mechanical contractor, but the solar thermal installer can complete much of the connection and duct work necessary. Sometimes a PLT is also needed for certain electrical components of these systems.

System Overview and Check-Out

Upon completing the wiring, piping or duct work, the installers must ensure that the system is functional. They perform diagnostic tests on the entire system and review their work. At RREAL, a big piece of this final step is to educate the homeowners by walking them through the system, making sure they understand how to operate the system and reviewing an owner and operations manual.

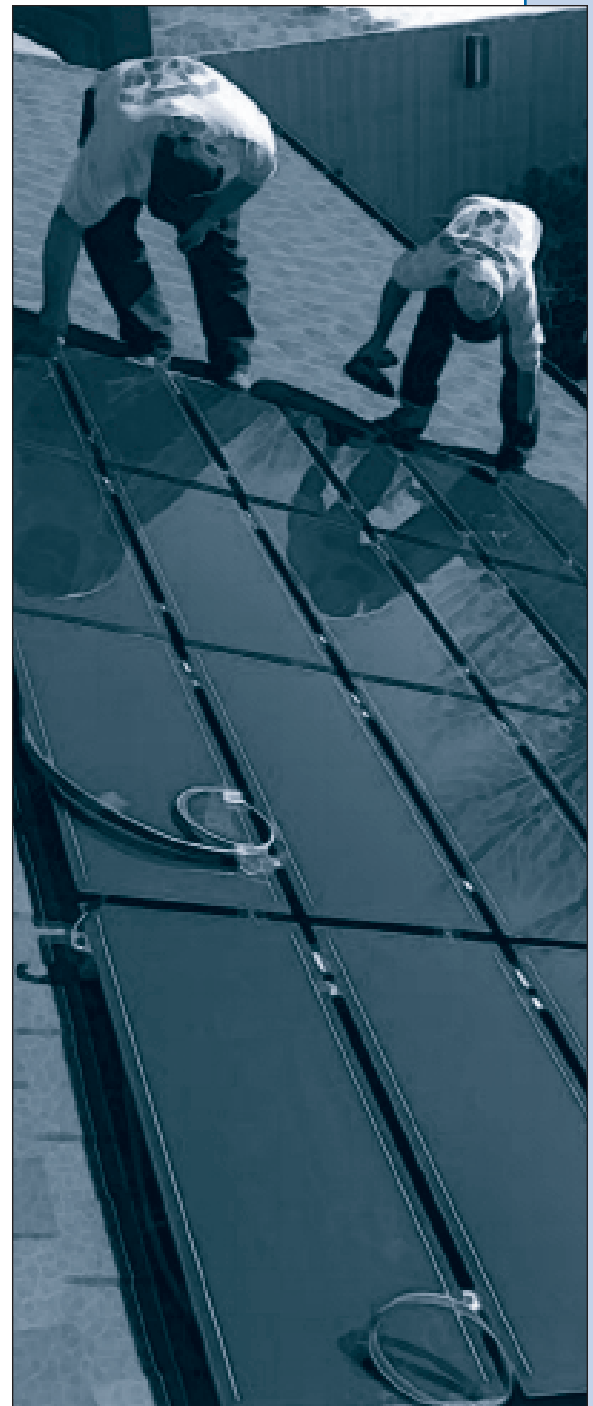
Conclusion

As the industry evolves, Edens foresees increasing regulations and certification related to products and installation. He also anticipates increasing competition and hopes to see more demand for these technologies.

His advice to those who want to get into this industry: “Get your hands dirty — volunteer, figure out if it’s what you want to do and if it is a good match with your skill set. Because solar energy crosses so many trades, any exposure to the trades (electrical, general contracting, plumbing) is useful. It’s such a large industry. It just depends on where you see yourself fitting in.” 

Additional Resources

- Learn more about the Rural Renewable Energy Alliance: www.rreal.org
- Find solar energy training programs around the state: www.iseek.org/industry/energy/education/educationProgram
- Learn more about the National Association of Board Certified Energy Practitioners (NABCEP), their installers and their certification processes: www.nabcep.org/
- Find out what’s going on in the region at the Midwest Renewable Energy Association: www.the-mrea.org/



ENDNOTES:

¹ Interstate Renewable Energy Council, “Occupational Profiles for the Solar Industry,” pages 2-3, August 2008.

² Retrieved from www.nabcep.org/installer-locator?state=MN and from www.nabcep.org/news/september-2009-nabcep-exams-breaks-all-records-129-increase-in-test-takers-from-the-spring-2009-exam.