

Exploring Jobs in the

SKILLED TRADES



Stuart A. Kallen

Contents

Introduction: Opportunities Available	4
Auto Service Technician	7
Solar Photovoltaic Installer	15
HVACR Technician	23
Electrician	30
Nursery and Greenhouse Manager	38
Wind Turbine Technician	46
Source Notes	54
Interview with a Wind Turbine Technician	57
Other Jobs in the Skilled Trades	60
Index	61
Picture Credits	64
About the Author	64

Solar Photovoltaic Installer

What Does a Solar Photovoltaic Installer Do?

In 2021 the US Department of Energy (DOE) announced plans to increase the nation's solar energy output by 40 percent within fifteen years. According to the DOE, this would require a tenfold increase in the number of solar installations in the

United States. This program is expected to create at least 1.5 million jobs. Many of those jobs will go to solar photovoltaic installers, also known as PV installers. These skilled workers assemble, install, and maintain solar systems that convert sunlight to electricity. While PV installers sometimes install solar panels on the ground, most of the work is performed on rooftops.

Many states mandate that licensed electricians perform the most critical work on solar systems, such as hooking them up to the electric grid. But PV installers do most of the work. This prompts electrical engineer Neil Kirby to call PV installers "almost electricians."⁷ Like electricians,

A Few Facts

Number of Jobs

About 11,800 in 2020

Pay

Average annual salary of \$46,470 in 2020

Educational Requirements

High school diploma

Personal Qualities

Physical strength and agility, math and mechanical skills, no fear of heights

Work Settings

Outdoors on roofs and indoors in attics, basements, and garages

Future Job Outlook

Growth rate of 52 percent through 2030

solar techs use their knowledge of electrical codes and building codes to plan out solar installations. They measure, cut, and assemble the racking that fastens the solar panels securely to a roof. Individual solar panels are bolted onto the racking and wired to a piece of equipment called an inverter. This device converts the direct current (DC) produced by solar panels into alternating current (AC), the type of electricity necessary to power lights and electrical appliances. Some solar arrays store power in large rechargeable batteries that are wired into the system. After the job is finished, the PV installer activates and tests the system with a digital multimeter to test electrical circuits, components, and devices. Some will return to the site to conduct routine maintenance.

A Typical Workday

Like most in the building trades, PV installers rise early and work hard. According to PV installer Willie Artis, his team is on the job site by 6:30 or 7:00 a.m. He says, “[We] usually work 12-hour days . . . either installing the panels or the racking and get a 10 minute break every 2 hours until lunch time when we get an hour for lunch in the middle of the shift.”⁸

PV installers put on harnesses, hard hats, and safety goggles and set up ladders. They secure ropes and anchors, which are part of a fall-protection system that allows them to work safely on slanted roofs. Installers use measuring tapes, power saws, power screwdrivers, and other tools to attach long rows of racking along the length of a roof.

After the solar panels are installed on the racking, they are plugged in to one another. Wires are run through pipes called conduit, which can be cut and bent with a conduit bender. Conduit usually runs from the roof, through the attic, and into the garage or basement, where meters, batteries, and inverters are located.

Solar shingles provide another method of harnessing power from the sun. Those who install these innovative systems require skills more typically used by roofers. Installers remove the old shingles, tack down felt sheeting, and weave solar wiring through the

Beginners Learning On-Site

“[PV installer trainees learn] how to safely carry a 3x5 foot (1m x 1.5m) solar panel from the ground to the roof without damaging anything. Up on the roof it was ‘class in session’ as others showed how the nuts and bolts worked and how the wires all connected. Back on the ground, the beginners were working shovels in the cable trenches and being taught all of the aspects of getting cables into the ground. Safety was topic number one. . . . There is a lot of technical know-how and hands on [experience].”

—Neil Kirby, electrical engineer

Neil Kirby, “Is a Solar Panel Installer a Good Job?,” Quora, November 30, 2019. www.quora.com.

surface area of the roof. Solar shingles are about one foot square. PV installers attach shingles one at a time with a nail gun. When all are in place, the wiring is connected from each shingle to a main wiring harness that runs to the inverter.

While working as a PV installer might be hard at times, solar power expert Kim Rivera says the job comes with something special. “Working in the solar [industry] helps you leave work every day feeling fulfilled knowing you are creating a world run on clean, renewable energy,”⁹ she says.

Education and Training

Solar photovoltaic installers are only required to have a high school diploma. Some PV installers learn the trade on the job as apprentices, working with experienced installers. Apprenticeships last anywhere from a few months to a year. Prospective PV installers can also take courses at a technical school or community college, where they learn about solar panels, electrical wiring, PV system design, tools, and basic safety measures. Courses might last from a few days to a few months.

As with any trade, those with certification demonstrate to prospective employers that they are willing to invest time and effort in expanding their knowledge. Certified PV installers can expect to receive higher wages and a chance to become project supervisors or project managers.

The North American Board of Certified Energy Practitioners has been offering several levels of board certification since 2003. The board provides affordable training courses and a certification ladder that goes from PV Installation Professional to PV Installer Specialist and PV System Inspector. Those seeking accreditation must have minimal experience working as a PV installer, complete fifty-eight hours of advanced training, and pass a written exam.

Skills and Personality

Solar photovoltaic installers must be comfortable working high off the ground. These workers spend their days climbing up and down ladders and walking around on sheet metal, shingled, or tiled roofs that might be wet and slippery.

PV installers also need to be physically fit and agile. Individual solar panels are big and awkward. They are roughly 5 feet (1.5 m) long and 3 feet (91 cm) wide and weigh around 40 pounds (18 kg). While some teams of PV installers have access to forklifts or hoists, others balance the panels on their shoulders and haul them up ladders. When it is windy outside, a panel can act as a sail, requiring the PV installer to keep a tight grip on the panel with one hand and the ladder with the other.

Basic math skills are important when installing racking and other equipment. PV installers calculate angles and measurements using algebra and geometry. Mechanical skills are also important since the work requires installers to use a variety of tools to assemble complex electrical systems. As a solar technical trainer known as Bryan says, the job requires a mix of brains and brawn. “When I was the boss, the hardest part was convincing a bunch of [young installers] that it was dangerous,” he says. “Safety first. It is physically challenging as well as mentally chal-



Installation of rooftop solar panels (pictured) is done by a solar photovoltaic installer. In addition to installing panels, these skilled workers also assemble and maintain commercial and residential solar systems.

lenging. You have to know how to physically install the system and you must KNOW the code required for a safe and functioning system.”¹⁰

Working Conditions

PV installers work outdoors in the hot sun, wind, and cold. However, when the weather is bad, they are not required to report to the work site. As Kirby points out, “[The job] is somewhat seasonal. It’s not safe to stand on a 35 degree pitched metal roof in blowing snow or driving rain to try to do an install. Those days are good days to go to class or maybe restock the truck.”¹¹

Working on a rooftop electrical system can be dangerous. PV installers risk injury from cuts, falls, electrical shocks, and burns from soldering and welding tools.

Challenging but Not Stressful

“I was [a PV installer] for about 4 years before taking an office position. I loved it. I did residential installation so I was at a different site daily. Even though the process is pretty much the same, each day is slightly different with unique characteristics. The work is challenging enough to not be boring but it’s not so hard that it’s stressful. It’s physically demanding so I stayed in good shape. It pays well, I worked with great people, and got to be outside. (I live in southern California, being outside may not be a pro depending on where you live.)”

—William Holliday, former PV installer

William Holliday, “Do You Like Being a Solar Photovoltaic Installer?,” Quora, March 17, 2019. www.quora.com.

Employers and Pay

According to the Bureau of Labor Statistics (BLS), three-quarters of PV installers work for plumbing, heating, or electrical contractors, while 4 percent are employed by utility companies. Around 5 percent are self-employed. The rest work for solar manufacturers. While most PV installers work on residential, office, or industrial buildings, some are employed at large, ground-based solar production sites. In 2021 there were more than five thousand major solar projects under construction throughout the country.

Most jobs for residential PV installers are in Arizona, California, Florida, Texas, and other southern and western states where the sun shines year-round. Salaries vary from state to state. In 2019 California solar company owner Dejan Obradovic said he paid his PV installers over \$66,500 a year, plus a 50 percent match to whatever workers deposit in their 401K retirement fund. At that time the annual salary in Arizona was only about \$41,600. When

salaries are averaged out, the median annual wage for a solar photovoltaic installer in 2020 was \$46,470, according to the BLS. The median wage is the wage at which half the workers in an occupation earned more than that amount and half earned less. As solar energy expert Henrietta Black says, “Jobs in the solar industry pay very well, and consistent salary growth tends to be very common. So, as you gain more skills and experience, you will most likely see your pay increase. . . . With experience, a solar installer can make well over \$50,000.”¹²

What Is the Future Outlook for Solar Photovoltaic Installers?

There is no doubt that solar energy is going to play a major role in slowing climate change while producing millions of jobs. This is why the BLS predicts that employment of solar photovoltaic installers will grow by an astounding 52 percent through 2030. The BLS says there will be twenty-three hundred additional job openings for PV installers every year throughout the decade.

While the employment figures look promising, 91 percent of construction employers in the energy efficiency sector had a difficult time recruiting employees, according to a 2020 study by the National Association of State Energy Officials. This means that those with the skills to install solar panels will not have a difficult time finding work now or in the future.

Find Out More

Interstate Renewable Energy Council (IREC)

<https://irecusa.org>

IREC is focused on building a renewable energy workforce. The council offers online clean energy training, certification, career advice, and a training-to-job pipeline. The Career Map section of the website helps students prepare for local careers in the green building sector.

Source Notes

Introduction: Opportunities Available

1. Quoted in Michael d'Estries, "The 24 Highest-Paying Trade Jobs in 2021—No Bachelor's Degree Required," SkillPointe, June 3, 2021. <https://skillpointe.com>.
2. Erin Flynn, "What Is Career and Technical Education, and Why Does It Matter?," Education Northwest, February 19, 2021. <https://educationnorthwest.org>.
3. Mischa Fisher, "2021 Skilled Trade Report," Angi, 2021. www.angi.com.

Auto Service Technician

4. Quoted in Grace Hase, "Who'll Fix Your Electric Car?," *SF Weekly*, July 29, 2021. www.sfweekly.com.
5. Quoted in Scott Sturgis, "As Auto Repair Goes High Tech, Top Technicians Can Earn Over \$100,000," *Philadelphia Inquirer*, March 13, 2021. www.inquirer.com.
6. Larry Poorwoman, "Is It a Good Idea to Become a Car Mechanic in 2019?," Quora, June 8, 2018. www.quora.com.

Solar Photovoltaic Installer

7. Neil Kirby, "Is a Solar Panel Installer a Good Job?," Quora, November 30, 2019. www.quora.com.
8. Willie Artis, "Prospective Students: Build Your Solar Career," SHINE, 2021. www.shine.energy.
9. Kim Rivera, "Do You Like Being a Solar Photovoltaic Installer?," Quora, November 11, 2021. www.quora.com.
10. Bryan, "Do You Like Being a Solar Photovoltaic Installer?," Quora, March 27, 2019. www.quora.com.
11. Kirby, "Is a Solar Panel Installer a Good Job?"
12. Henrietta Black, "Is a Solar Panel Installer a Good Job?," Quora, October 7, 2021. www.quora.com.

HVACR Technician

13. Quoted in Cieana Detloff, "A Day in the Life of an HVACR Mechanic/Gas Fitter 1," Empowering Pumps & Equipment, January 31, 2020. <https://empowerinpumps.com>.

Interview with a Wind Turbine Technician

Jordan Budreau has been a wind turbine technician since 2014. In 2021 he was the lead field service technician for Uptower Repair in Osage, Iowa. Budreau conducted this interview via email with the author.

Q: Why did you decide to become a wind turbine tech?

A: My hometown is in rural Indiana and our community was one of the first major wind projects in the United States. I was fascinated watching the wind towers being constructed and impressed with the engineering and design of the turbines. I also saw the economic impact the project had in my community. Companies were offering jobs with great starting pay and benefits which can be hard to find in small rural communities. Wind turbine tech jobs offered retirement fund matches, insurance, and dental. And the jobs also offered a lifelong satisfying career path for many local citizens. The companies brought money and jobs into our community that helped local businesses grow and thrive as well as helped with community projects. Wind is a backbone of our community and the effect it has on our county can be seen daily.

Q: What is your typical workday like?

A: My typical workday varies quite a bit, which is an appealing part of my current position. Typically I travel to sites all over the United States and coordinate with my team members to carry out complicated repairs on the drive trains of wind turbines. I often do in-depth repairs with myself and another technician or lead a team of up to 6 members. Smaller gearbox and generator repairs are carried out by teams of 2

Other Jobs in the Skilled Trades

Boilermaker	Industrial machinery mechanic
Carpenter	Insulation worker
Construction and building inspector	Ironworker
Construction manager	Line installer and repairer
Cost estimator	Machinist
Craft worker	Mason
Crane and tower operator	Occupational health and safety specialist
Drafter	Plumber
Drywall and ceiling tile installer	Power plant operator
Elevator installer and repairer	Real estate appraiser
Fabricator	Roofer
Flooring installer	Sheet metal worker
Glazier	Surveyor
Heavy equipment operator	Welder
Industrial designer	Woodworker

Editor's note: The online *Occupational Outlook Handbook* of the US Department of Labor's Bureau of Labor Statistics is an excellent source of information on jobs in hundreds of career fields, including many of those listed here. The *Occupational Outlook Handbook* may be accessed online at www.bls.gov/ooh.

Index

Note: Boldface page numbers indicate illustrations.

American Society for Horticultural Science, 45
American Society of Farm Managers and Rural Appraisers, 42
apprenticeship programs, 5
auto service technician, **10**
 educational requirements, 7, 10–11
 employers of, 12–13
 future job outlook, 7, 14
 information resources, 14
 number of jobs, 7
 role of, 7–9
 salary/earnings, 7, 12–13
 skills/personal qualities, 7, 11–12
 typical workday, 9–10
 working conditions, 12
 work settings, 7

Black, Henrietta, 21
Budreau, Jordan, 57–59
Bureau of Labor Statistics (BLS), 26, 60
 on auto service technician, 3
 on electrician, 36
 on HVACR technician, 27–28
 on nursery and greenhouse manager, 44–45
 on solar photovoltaic installer, 20, 21
 on wind turbine technician, 51–52

career and technical education (CTE), 5–6
Coquillet, Carolyn, 8

Darrow, James, 39, 40
Department of Energy, US (DOE), 8, 15, 53
Doublet, Charles, 33
Dye, Jeremiah, 47

electrician, **35**
 educational requirements, 30, 32–33
 employers of, 35–36
 future job outlook, 30, 36
 information resources, 37
 number of jobs, 30
 role of, 30–31
 salary/earnings, 30, 36
 skills/personal qualities, 30, 33–34
 typical workday, 31–32
 working conditions, 34–35
 work settings, 30

Farmers.gov, 45
Ferenc, Brandi R., 24, 25, 26
Fisher, Mischa, 6
Flynn, Erin, 5–6
Forbes (magazine), 6

Grayston, Mark, 9–10
Great Resignation, 4
Holliday, William, 20
Holloway, Tim, 27