



**2021 PENNSYLVANIA CLEAN ENERGY INDUSTRY**  
**Workforce Development**  
**Needs Assessment & Gap**  
**Analysis**

APRIL 2021

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## About This Report

The Pennsylvania Department of Environmental Protection (DEP) commissioned BW Research Partnership to produce the following Pennsylvania Clean Energy Industry Workforce Development Needs Assessment and Gap Analysis Report. As mentioned in the 2020 Pennsylvania Clean Energy Employment Report, the clean energy industry had been a growing source of jobs in Pennsylvania for several years prior to the global pandemic. The following report is meant to identify how to best support continued job growth in the state's clean energy technology sectors.

For the purpose of this report, the clean energy industry in Pennsylvania are the same sectors as defined in the 2020 Pennsylvania Clean Energy Employment Report. The industry is comprised of five major technology sectors—energy efficiency, clean energy generation, alternative transportation, clean grid and storage, and clean fuels—as well as various sub-sectors within each such as solar, wind, efficient lighting, hydropower, smart grid, electric vehicles, and biomass fuels. For more information on what technologies and sub-technologies are included in Pennsylvania's clean energy industry definition, please refer to the 2020 Clean Energy Employment Report or the forthcoming 2021 Clean Energy Employment Report.

The 2020 Pennsylvania Clean Energy Employment Report highlighted particular strengths in the state's growing clean energy industry.<sup>1</sup> Most notably, Pennsylvania is a strong manufacturing hub for wind turbines and ENERGY STAR® products. At the same time, the state has ramped up the deployment of energy efficient and clean electricity generating technologies, boosting the clean energy construction and installation industry. Yet despite this growth, eight in ten clean energy employers in the state reported difficulty finding qualified applicants at the end of 2019, citing lack of experience, industry-specific knowledge, and competition as main concerns.<sup>2</sup>

The global Coronavirus (COVID-19) pandemic in the first quarter of 2020 resulted in layoffs, furloughs, and project delays for clean energy businesses across the state. BW Research estimates that Pennsylvania lost a net 13,200 clean energy jobs between March and December 2020 due to the COVID-19 economic fallout—a 14 percent decline compared to the 2019 baseline.<sup>3</sup> As the overall economy and clean energy businesses begin to recover from the recession, some employers have indicated that the pandemic has created backups in their project pipeline, resulting in a need for more skilled workers to fulfill project demands.

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<sup>1</sup> For the purposes of this report, clean energy jobs are defined as those that dedicate any portion of their labor hours to the research, development, production, manufacturing, distribution, sales, installation, and repair of clean energy and energy-related goods and services; these include clean energy generation, energy efficiency, alternative transportation, clean fuels, and clean grid and storage.

<sup>2</sup> See *generally*: 2020 Pennsylvania Clean Energy Employment Report.

<http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/2020EnergyReport/2020PA CEIR.pdf>.

<sup>3</sup> For more information on the impacts of COVID-19 to U.S. energy sector employment, please visit <https://www.bwresearch.com/covid/>.

The purpose of this report is to identify what partnerships and programs can most effectively train and prepare the Pennsylvania workforce to meet the needs of clean energy businesses in the state. More specifically, the research efforts gathered data on the following:

- Employer hiring needs and difficulties, including education, experience, and certification requirements; preferred hiring sources; the provision of mentorship, internship, and apprenticeship programs; and typical promotion pathways.
- Current clean energy training and education offered in Pennsylvania, both in-person and online, including geographic distribution; energy sector and occupational focus; and degree outcomes.
- Detailed data on seven clean energy occupations found in the state's key technology sectors, including typical career pathway, educational attainment, common certifications, and work experience; career satisfaction; wages; and employment benefits. These data are found in the Occupational Career Profiles section beginning on page 47.

Data in this report is compiled from a variety of sources, including the 2020 United States Energy and Employment Report, the 2020 Pennsylvania Clean Energy Employment Report, and novel to this report, two surveys administered to both clean energy employers and workers in the state of Pennsylvania, and executive interviews with clean energy businesses in the state. Survey data was collected in the third and fourth quarters of 2020 between August 27<sup>th</sup> and November 2<sup>nd</sup>, 2020. The survey methodology is described in Appendix A. The report also synthesizes publicly-available data from the Bureau of Labor Statistics and proprietary economic data from Emsi, a proprietary economic modeling and labor market dataset.

This research effort was originally commissioned before the onset of the global pandemic. While there are still many uncertainties and it remains difficult to forecast how various industry sectors will recover, this report highlights current workforce development needs and opportunities within Pennsylvania's clean energy industry. Moving forward, targeted regional workforce development initiatives and partnerships could assist both clean energy businesses and Pennsylvania residents as they recover from the pandemic-induced economic recession.

# Executive Summary

## Key Findings

### OVERALL PROJECTED DEMAND & HIRING DIFFICULTIES

**The seven clean energy jobs selected for this study were high-growth occupations prior to the pandemic and will likely remain in demand in the coming years.** Over the last five years, the seven occupations grew by a collective six percent, and these occupations are pivotal to clean energy deployment. Pennsylvania is a manufacturing hub for wind, hydro turbine, and ENERGY STAR products, which means the state is well-poised to supply nationwide demand for clean energy goods and services, possibly requiring the need for more skilled assemblers and fabricators and other manufacturing positions. Meanwhile, within state borders, the ramping up of clean energy generation and energy efficiency measures indicates a need for construction and installation workers such as HVAC mechanics, electricians, and solar photovoltaic installers.

**Despite furloughs and layoffs due to COVID-19, the majority of surveyed employers indicated that they expect to have either the same or more workers by the end of the year.** Six in ten employers noted that they expected to have the same number of employees they had in January 2020 by the end of December 2020, and a quarter of firms indicated that they expected to have more workers by December 2020 compared to their original January 2020 baseline employment.

**In general, prior to COVID-19, employers reported hiring difficulties related to a small applicant pool, lack of experience, and competition with other industries.** The employer survey found that 84 percent of businesses had some level of hiring difficulty before the onset of COVID-19. Most commonly, employers indicated that hiring difficulties were related to having a small pool of applicants to select from; just over a third of employers indicated that this contributed to their difficulty in finding qualified candidates to fill open positions. About a third of employers also reported that candidates lack the work experience needed for the job and another two in ten employers cited job competition with other industries.

**Employers especially noted that they faced industry competition for skilled electricians.** Several solar firms mentioned an ongoing shortage for master electricians and generally for electricians with significant work experience and industry-specific knowledge. These skills are valuable across a variety of industries and are not only clean energy specific.

## EXPERIENCE, EDUCATION, & CERTIFICATIONS

**Lack of experience or qualified applicants with industry-specific knowledge is especially difficult in the aftermath of COVID-19.** During the executive interviews, several employers indicated that lack of relevant work experience is particularly prevalent now, as many new applicants to clean energy positions are transitioning from industries that were hardest hit by the pandemic; these include largely customer service-related positions such as hospitality, food service, and retail. Without relevant construction-related experience working outdoors, on roofs, and with electrical equipment, these new job candidates lack the hands-on skills required to land entry-level installer positions.

**Relevant work experience is required by significantly more employers over an academic degree.** Nine in ten surveyed employers reported that their highest required level of education is either a high school diploma or vocational technical training, yet three-quarters of employers require some amount of work experience. About six in ten surveyed employers indicated that they require one to three years of relevant work experience and 13 percent noted that they require more than three years of experience in a comparable position.

**Surveyed clean energy workers also cited the importance of relevant work experience in landing their job.** Fewer than one percent of surveyed clean energy workers indicated that they did not have any related work experience prior to landing their current job; almost three-quarters of current workers had more than three years of related work experience. In fact, the biggest obstacle to finding employment in the clean energy industry, according to current workers, was getting relevant industry and work experience. About three in ten surveyed clean energy workers reported that this was a considerable challenge and another 44 percent indicated this was somewhat of a challenge to finding employment; this received the highest rating as an obstacle to finding employment in the clean energy industry.

**According to clean energy workers, programs that provide on-the-job training were pivotal to landing a clean energy job.** The majority of surveyed workers indicated that they have participated in an internship (65 percent) or apprenticeship (71 percent) program. Of survey respondents that participated in these programs, between 95 to 96 percent indicated that it improved their ability to land their current job.

**Half of employers require or prefer specific certifications.** Fifty-three percent of employers indicated that they require or prefer specific certifications. Of these 53 percent, 30 percent reported that they *require* specific certifications and 23 percent indicated that they *prefer*, but do not require, specific certifications. Forty-seven percent of survey respondents reported that they neither require nor prefer certifications. In executive interviews with solar firms, NABCEP (North American Board of Certified Energy Practitioners) certifications were reported to be highly valued yet difficult to find due to a lack of training programs and exam courses available in Pennsylvania. For energy efficiency occupations, such as HVAC mechanics, the EPA certification was noted by several employers as either required or preferred. For electricians, employers largely indicated that they would prefer electricians to have a license, though it is not necessarily required.

## TALENT PIPELINE

**The talent pipeline relies mostly on word-of-mouth.** Seven in ten employers reported regularly using word-of-mouth when searching for job candidates. Just under half of survey respondents (49 percent) indicated regularly using online job sites such as Indeed, Monster, and CareerBuilder when seeking qualified candidates. At the same time, surveyed clean energy workers indicated that they regularly use online job sites and social media sites when searching for a job.

## PROJECT PIPELINES

**COVID-19 has resulted in project pipeline backups for most clean energy employers.** In fact, 85 percent of survey respondents agreed that the pandemic impacted their firm's ability to complete projects, and another 69 percent reported that COVID-19 reduced their firm's overall work.

**Despite a slowdown in installations, project sales did not stall for some clean energy firms.** Several employers noted that they had continued project sales throughout COVID-19, despite being unable to fulfill installations. As social distancing measures have eased, these businesses are faced with bandwidth issues trying to catch up to prior projects on pause due to the pandemic as well as new projects that have additionally come online in 2020. Though some firms reported continued sales during the pandemic, the majority of firms (77 percent) agreed that COVID-19 impacted their ability to acquire new customers or projects.

## TRAINING LANDSCAPE

**In-person clean energy training programs in Pennsylvania are largely focused on the electrical, HVAC, and construction trades.** About a third of all programs in the inventory were for electrical-related trainings, followed closely by HVAC programs, which represent 27 percent of the inventory. Other construction-related programs accounted for 15 percent of programs while clean energy engineering-related training represented 14 percent of programs in the training inventory. Online course offerings are largely focused on building analysis,<sup>4</sup> construction, HVAC, and weatherization.

**With the prevalence of programs for skilled trades, it is not surprising that the state's clean energy training landscape appears largely focused on the energy efficiency sector.** Ninety-five percent of in-person programs and 82 percent of web offerings in the training inventory are related to energy efficiency, which includes all construction and electrical programs that are not explicitly focused on renewable energy.

**Three counties have the highest concentration of program offerings at physical locations, though there are many clean energy training courses offered online.** The counties of Allegheny, Bucks, and

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<sup>4</sup> This includes energy auditor, building analyst, multifamily building analyst, healthy home evaluator, and home energy professional trainings offered by the Building Performance Institute (BPI).

Philadelphia each had the highest number of training programs within the county, with 25 to 37 programs each; altogether, these three counties represented a quarter of all physical clean energy training locations. However, there are 627 training programs in the inventory that are offered online, which enhances access for a wider population.

## EMPLOYMENT BENEFITS & CAREER SATISFACTION

**The majority of surveyed clean energy workers in each of the seven occupations reported receiving both healthcare benefits and retirement contributions from their employers.** Overall, across all occupations surveyed, about seven in ten workers reported that their company pays for all health insurance costs and another 25 percent indicated that their company pays for part of their health insurance. More than three-quarters of current workers also reported that their company contributes to their retirement. For information on healthcare and retirement benefits by occupation, please refer to the Occupational Career Profiles section beginning on page 47. Additional employment benefits cited by clean energy workers include paid vacation, flexible work hours, company vehicles, transportation stipends, and tuition support.

**Clean energy workers are also very satisfied with their current careers as well as their opportunities for career advancement.** Almost all surveyed clean energy workers indicated that they are satisfied with their clean energy career, and more than half reported that they are very satisfied. Furthermore, nearly all surveyed workers expect to advance, either within their current company or at another company in the same industry. In fact, 78 percent of current workers expect to be promoted within their current company, while 17 percent of respondents expect to advance at another company in the same industry. Less than one percent of current workers indicated that they expect to remain in their current positions but move to another industry or field.



## Recommendations

The clean energy industry has the potential to contribute to Pennsylvania's economic recovery. Many clean energy occupations have higher hourly wages compared to the national and statewide median as well as jobs in industries hardest hit by the pandemic, such as hospitality, food service, and retail. Median hourly wages for the seven occupations examined in this report were between \$17 to \$33 per hour. By comparison, food preparation and serving-related occupations in Pennsylvania had an hourly median wage of \$10.72 while retail sales workers earned an hourly wage of \$11.53.<sup>5</sup> Furthermore, clean energy workers are more likely to receive healthcare and retirement benefits compared to national private sector averages and are very satisfied with their careers and their opportunities for advancement. With often lower formal educational requirements than a four-year degree, the clean energy industry is largely accessible with fewer barriers to entry and can serve as a source of high-quality jobs for displaced workers.

However, in order to create more jobs and support displaced worker transitions, clean energy businesses need workforce development support that creates partnerships with training providers across the state to provide hands-on training and industry-specific knowledge. With these supports, the Commonwealth of Pennsylvania and programs that support a clean energy economy can help to meet the needs of clean energy businesses in the state that are unable to find qualified workers to fulfill project demand. In training the next generation of clean energy workers, the state will also be well-poised to meet the demands of the coming energy transition.

### ACTION ITEMS

The following are recommended action items based on the research findings that could support clean energy workforce development in Pennsylvania:

**Facilitate on-the-job training opportunities and hands-on industry experience for workers.** Relevant work experience was considered important by both employers and current workers, yet difficult to obtain for both. The Commonwealth can facilitate opportunities for workers to get on-the-job training (OJT) through apprenticeships or internships at a lower risk to companies. These experiential trainings could also be tacked onto existing clean energy training programs that do not have a hands-on training module or component. Examples of successful programs in other states include the Massachusetts Clean Energy Center's Vocational Internship program, which funds internships for vocational high school students at clean energy companies.<sup>6</sup> The Workforce Development and Training Chapter in NYSERDA's Clean Energy Fund Investment Plan facilitates employer and training provider partnerships to develop OJT training modules, internships, and apprenticeships. In Rhode Island, the Department of Labor and

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<sup>5</sup> Statewide wages for food preparation and serving-related occupations and sales workers are from the Bureau of Labor Statistics, Occupational Employment Statistics, May 2019.

<sup>6</sup> <https://www.masscec.com/vocational-internship-program-0>

Training partners with the Apprenticeship Rhode Island program, part of a national initiative<sup>7</sup> that works with employers to build apprenticeship programs across a number of industries including manufacturing and technology. The program has a goal of doubling the number of workers trained through apprenticeships within five years.

**Support curriculum sharing and procurement.** It is a lengthy and expensive process to develop curriculums from scratch. The DEP could facilitate round table discussions with clean energy employers, identifying key skills and certifications, then assist training providers in either finding curriculums already in use or in procuring nationally accredited curriculums. An example of this would be offering more opportunities for NABCEP certification and testing within Pennsylvania. NABCEP is particularly suited for the solar industry because it includes OSHA training and is consistently up to date with standards.

**Create a pipeline for displaced workers to transition into the clean energy workforce.** Individuals most negatively impacted by COVID-19, including hospitality, retail, and food service workers, may need more assistance navigating the educational and experience requirements of the clean energy workforce. Solar employers in particular reported that the high volume of hospitality workers applying for installation positions lack experience and industry-specific knowledge. Pennsylvania could consider supporting programs that connect these individuals to training providers in the state that give them basic knowledge and skills to prepare them to enter the clean energy workforce. The Pennsylvania College of Technology can be used to provide the initial industry-specific trainings, as they are already equipped with virtual seminars focused on energy efficiency skills. The online simulations include virtual walk-throughs with a hands-on skills training module as well and many courses have reduced the time required for completion, which means these trainings are viable options for displaced workers.

**Promote manufacturer-specific certifications for clean energy technologies.** These would include air-source heat pumps or high-efficiency heating and cooling technologies and could be integrated into existing training programs as an additional component or module. Manufacturers such as Rinnai, Fujitsu, Carrier, Trane, or Mitsubishi often offer certifications to demonstrate both industry- and technology-specific knowledge. Such certifications would be valuable to both new and incumbent clean energy workers to improve skills and expertise with specific technologies. Pennsylvania could facilitate connections between employers, manufacturers, and training administrators in the state to determine ways that these certifications can be incorporated into existing programs.

## Introduction

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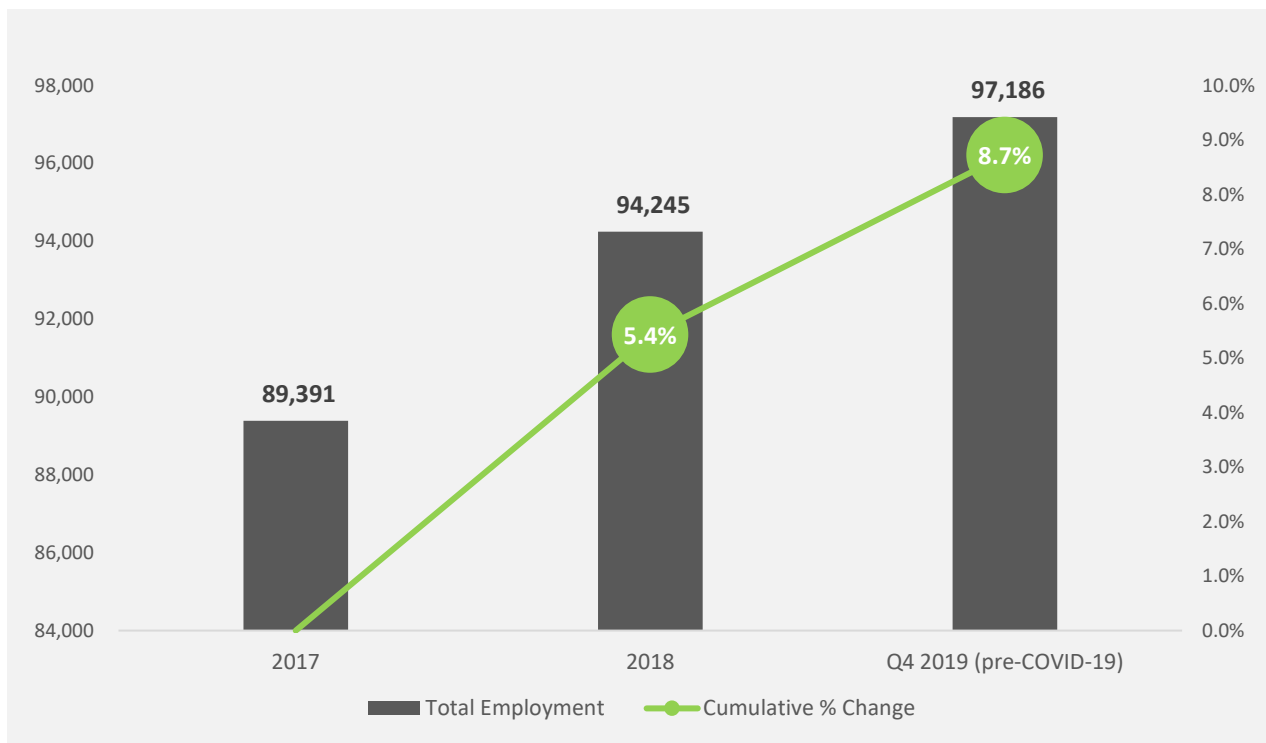
<sup>7</sup> Apprenticeship Rhode Island is part of the American Apprenticeship Initiative (AAI), which was launched by the U.S. Department of Labor in 2015. AAI funded public-private partnerships across the country between employers, organized labor, non-profits, local governments, and educational institutions to train and hire apprentices in high-growth and high-tech industries. For more information, please see <https://innovativeapprenticeship.org/wp-content/uploads/2017/08/AAI-Success-Stories-Summer-2017.pdf>. c

## Clean Energy Jobs in Pennsylvania

Between 2017 and 2019, the clean energy industry in Pennsylvania saw a nearly nine percent growth rate, creating just under 7,800 new jobs for residents across the state in only two years. In the last quarter of 2019, the clean energy economy totaled to about 97,200 workers in the labor force (Figure 1).

Before the onset of the COVID-19 pandemic, the clean energy industry was growing faster than the overall statewide labor market by four to seven percentage points annually. At the end of 2019, clean energy jobs accounted for almost two percent of all jobs in the state.<sup>8</sup>

FIGURE 1. CLEAN ENERGY EMPLOYMENT, 2017 – OCTOBER 2020



<sup>8</sup> Statewide employment data is taken from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages. Data accessed December 2020.

## COVID-19 IMPACTS TO THE CLEAN ENERGY LABOR MARKET

Following two years of marked growth, clean energy businesses were hard hit by the global pandemic. Between March and December 2020, Pennsylvania’s clean energy businesses have shed a net 13,200 jobs, wiping out any job gains from 2017 through 2019.

Losses were concentrated in March through May, at the peak of business closures and social distancing measures. Throughout these three months, the clean energy industry lost more than 17,000 workers. Since June, however, the sector has seen gradual gains in employment, adding back about 4,000 jobs from June through December (Figure 2).

Despite these job gains over the last several months, overall employment across Pennsylvania’s clean energy businesses remains six percent below the 2017 baseline and about 14 percent below the 2019 baseline (Figure 3).

FIGURE 2. MONTHLY JOB CHANGE, MARCH 2020 - DECEMBER 2020

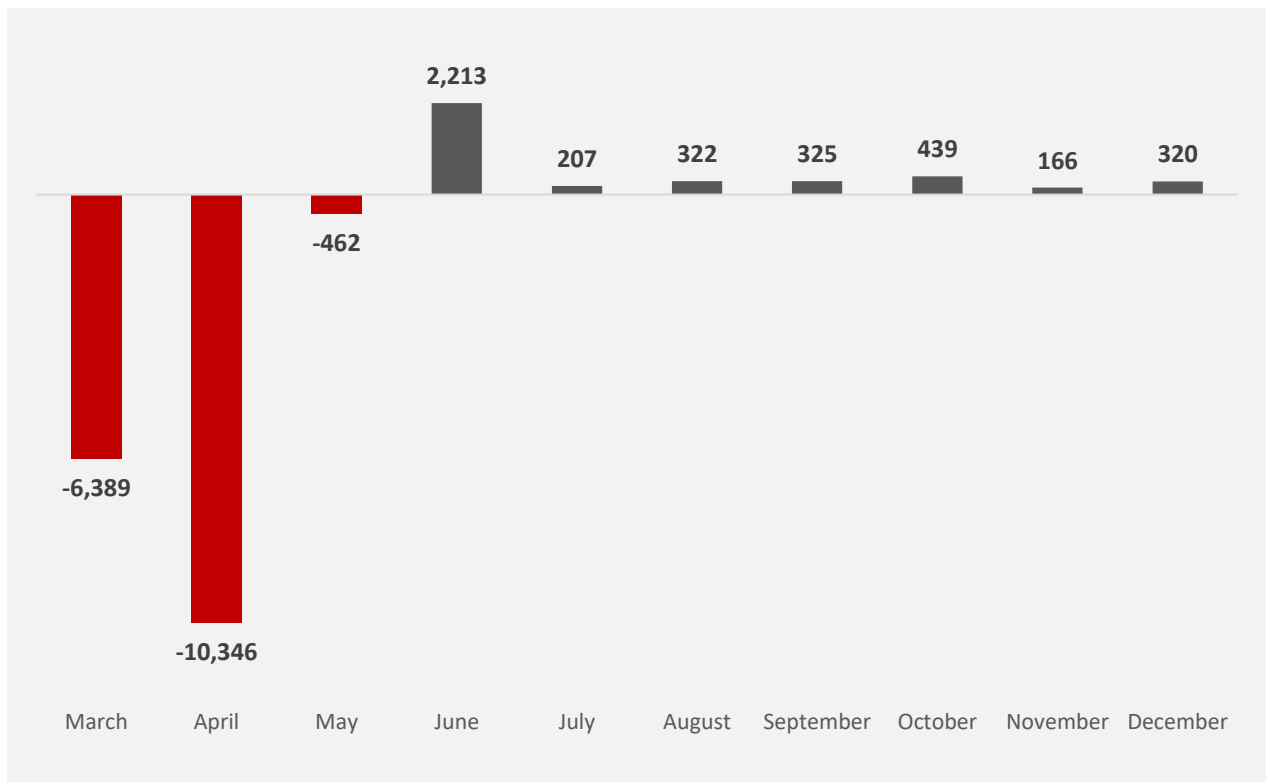


FIGURE 3. CLEAN ENERGY JOBS, 2017 – DECEMBER 2020



## Clean Energy Occupations

### OVERVIEW

These unexpected declines in employment are due to unpredictable forces, such as the spread of the virus, unknown political response, and consumer purchasing decisions. However, as the state and nation recover from the economic recession, with proper support, the clean energy industry can provide a strong source of sustainable job opportunities for Pennsylvania residents.

The research team in conjunction with the Pennsylvania DEP's Energy Programs Office selected a handful of occupations that are determined to be vital to a clean energy future, both in the near- and long-term. Many of these occupations will likely experience a surge in demand because of their pivotal and supportive roles in clean energy deployment.

The seven occupations identified for focused study are briefly described below. For each, a Standard Occupational Classification (SOC) code is included in a footnote. All occupations examined in this report have equivalent or closely related SOC codes.



**Assemblers and fabricators**<sup>9</sup> are responsible for assembling finished products and their component parts. They are typically found in the manufacturing industry, serving multiple technology areas of the clean energy economy. These individuals may be involved in the production of ENERGY STAR products, wind turbines, solar panels, electric vehicles, or smart grid technologies.

In Pennsylvania, clean energy manufacturing capacity is heavily concentrated in the wind and energy efficiency sectors. The state is home to 29 manufacturing facilities that produce components for the wind industry,<sup>10</sup> 81 manufacturers of ENERGY STAR-certified products,<sup>11</sup> and two of the world's largest hydro turbine manufacturers—Voith Hydro and Weir American Hydro.<sup>12</sup> As the demand for these products increases both in-state and across the nation, it is likely that there will be increasing job opportunities for these positions in years to come.

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<sup>9</sup> SOC Code 51-2000 (Assemblers and Fabricators), more specifically SOC 51-2020 (Electrical, Electronics, and Electromechanical Assemblers); SOC 51-2030 (Engine and Other Machine Assemblers); SOC 51-2040 (Structural Metal Fabricators and Fitters); and SOC 51-2090 (Miscellaneous Assemblers and Fabricators). Aircraft Structure, Surfaces, Rigging, and Systems Assemblers are not included in this definition.

<sup>10</sup> American Wind Energy Association. Wind Energy in Pennsylvania.

<https://www.awea.org/Awea/media/Resources/StateFactSheets/Pennsylvania.pdf>.

<sup>11</sup> Pennsylvania ENERGY STAR® Fact Sheet, April 2017. Accessed April 2020.

[https://www.energystar.gov/sites/default/files/asset/document/Pennsylvania\\_2017.pdf](https://www.energystar.gov/sites/default/files/asset/document/Pennsylvania_2017.pdf).

<sup>12</sup> Pennsylvania Alternative Energy Portfolio Standards Act, Compliance for Reporting Year 2019.

<https://www.pennaeps.com/wp-content/uploads/2020/09/2019-AEPS-Annual-Report.pdf>.

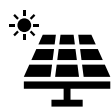


**Insulation workers**<sup>13</sup> line and cover floors, ceiling, and walls with insulating materials such as fiberglass, mineral wool, cellulose, or foam. Their work increases the energy efficiency of residential, commercial, and industrial buildings, as improved insulation reduces heating and cooling needs and a building's overall energy consumption.

Pennsylvania's energy efficiency workforce is significant, accounting for almost three-quarters of all clean energy jobs in the state. Between 2017 and 2019, energy efficiency jobs grew by more than nine percent, creating just over 6,100 new jobs in two years. With financial incentives for energy efficiency retrofits and upgrades available through the Pennsylvania DEP and other agencies, the demand for weatherization and building efficiency insulation is likely to increase in the near-term, making insulation workers a vital and growing component of the clean energy economy.



**HVAC mechanics, installers, or technicians**<sup>14</sup> install, service, or repair heating and air conditioning systems in residential, commercial, and industrial buildings. Like insulation workers, these individuals are also employed in the energy efficiency sector of the clean energy economy and are pivotal to the reduction of building energy consumption. With building efficiency, a central focus of energy use reduction, HVAC workers will be needed in the future to update old systems to new ENERGY STAR and high-efficiency technologies.



**Solar photovoltaic installers**<sup>15</sup> assemble, install, and maintain solar PV systems on roofs and other structures. In Pennsylvania, solar employment saw marked growth from 2017 through 2019, despite overall declines in the national solar workforce. At the end of 2019, solar jobs accounted for 35 percent of the state's clean energy generation workforce, growing by eight percent, or 396 jobs, in two years.

Between 2018 and 2019, Pennsylvania installed just under 60 MW of residential, non-residential, and utility-scale solar capacity. In 2019, annual installed capacity reached about 70 MW.<sup>16</sup> To date, the state has just over 550 MW of installed solar capacity.<sup>17</sup> In 2018, the DEP released a report detailing potential pathways to achieving 10 percent solar electricity generation by 2030. This would require an additional 11 GW of generation capacity to be added over the next decade, indicating that demand for solar photovoltaic installers will likely continue to increase over the coming years.<sup>18</sup>



**Energy auditors**<sup>19</sup> conduct energy audits of buildings and building systems; they are also referred to as energy consultants or energy raters. They are in charge of identifying potential energy-saving measures and opportunities to improve building system efficiency and analyzing the feasibility of energy-saving measures.

<sup>13</sup> SOC Code 47-2131 (Insulation Workers, Floor, Ceiling, and Wall)

<sup>14</sup> SOC Code 49-9021 (Heating, Air Conditioning, and Refrigeration Mechanics and Installers)

<sup>15</sup> SOC Code 47-2231 (Solar Photovoltaic Installers)

<sup>16</sup> Solar Energy Industries Association (SEIA), Pennsylvania Solar Fact Sheet. Data through Q4 2019. Accessed April 2020.

<sup>17</sup> Solar Energy Industries Association (SEIA), Pennsylvania Solar Fact Sheet. Data through Q2 2020. Accessed December 2020.

<sup>18</sup> Pennsylvania Department of Environmental Protection. Pennsylvania's Solar Future Plan: Strategies to Increase Electricity Generation from In-State Solar Energy. November 2018.

<sup>19</sup> Most closely related to 47-4011 (Construction and Building Inspectors). Energy auditors specifically can be found on O\*NET under 47-4011.01.

These occupations are particularly important, working in tandem with other individuals in the energy efficiency sector to improve building efficiency, reduce energy consumption, and improve cost savings. Energy auditors play a pivotal role in identifying leakage and waste, paving the way for HVAC mechanics, insulation workers, and other energy efficiency technicians to lower building energy demands.



**Electricians**<sup>20</sup> install, maintain, and repair electrical wiring, control systems, equipment, and fixtures. They typically have knowledge of both electrical components and systems as well as some understanding of building construction.

Electricians are important across all technology sectors of the clean energy economy, as these workers are needed to install solar panels and wind turbines, LED and other efficient lighting technologies, ENERGY STAR products, or smart meters. Electricians are also increasingly important for the growing electric vehicle market in the United States, as these individuals are specially trained to work on the newer electrical systems in hybrid and electric cars, trucks, and buses.



**Plumbers, pipefitters, and steamfitters**<sup>21</sup> work with pipe systems that carry water, steam, air, or other liquids and gases. They install and test fixtures, appliances, or equipment that are designed to reduce water and energy consumption, including gray water systems or geothermal heating and cooling systems.

Plumbers, pipefitters, and steamfitters are mostly found in the energy efficiency sector, but may also be employed in grid modernization, renewable energy generation, and clean fuels. Plumbers are essential to the construction of new buildings and may support energy efficient building retrofits or the installation and maintenance of clean heating and cooling systems. Plumbers also support the clean energy economy during the build out of new clean fuel power plants or the retrofitting and decommissioning of older power plants.

## HISTORICAL OCCUPATIONAL GROWTH & DEMAND

PRIOR TO THE ADVENT OF COVID-19, THE FIVE-YEAR HISTORICAL JOBS DATA INDICATES THAT MOST OF THESE OCCUPATIONS HAD AN OVERALL HIGH-GROWTH NATURE; THE GROWTH RATES PROFILED IN Figure 4 depict the five-year job changes for these seven occupations.

Nearly all occupations, with the exception of assemblers and fabricators, have seen marked growth over the last five years. However, despite the slight decline in assemblers and fabricators from 2014 through 2019, assembler and fabricator positions actually grew between 2017 and 2019, driven by job growth for electrical, electronics, and electromechanical assemblers. If the state continues to build out its strong clean energy manufacturing capacity, meeting both local and regional demands, it is possible that assembler and fabricator jobs may continue to see growth in years to come.

<sup>20</sup> SOC Code 47-2111 (Electricians)

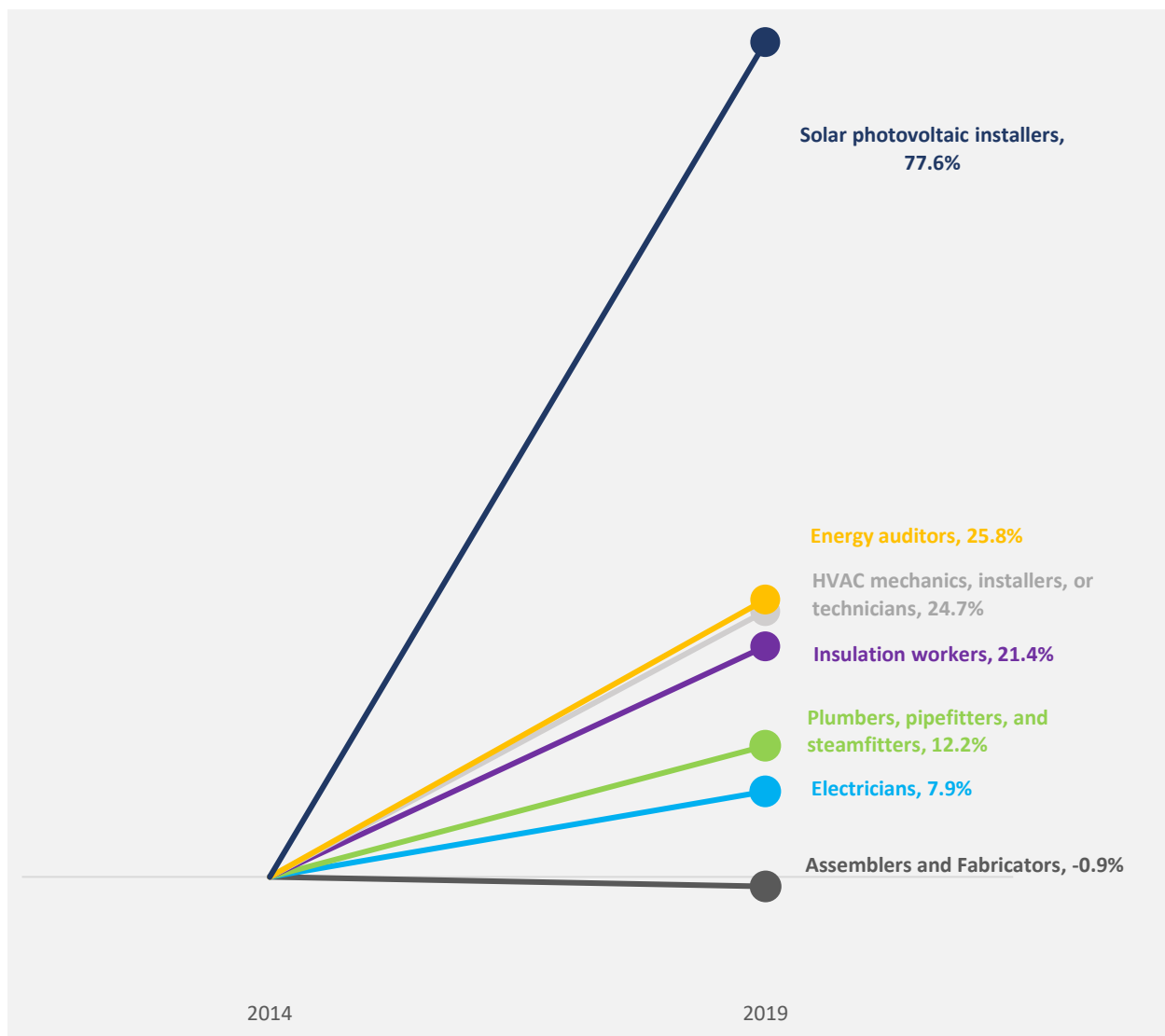
<sup>21</sup> SOC Code 47-2152 (Plumbers, Pipefitters, and Steamfitters)



Solar photovoltaic installers have seen the greatest relative growth, at almost 78 percent, or 150 new jobs between 2014 and 2019, while HVAC mechanics, installers, and technicians have seen the greatest absolute growth. From 2014 through 2019, there were about 3,100 new HVAC mechanic positions created; this represents a 25 percent growth rate over five years and is not surprising given Pennsylvania’s strong overall job growth in the energy efficiency sector. Similarly, energy auditor positions in the state have grown by 26 percent, resulting in an additional almost 1,300 new jobs.

Insulation workers, plumbers, pipefitters, and steamfitters, and electricians collectively grew by about 10 percent, resulting in 3,500 new skilled trade positions in Pennsylvania.

FIGURE 4. JOB GROWTH BY OCCUPATION, 2014-2019<sup>22</sup>



<sup>22</sup> Source: Emsi Q4 2020, Data accessed December 2020.

## Clean Energy Training Landscape

After a thorough review of all publicly available listings, school programs, and existing inventories, the research team constructed a comprehensive clean energy training inventory. The inventory contains a total of 390 in-person training programs for the clean energy workforce in Pennsylvania plus 627 clean energy training courses offered online. The following section details results from this inventory and serves to provide a basic understanding and overview of the occupational and geographic distribution of existing training programs.

Approximately 31 percent of in-person programs were aimed at electrical workers, closely followed by HVAC workers (26 percent). Construction- and engineering-related programs accounted for 14 percent each of in-person training programs in the inventory.

For trainings primarily offered online, these include any courses hosted by providers in the Northeast, as well as nationally recognized industry certifications. Approximately 23 percent of online programs were aimed at building analysts, closely followed by construction-related courses (20 percent). HVAC and weatherization courses accounted for a respective 16 and 10 percent of web trainings.

TABLE 1. PENNSYLVANIA CLEAN ENERGY TRAINING PROGRAMS BY FIELD

Occupational Focus	Number of In-Person Programs	Number of Web Trainings
Architecture	5	3
Biomass	n/a	2
Building Analyst	11	141
Construction	55	125
Electric Vehicles	n/a	2
Electrical	122	16
Energy Management	7	55
Energy Storage	1	n/a
Engineering	53	1
General Clean Energy	6	57
Geothermal	n/a	3
HVAC	101	103
Hydropower	n/a	2
Policy	3	2
Smart Grid	n/a	3
Solar	17	41
Weatherization	9	63
Wind	n/a	8
<b>Total Programs</b>	<b>390</b>	<b>627</b>

A variety of different providers offer in-person training programs throughout the state of Pennsylvania. Most in-person programs are offered by vocational and technical schools (43 percent), followed by community or junior colleges (38 percent). Technical colleges were counted amongst community and junior colleges.

Most online training programs are also offered by vocational and technical schools (41 percent), followed by private training firms (36 percent).

TABLE 2. PENNSYLVANIA CLEAN ENERGY TRAINING PROGRAMS BY PROGRAM TYPE

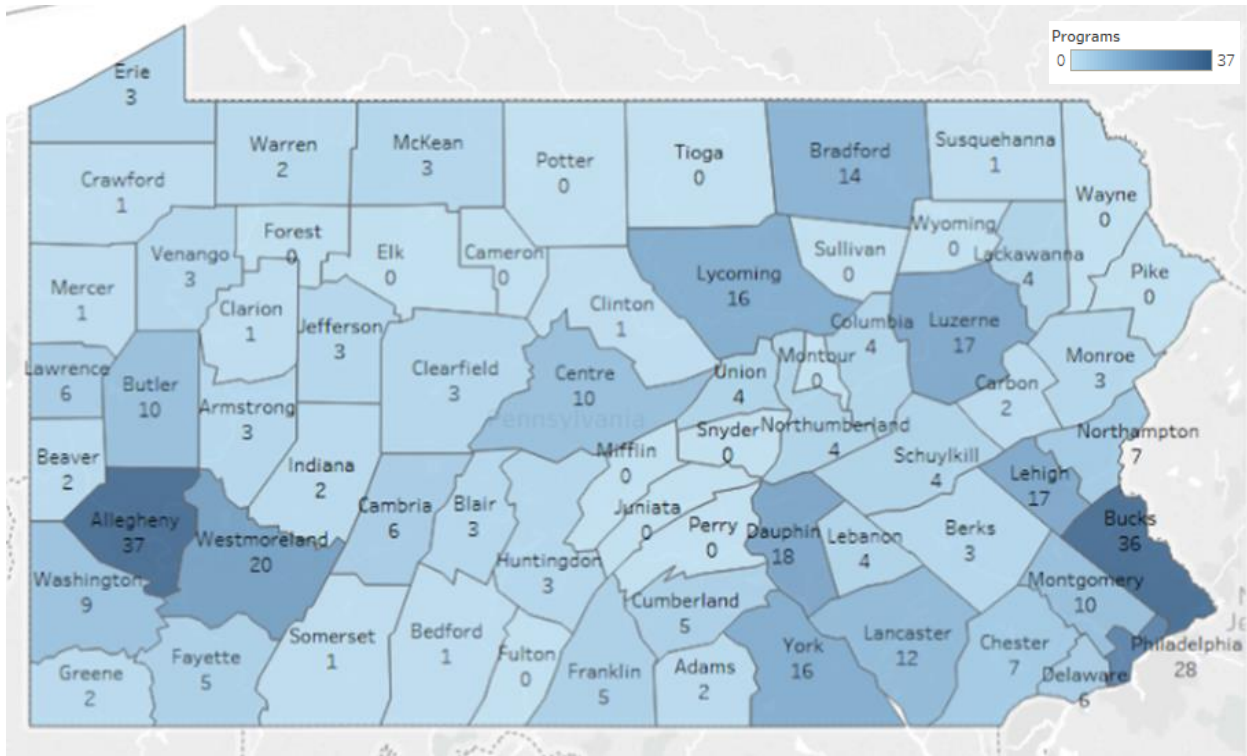
Program Type	Number of In-Person Programs	Number of Web Trainings
4-Year College or University	27	36
Community/ Junior College	149	27
Government	0	7
Manufacturer	12	0
Massive Open Online Course (MOOC) <sup>23</sup>	0	15
Non-Profit Organization	5	46
Private Consulting/ Training Firm <sup>24</sup>	5	228
Trade Association	16	13
Union	8	0
Vocational/ Technical School	168	255
<b>Total Programs</b>	<b>390</b>	<b>627</b>

<sup>23</sup> Massive Open Online Courses (MOOCs) are web-based classes that are available and open to anyone; MOOCs often have an unlimited rate of participation. Many MOOCs are offered on an individual course-by-course basis, without requiring commitment to an academic program.

<sup>24</sup> Private consulting/ training firms encompass privately-owned for-profit businesses that host online training courses, while typically offering other consulting services. Examples include Dupont Sustainable Solutions (a management consulting firm that offers a [16-part energy efficiency training series](#)), Enerdynamics (energy education experts that work with companies to design custom training programs, while offering a variety of [energy industry training products](#)), and Saturn Resource Management (a small firm of energy efficiency consultants that offer curriculum development and [online training courses](#) among their products).

Allegheny, Bucks, and Philadelphia counties were home to the most in-person training programs, with 37, 36, and 28 programs, respectively. It is important to note, however, that since many additional programs are offered online, there is greater geographical access to clean energy workforce training than pictured in Figure 5.

FIGURE 5. PENNSYLVANIA CLEAN ENERGY TRAINING PROGRAMS BY COUNTY



Most in-person training programs focus on energy efficiency (91 percent); this includes construction and electrical programs that were not explicitly focused on renewable energy generation. Fewer in-person programs focused explicitly on renewable energy generation (eight percent), grid modernization and energy storage (one percent), and alternative transportation (less than one percent).

The majority of web-based courses are also focused on energy efficiency (82 percent), followed by those focused explicitly on renewable energy generation (17 percent). Grid modernization and energy storage, clean fuels, and alternative transportation web courses account for less than one percent each.

TABLE 3. PENNSYLVANIA CLEAN ENERGY TRAINING PROGRAMS BY SECTOR FOCUS

Sector	Number of In-Person Programs	Number of Web Trainings
Alternative Transportation	1	2
Clean Fuels	0	2
Energy Efficiency	355	512
Grid Modernization & Energy Storage	4	3
Renewable Energy Generation	30	108
<b>Total Programs</b>	<b>390</b>	<b>627</b>

In-person clean energy training programs offer several degree outcomes. Diplomas (40 percent) and certificates (37 percent) were the most common, followed by Associate's (16 percent) and Bachelor's degrees (five percent).

Online training programs differed most from in-person courses in their degree outcomes. While certificates are still offered for the majority (53 percent) of online trainings, many programs offer continuing education credits (26 percent) or no credential (20 percent). Less than one percent of web programs are for the maintenance of existing credentials.

TABLE 4. PENNSYLVANIA CLEAN ENERGY TRAINING PROGRAMS BY DEGREE OUTCOMES

Degree Outcomes	Number of In-Person Programs	Number of Web Trainings
HS Diploma	157	0
Associate's Degree	63	0
Bachelor's Degree	20	1
Certificate	145	331
Continuing Education Credit	0	165
Credential Maintenance	0	8
Doctoral Degree	1	0
Master's Degree	4	0
None	0	122
<b>Total Programs</b>	<b>390</b>	<b>627</b>

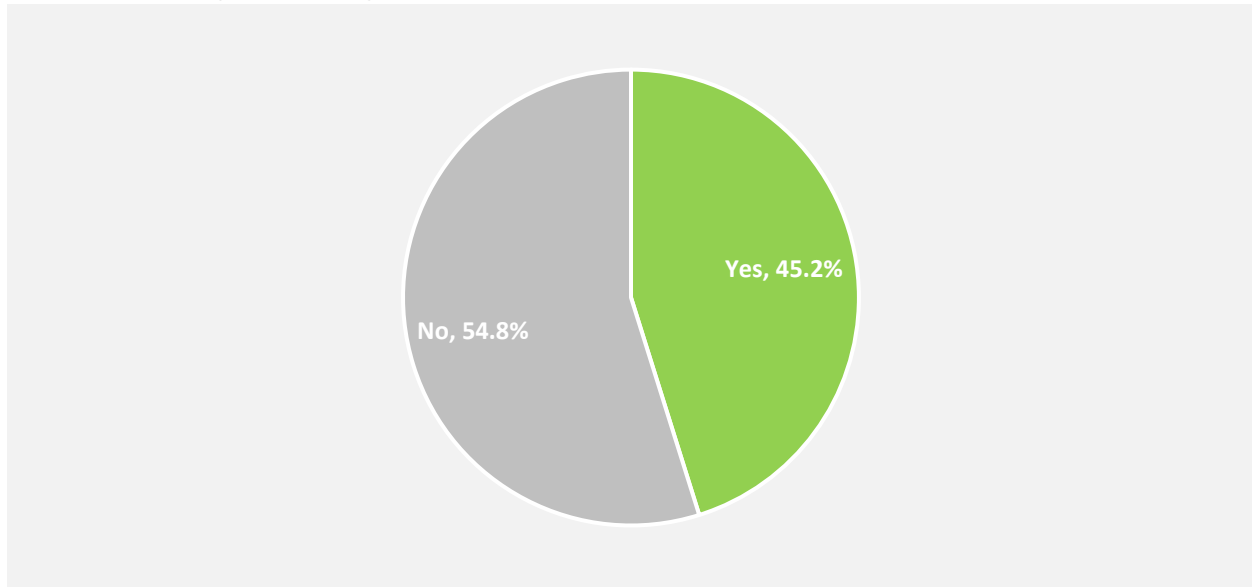
## Clean Energy Employers

The following section details the overall survey results from clean energy employers across Pennsylvania. These findings are specific only to clean energy firms in Pennsylvania and those that indicated they employ one of the seven previously identified occupations. Though this section provides an aggregated overview of findings, the Occupational Career Profiles beginning on page 47 is a breakout of specific data for each of the seven occupations. Where applicable, all “don’t know/ refused” responses were factored out of the analysis in order to provide a more accurate representation of the results.

### COVID-19 Impacts & Expectations

Just under half of all surveyed employers (45 percent) indicated that their firm had to lay off, furlough, or reduce the pay of their clean energy workers as a result of COVID-19 and related stay-at-home orders. More than half (54 percent) reported that they did not have to take these measures.

FIGURE 6. LAYOFFS, FURLOUGHS, OR PAY REDUCTION OF CLEAN ENERGY WORKERS



Of the firms that had to lay off or furlough their clean energy employees, about seven in ten (69 percent) reported that they had since brought back their laid off or furloughed staff. In fact, six in ten employers (58 percent) indicated that they expect to have the same number of workers as they had on January 1<sup>st</sup>, 2020 by the end of December 2020, while a quarter (25 percent) indicated they expected to have more employees by the end of the year.

FIGURE 7. RE-HIRING LAID OFF OR FURLOUGHED CLEAN ENERGY WORKERS

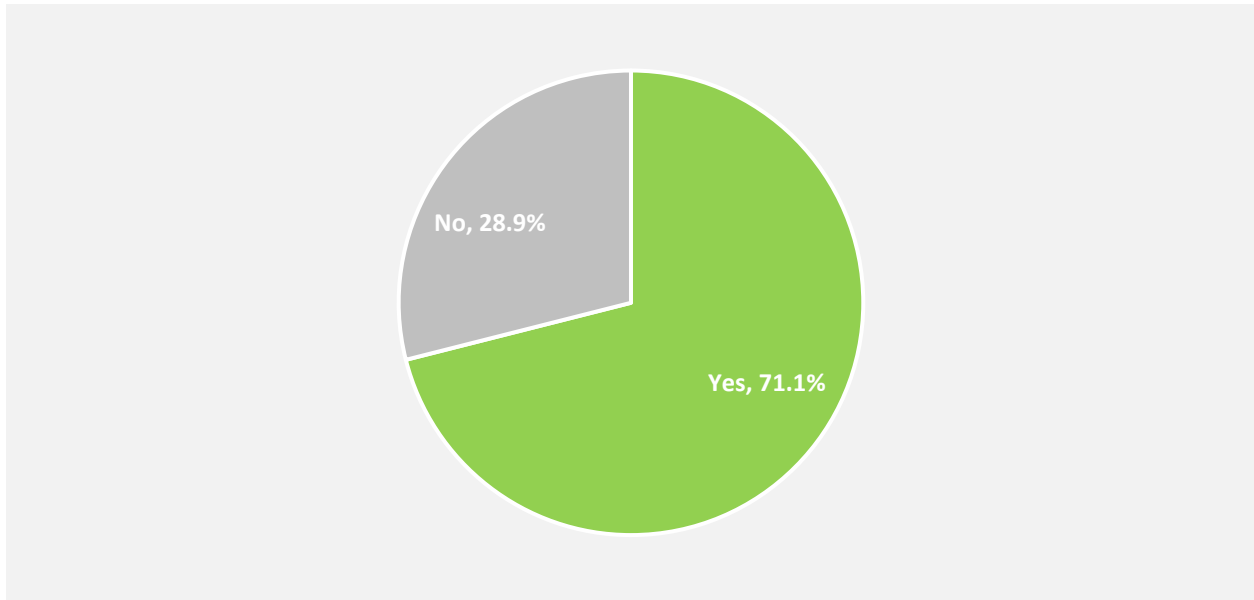
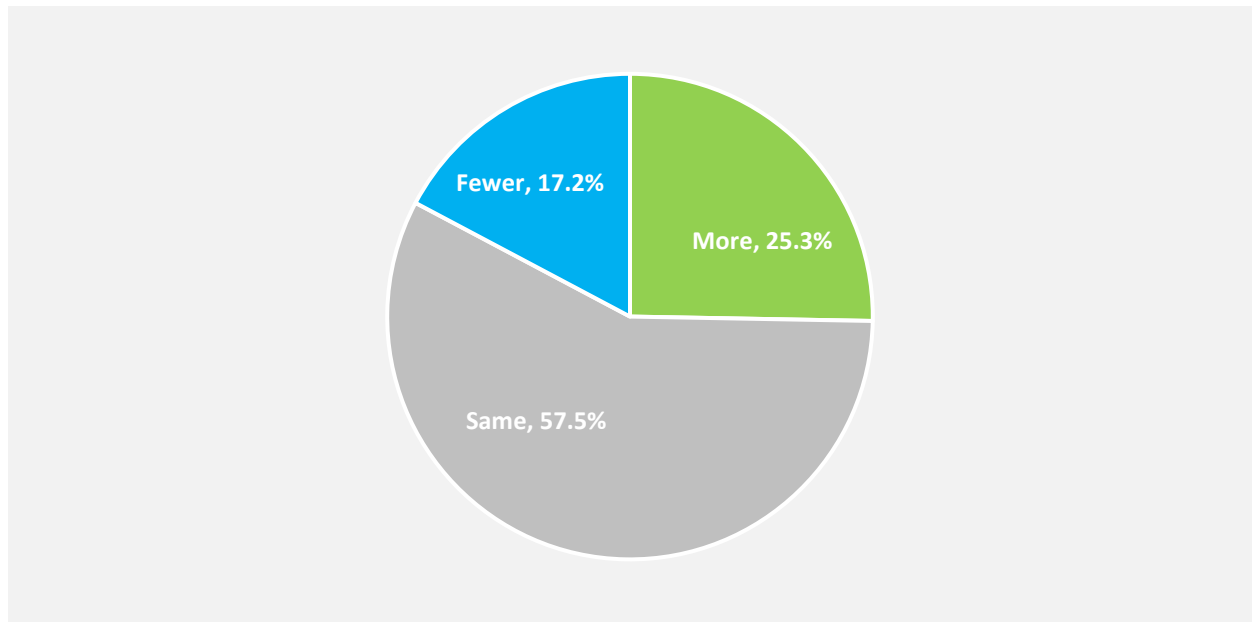


FIGURE 8. EMPLOYMENT EXPECTATIONS THROUGH DECEMBER 2020

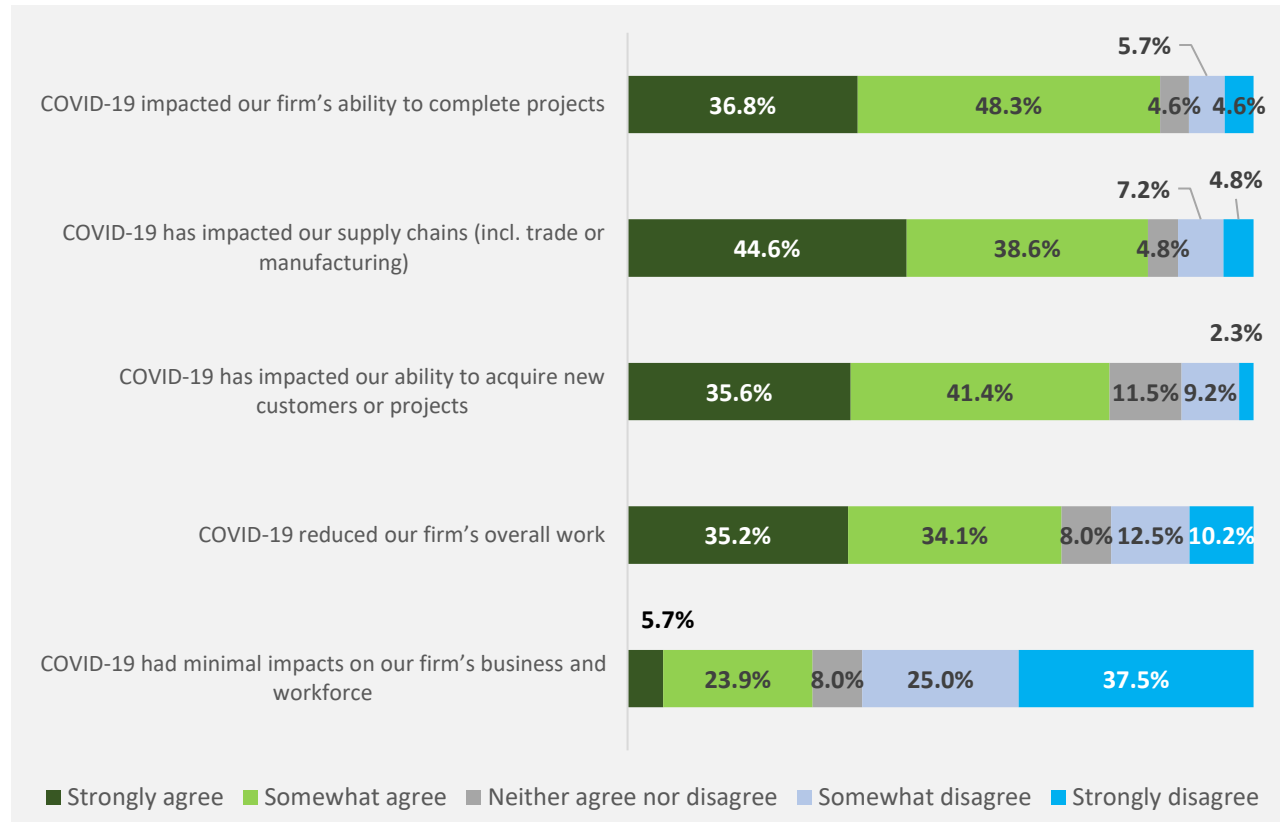


In addition to layoffs and furloughs, COVID-19 has largely impacted project pipelines for clean energy businesses. About eight in ten (85 percent) respondents agreed (strongly or somewhat) that COVID-19 has impacted their firm’s ability to complete projects, while 83 percent of businesses noted that the pandemic has also impacted their supply chains. Seventy-seven percent of employers agreed that the

pandemic impacted their ability to acquire new customers or projects and another 69 percent reported that the pandemic has reduced their overall work.

It is also important to note that about 23 percent of employers did not agree that COVID-19 reduced their firm’s overall work and another 11 percent disagreed that the pandemic impacted their ability to acquire new customers and projects. In fact, during executive interviews, several solar businesses noted that they continued to make sales throughout COVID-19. However, due to social distancing restrictions, the inability to install projects has resulted in a project pipeline backup. With the easing of social distancing measures, one solar employer indicated that they are simply trying to catch up on their backlog, while another noted that lack of bandwidth was impacting their ability to complete installations.

FIGURE 9. COVID-19 IMPACTS

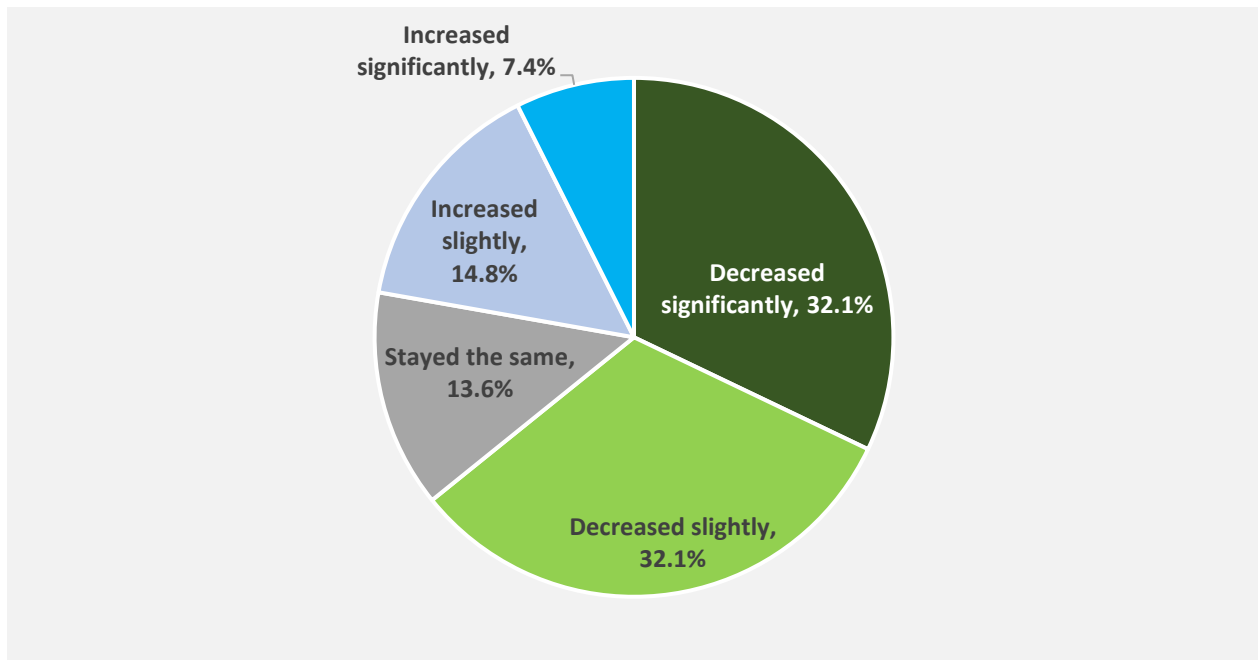




These project pipeline delays have resulted in revenue impacts for clean energy businesses over the last 12 months. Compared to the same time in 2019, 64 percent of firms indicated that their revenues have decreased, either slightly or significantly. Fourteen percent of respondents indicated that their revenues have stayed the same while 22 percent indicated that revenues have increased (slightly or significantly).

A couple solar firms specifically noted that they saw a small reduction in revenue as some projects that were originally slated for completion in 2020 fell through due to homeowners losing their jobs and other economic uncertainties.

FIGURE 10. REVENUE IMPACTS



## Hiring Needs, Challenges, & Preferences

Prior to COVID-19, clean energy businesses had difficulty finding qualified workers. In fact, 84 percent of employers reported some level of hiring difficulty before the onset of COVID-19. The most common reasons for reported hiring difficulty include a small applicant pool (36 percent), lack of work experience in a similar position (35 percent), and job competition with other industries (20 percent).

Competition with other industries was especially prominent for employers seeking to hire electricians, particularly those with several years of experience and industry-specific knowledge. In fact, one solar employer noted during executive interviews that there is an ongoing shortage of high-skilled electricians, especially since these skills are applicable across a variety of industries. As such, these individuals can find employment in many other fields outside of clean energy.

FIGURE 11. OVERALL HIRING DIFFICULTY (PRE-COVID-19)

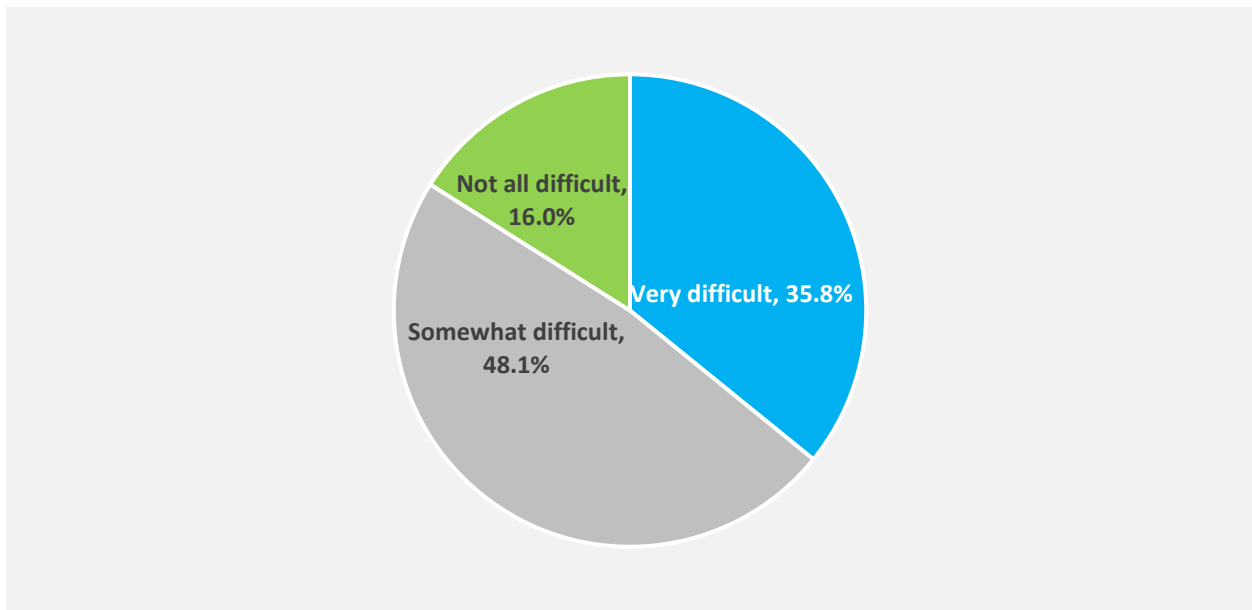
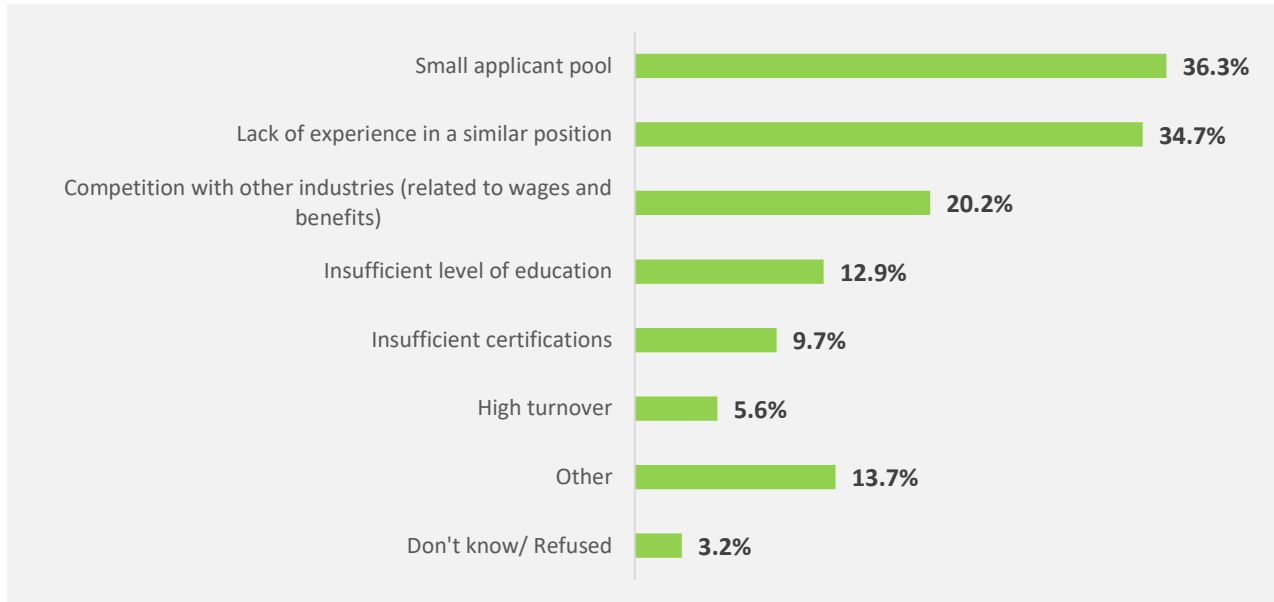


FIGURE 12. REASONS FOR HIRING DIFFICULTY

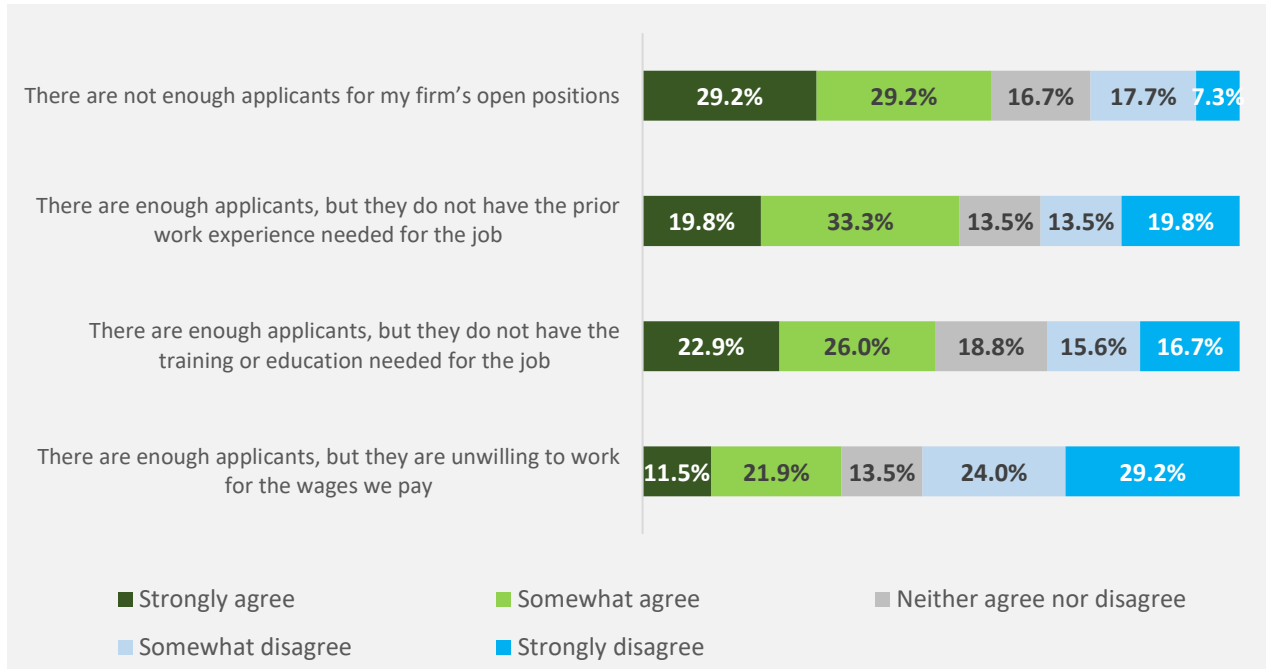


In general, 58 percent of employers agreed (both strongly and somewhat) that there are not enough applicants for their open positions. Fifty-three percent of employers indicated that while there are enough applicants, these individuals do not have the needed work experience, and another 49 percent reported that there are sufficient applicants, but they do not have the training or education required.

The high volume of applicants with insufficient experience rings true particularly in the aftermath of COVID-19. A couple employers noted that they are receiving more applicants for online job postings, but that many of these individuals have come from a background in hospitality or food service without any construction, electrical, or outdoor-related work experience.

In general, all employers interviewed indicated that sufficient experience in the construction trades as difficult to find among applicants.

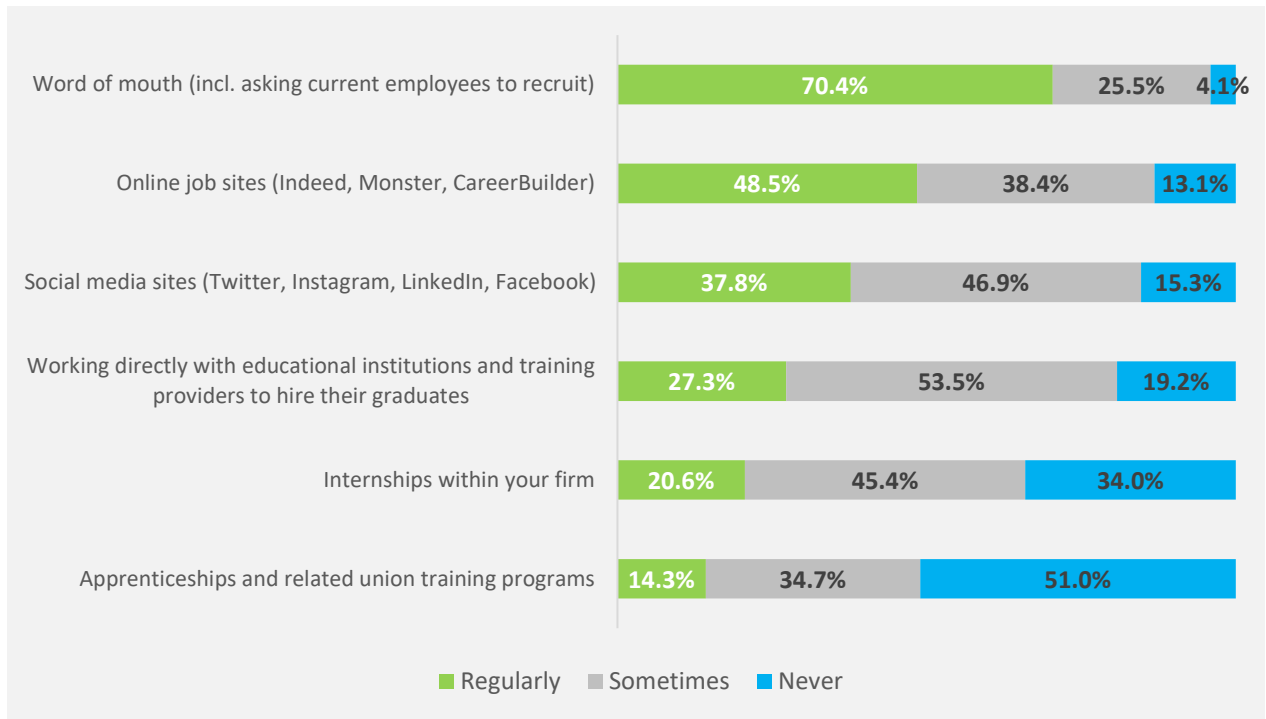
FIGURE 13. CLEAN ENERGY JOB APPLICANT CHARACTERISTICS<sup>25</sup>



For the most part, employers reported using word-of-mouth and online job sites when searching for job candidates for open positions. In fact, seven in ten clean energy employers (70 percent) reported that they regularly use word-of-mouth, such as asking current employees for recommendations, when seeking qualified candidates. About half of respondents reported regularly using online job sites, 38 percent regularly use social media sites, and 27 percent regularly work with educational institutions and training providers.

<sup>25</sup> It should be noted that each question is asked individually and thus sums to 100 percent within each specific question but not across. The question was also asked multiple times for each occupation the respondent selected currently employing. The data presented here is reported in aggregate so there may be overlap across the response categories; across respondents, one employer may have selected “there are not enough HVAC technician applicants” while another may have selected that “there are enough HVAC technician applicants, but they do not have the prior work experience needed for the job.”

FIGURE 14. FREQUENCY OF USE FOR VARIOUS HIRING CHANNELS



## Qualification Requirements & Promotion Pathways

The vast majority of employers (87 percent) indicated that their highest required level of education is either a high school diploma or vocational technical training. Three-quarters of workers (75 percent), however, do require some amount of work experience, with 63 percent requiring one to three years of relevant work experience and 13 percent requiring more than three years of work experience in a comparable position.

FIGURE 15. OVERALL REQUIRED LEVEL OF EDUCATIONAL ATTAINMENT

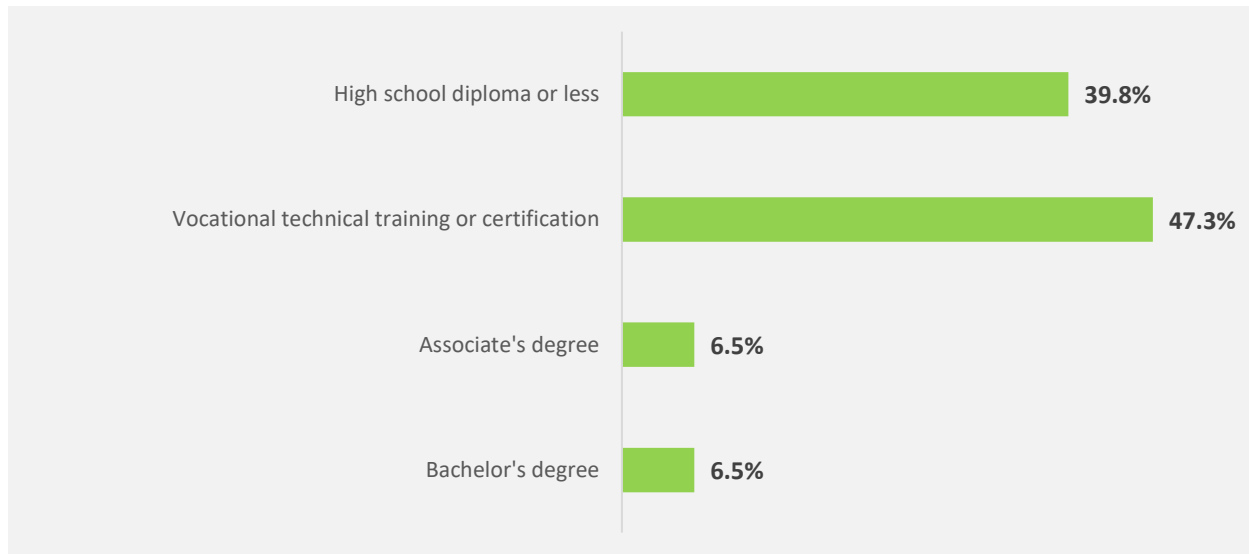
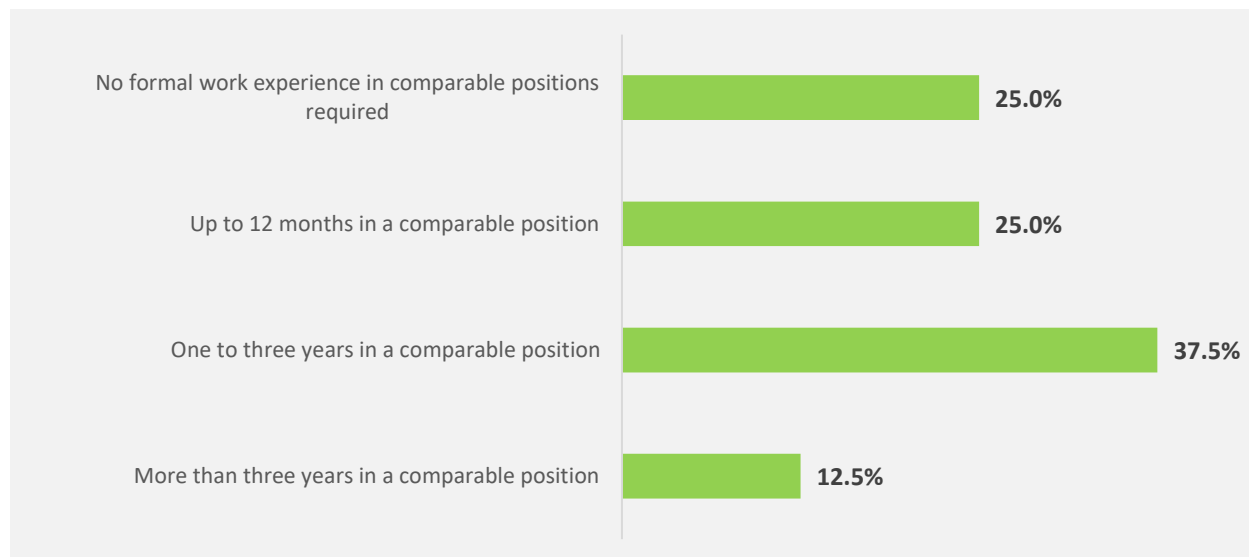


FIGURE 16. OVERALL REQUIRED LEVEL OF WORK EXPERIENCE



Almost half of surveyed employers (47 percent) indicated that they do not require or prefer any certifications for their workers; 23 percent of surveyed clean energy businesses reported that while they do not require any specific certifications, they do prefer certifications. Thirty percent of firms do require specific certifications.

For solar employers in particular, a NABCEP certification is highly valued, though it is not required. One employer indicated that NABCEP is the “gold standard for solar”, but that their business does not require these certifications partly due to the difficulty in obtaining the certification within the state. Though the trainings are offered online, testing is often out-of-state. In looking at the NABCEP course catalog online, there are no professional exam courses offered in Pennsylvania and only a handful of recertification, continuing education credits, and Associate trainings offered within the state.<sup>26</sup> According to several solar employers, because there are no state-specific certification requirements, there are fewer NABCEP trainings and exams offered in Pennsylvania compared to neighboring states.

In addition to solar-specific certifications, energy efficiency employers also reported preferences for HVAC mechanics to possess EPA certification<sup>27</sup> and electricians to have a license. Businesses that employ energy auditors also reported preferences for the following certifications: Certified Energy Manager (CEM), Certified Energy Auditor (CEA), and the Registered Environmental Professional (REP) certification. For more detail on common certifications by occupation, please refer to the Occupational Career Profiles beginning on page 47.

FIGURE 17. CERTIFICATION REQUIREMENTS

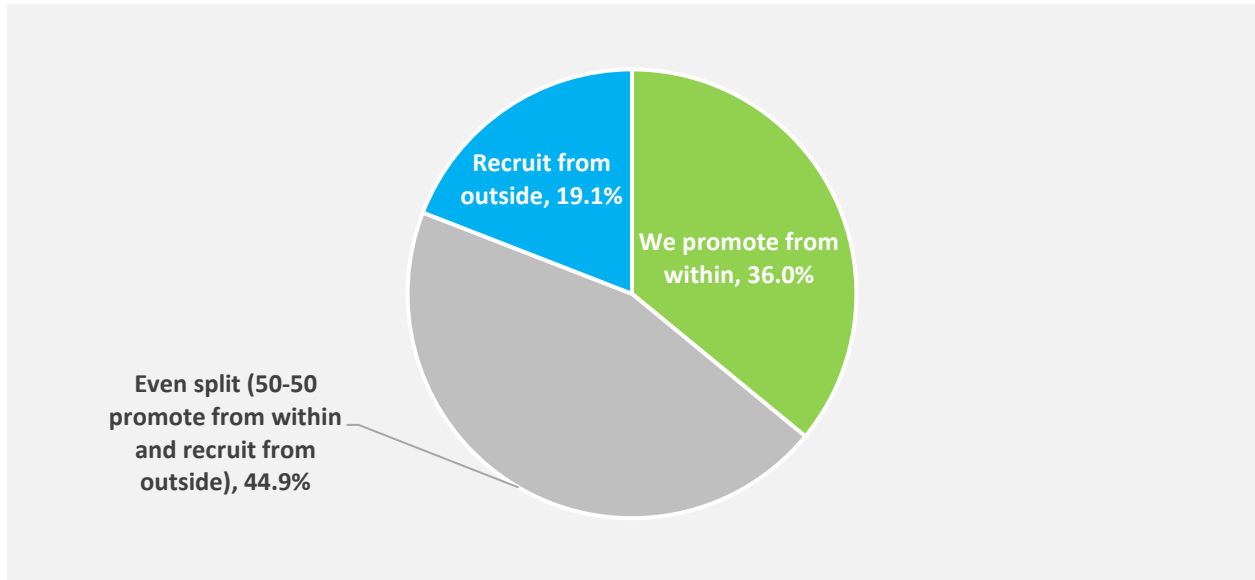


Just over a third of respondents (36 percent) noted that they mostly promote from within their firm when a non-entry-level position becomes available, while 19 percent of employers reported recruiting from outside their firm. Many employers (45 percent) indicated that they do both.

<sup>26</sup> <https://coursecatalog.nabcep.org/>

<sup>27</sup> For HVAC technicians working specifically with refrigerants, an EPA 608 certification is required.

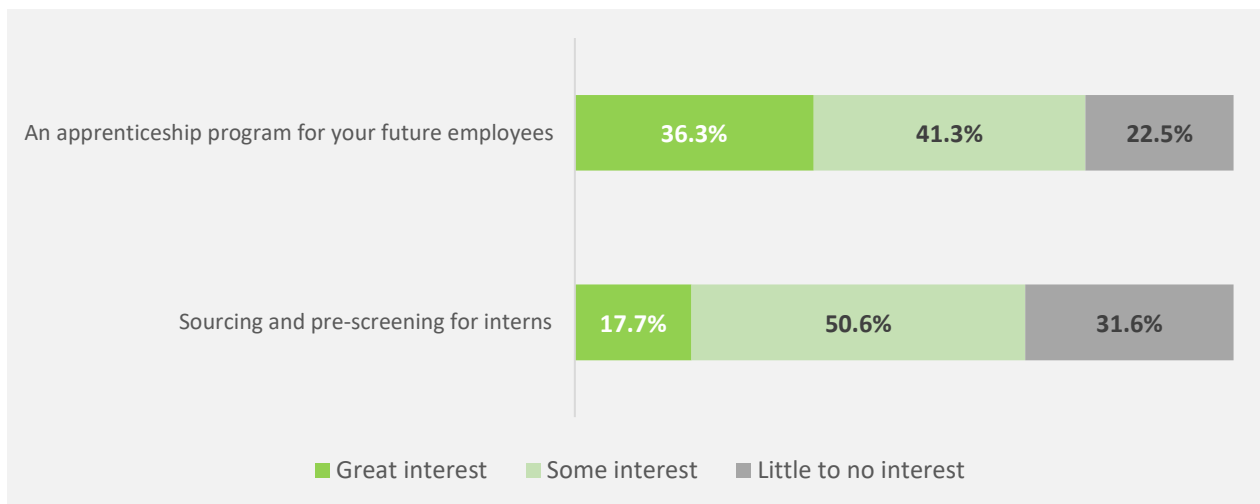
FIGURE 18. FIRM PROMOTION PATHWAYS



When asked about program interest for apprenticeships and internships, the majority of employers expressed some level of interest in an apprenticeship program (78 percent) and sourcing and pre-screening for interns (68 percent).

During executive interviews, many clean energy employers expressed explicit interest in apprenticeship programs, both as a way to build awareness of clean energy careers across high schools and as a means to provide the highly valued on-the-job, hands-on training and industry-specific knowledge and experience. Employers also noted the importance of any clean energy training program to have an experiential component, citing examples at community colleges in neighboring states such as New Jersey.

FIGURE 19. PROGRAM INTEREST





## Clean Energy Workers

The following section is a synopsis of overall findings from the current worker survey of clean energy workers. While the clean energy business survey focused solely on firms in Pennsylvania, the clean energy worker survey outreach also included clean energy workers in New York, New Jersey, Ohio, Maryland, and Delaware in addition to clean energy workers from Pennsylvania.

### Overall Qualifications & Program Participation

Overall, surveyed clean energy workers tended to have higher education, with 40 percent reporting a Bachelor's degree and 34 percent possessing a Master's degree or higher. Furthermore, 71 percent of surveyed workers indicated having a certification or professional license.

FIGURE 20. OVERALL EDUCATIONAL ATTAINMENT

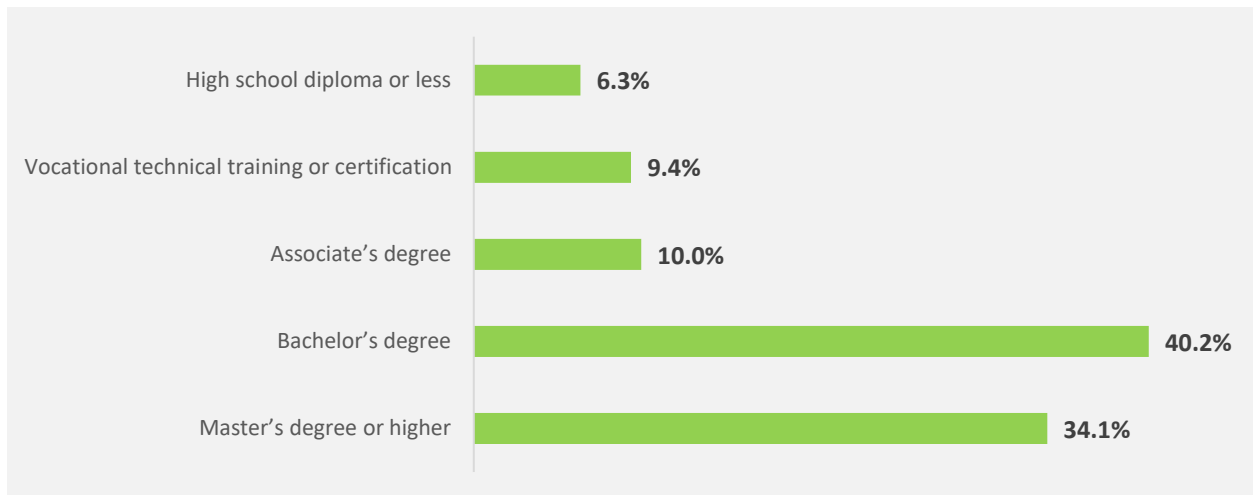
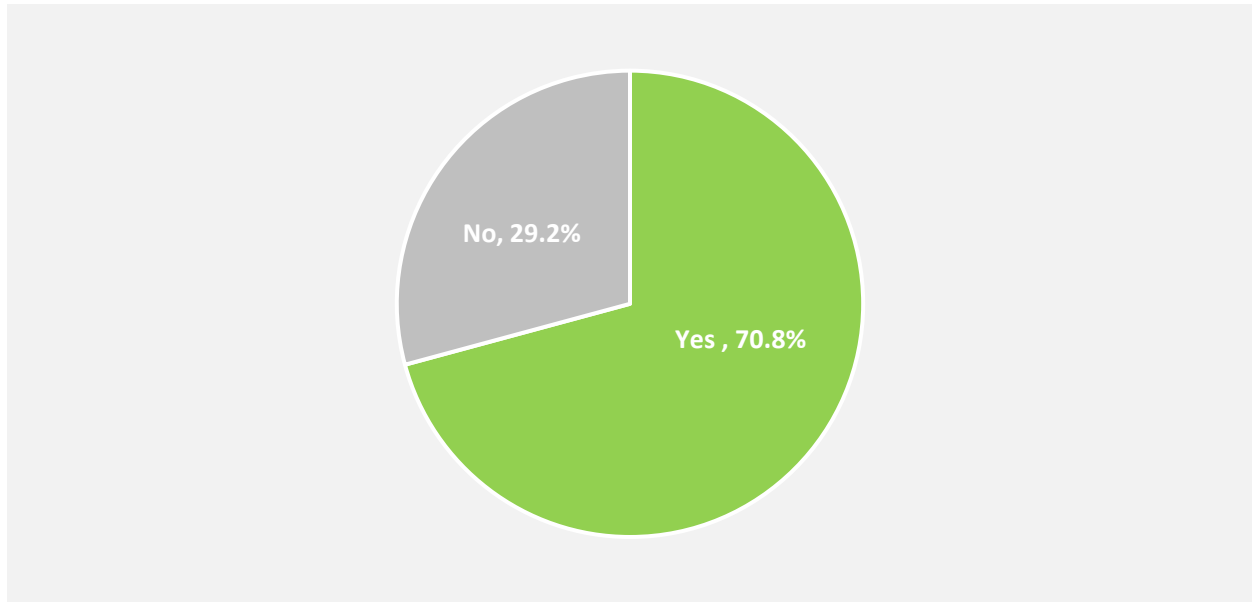
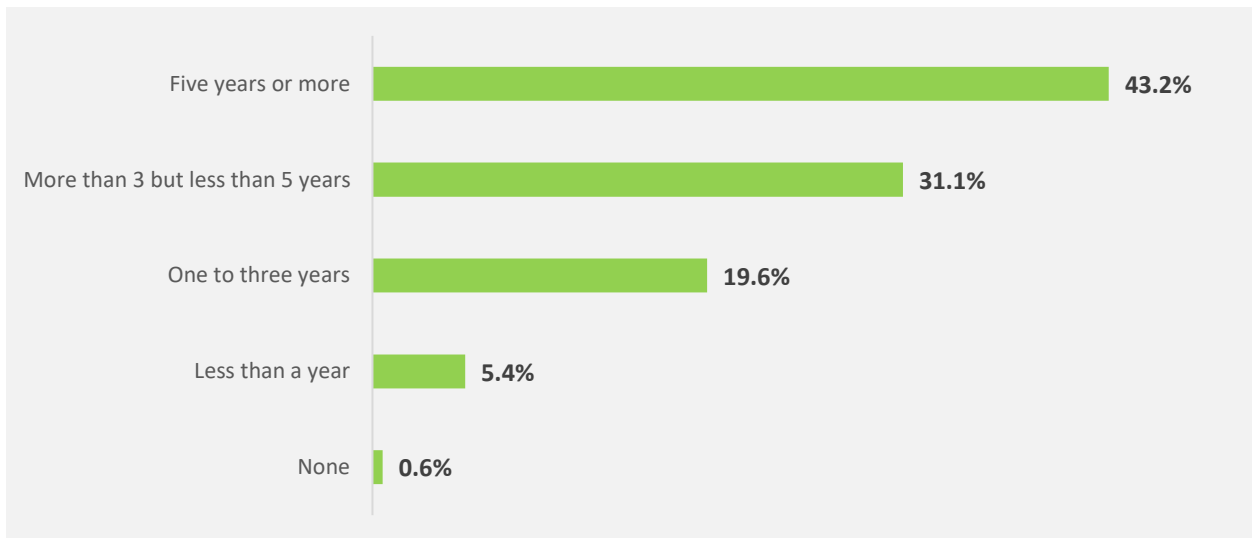


FIGURE 21. CERTIFICATIONS OR PROFESSIONAL LICENSES



Nearly all surveyed clean energy workers reported having some level of related work experience prior to landing their most recent job. In fact, many survey respondents (43 percent) reported having five years or more of related work experience.

FIGURE 22. OVERALL LEVEL OF EXPERIENCE



At the same time, the majority of surveyed clean energy workers have participated in either an internship (65 percent), mentorship (68 percent), or apprenticeship (71 percent) program. Of individuals who have participated in these programs, the vast majority agreed that program participation improved their ability to land their most recent or current job.

FIGURE 23. PROGRAM PARTICIPATION

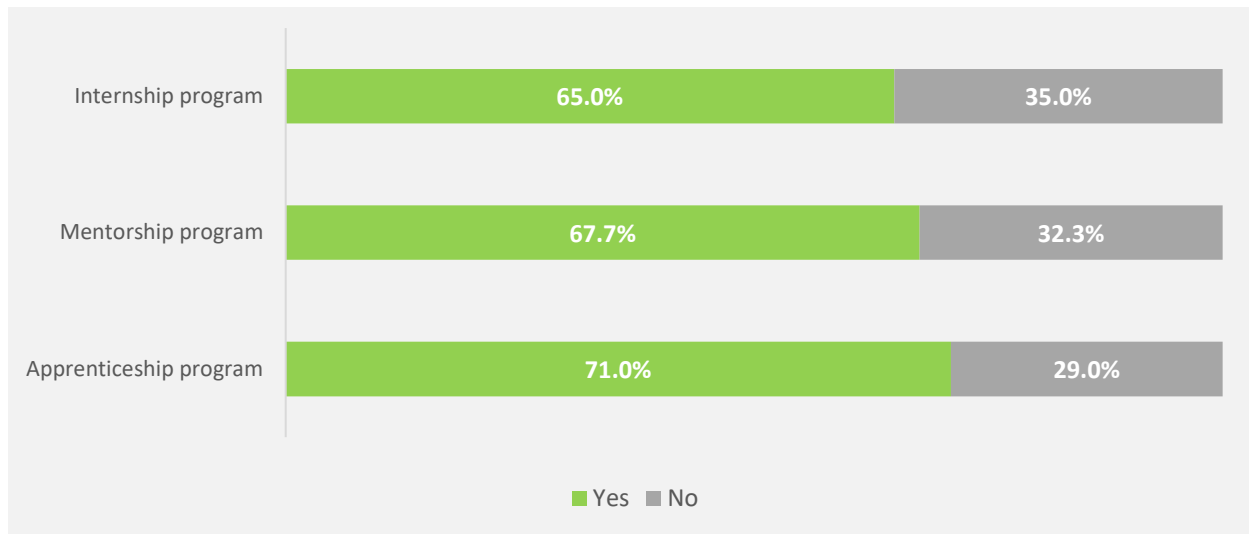
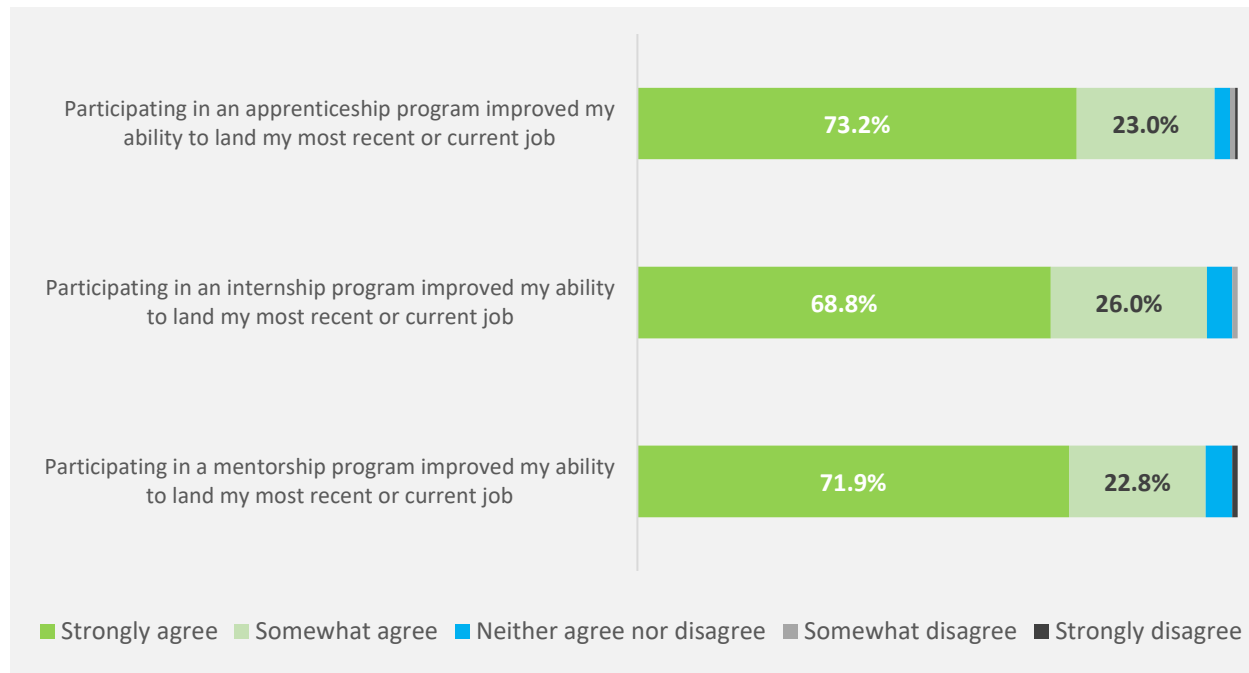


FIGURE 24. PROGRAM PARTICIPATION RESULTS

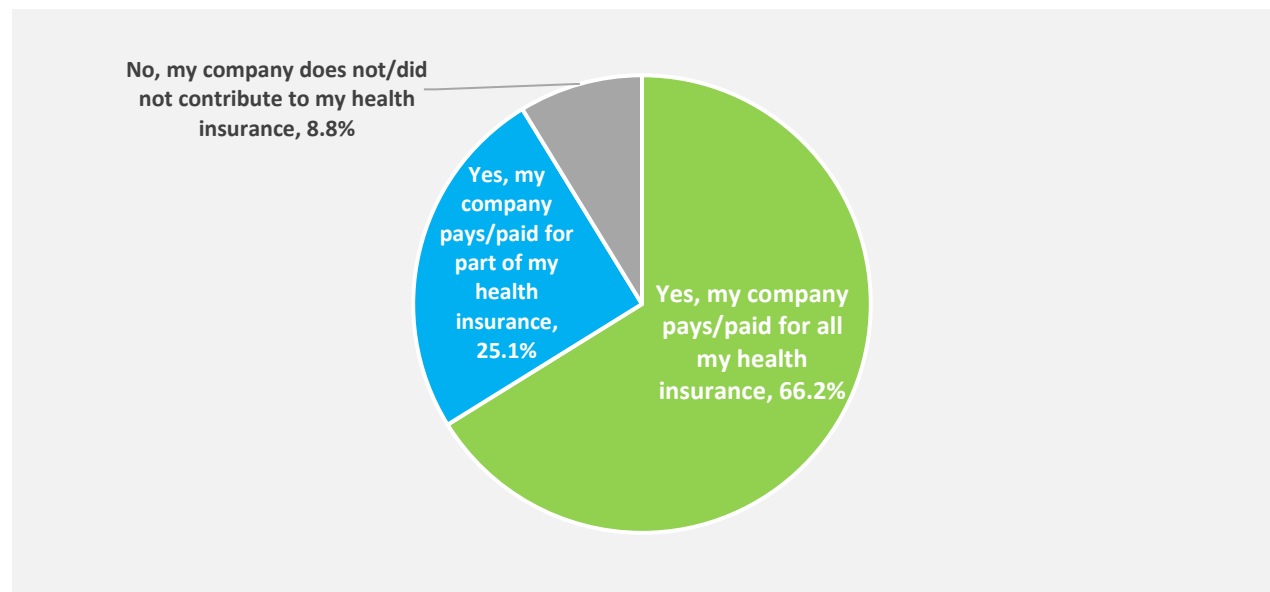


## Employment Benefits & Career Satisfaction

The majority of clean energy workers reported receiving both healthcare benefits and retirement contributions from their employer. Overall, 91 percent of surveyed clean energy workers reported access to health insurance benefits from their employer; this is higher than the national private sector average of 69 percent.<sup>28</sup> Sixty-six percent of clean energy workers reported that their company pays for all of their health insurance, while 25 percent indicated that their company pays for at least part of their health insurance.

Just over three-quarters (77 percent) of clean energy workers also indicated that they receive some form of retirement contributions from their company, which is higher than the national private sector average of 67 percent.<sup>29</sup>

FIGURE 25. HEALTHCARE BENEFITS<sup>30</sup>



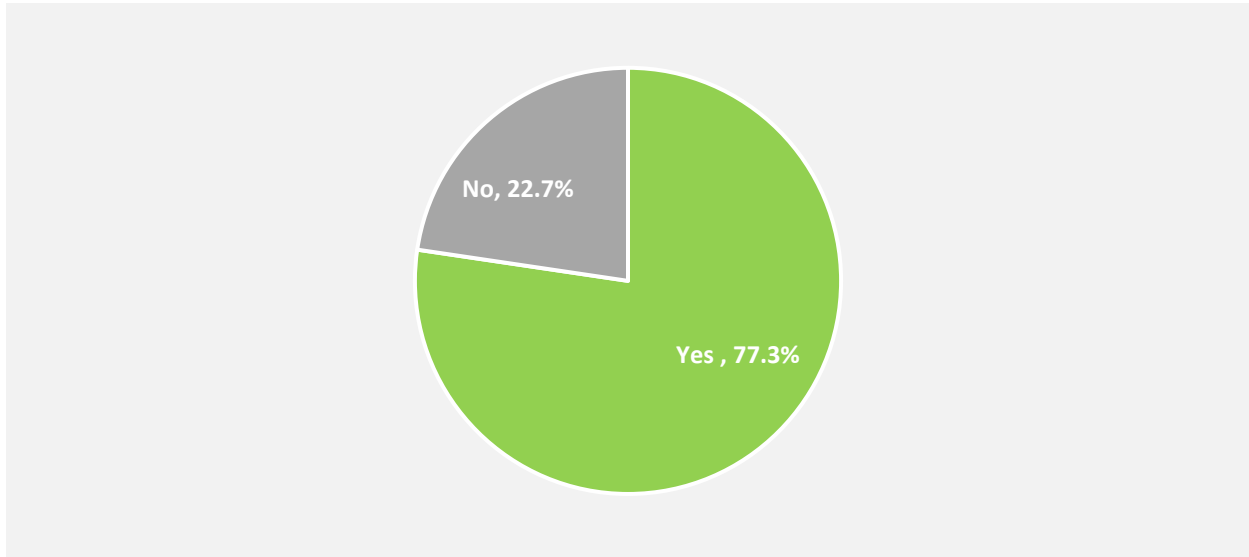
<sup>28</sup> Bureau of Labor Statistics. Employee Benefits in the United States, March 2019.

<https://www.bls.gov/news.release/pdf/ebs2.pdf>.

<sup>29</sup> *Id.*

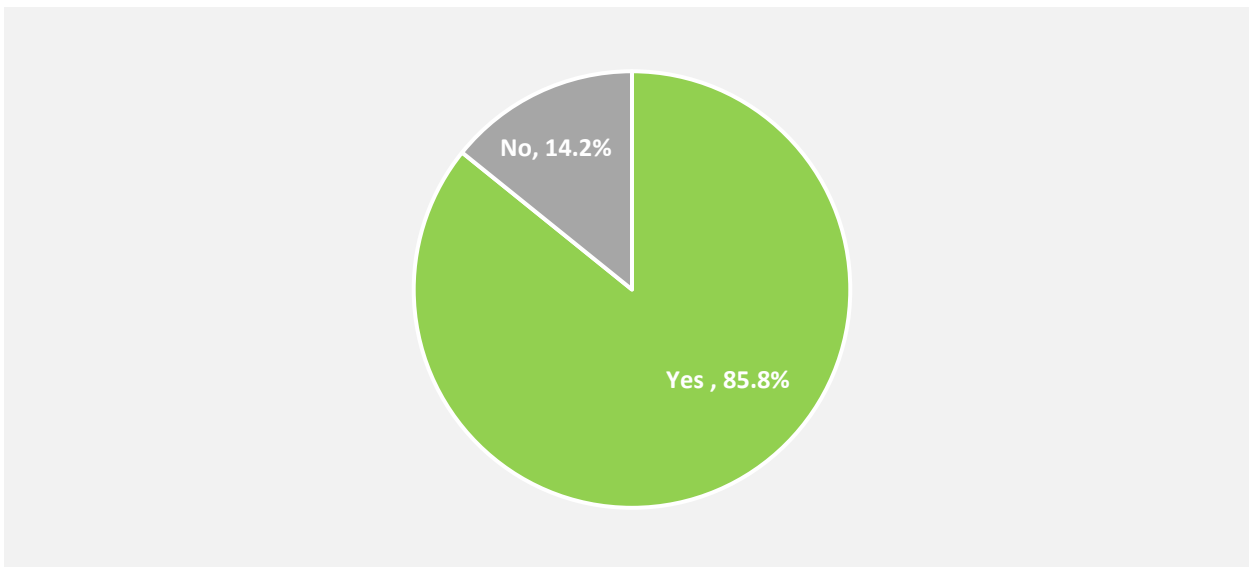
<sup>30</sup> This represents aggregate responses across all seven occupations. For specific information by occupation, please refer to the Occupational Career Profiles section beginning on page 47.

FIGURE 26. RETIREMENT CONTRIBUTIONS<sup>31</sup>



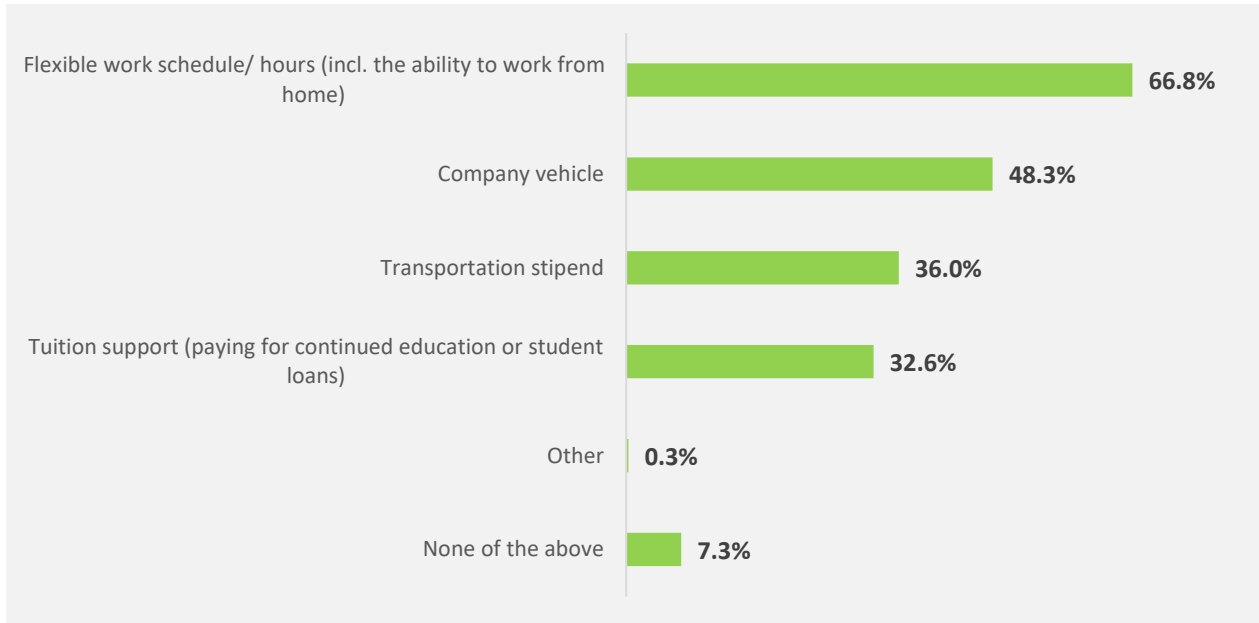
In addition to healthcare and retirement benefits, the majority of clean energy workers also receive paid vacation (86 percent) and flexible work scheduling and hours (67 percent). Another 48 percent reported receiving a company vehicle, followed by transportation stipends (36 percent) and tuition support (33 percent).

FIGURE 27. PAID VACATION



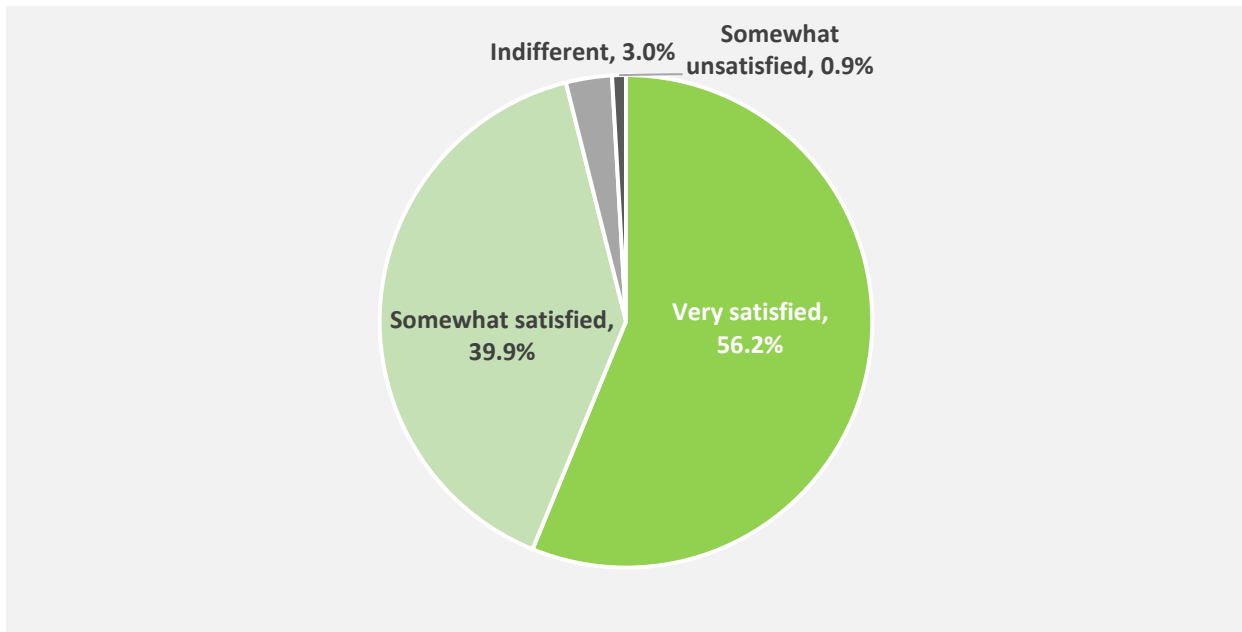
<sup>31</sup> This represents aggregate responses across all seven occupations. For specific information by occupation, please refer to the Occupational Career Profiles section beginning on page 47.

FIGURE 28. ADDITIONAL EMPLOYMENT BENEFITS



Nearly all surveyed clean energy workers reported career satisfaction (96 percent). In fact, more than half (56 percent) indicated that they are very satisfied with their current career and another 40 percent reported they are somewhat satisfied. Three percent of respondents indicated they are indifferent and less than one percent reported that they are somewhat unsatisfied.

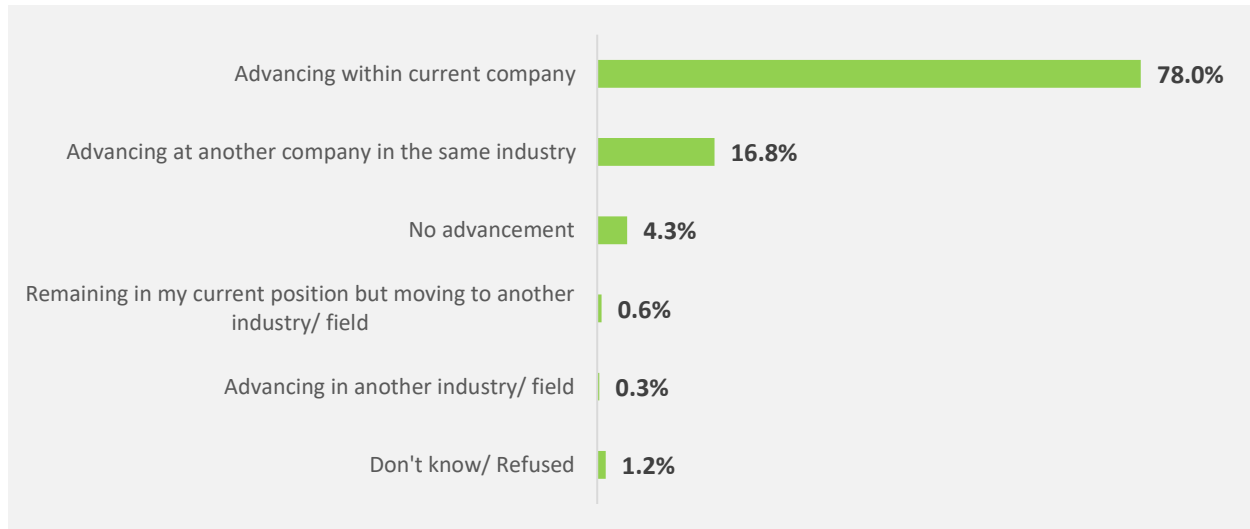
FIGURE 29. CAREER SATISFACTION



## Career Advancement & Promotion Pathways

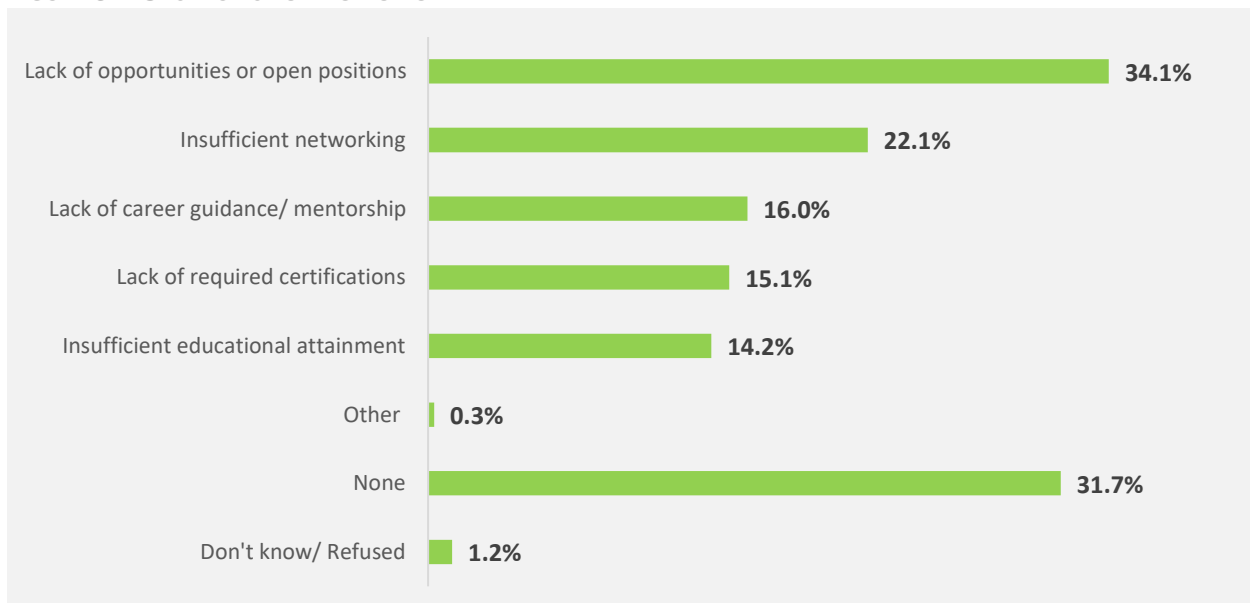
Nearly all clean energy workers (95 percent) expect to advance, either within their current company or at another company in the same industry. About eight in ten (78 percent) surveyed respondents indicated that they expect to advance within their current company.

FIGURE 30. EXPECTED PROMOTION PATHWAY



Thirty-four percent of individuals expecting to advance in their career are concerned about the lack of opportunities or open positions, followed by insufficient networking (22 percent) and lack of career guidance or mentorship (16 percent).

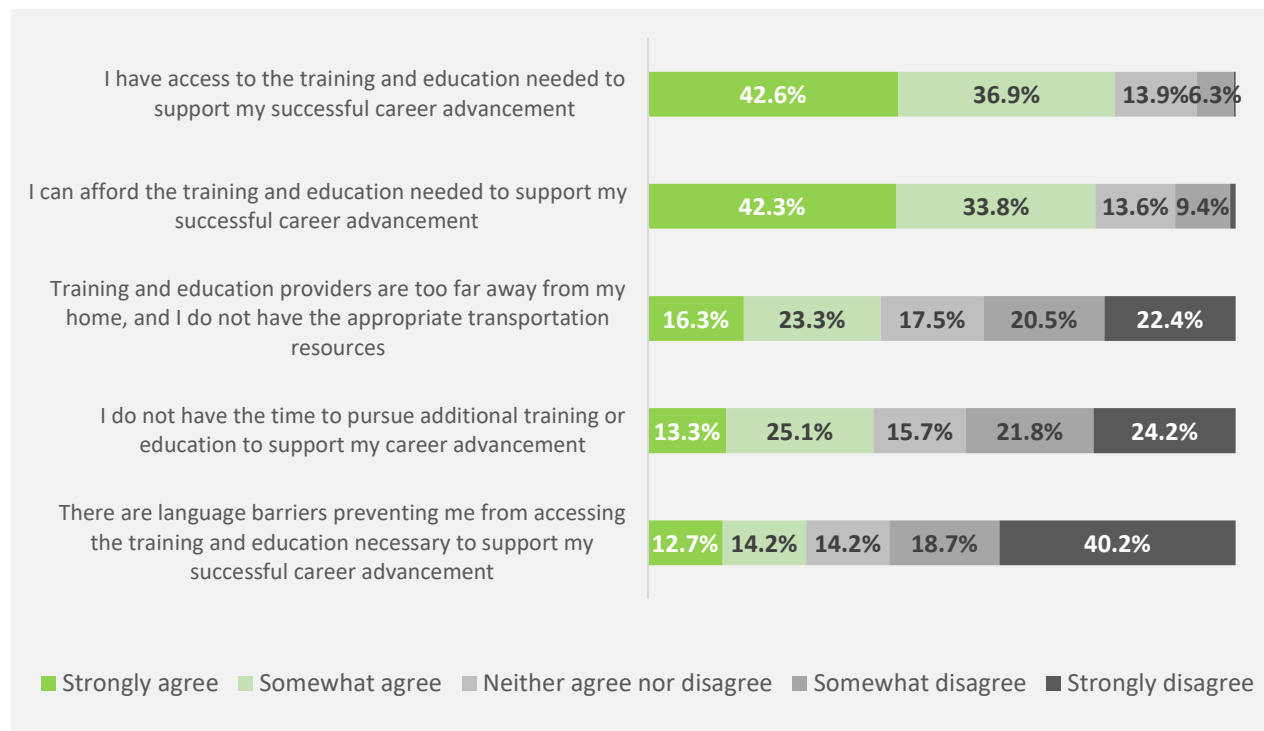
FIGURE 31. OBSTACLES TO PROMOTION



In general, however, few clean energy workers felt that they had career advancement obstacles related to education, finance, time, or language. In fact, 80 percent of survey respondents agreed that they have access to the training and education needed to support their career advancement, and another 76 percent reported that they can also afford the training and education required to support their career advancement.

Less than 40 percent of respondents indicated that training providers are too far away from their home, that they do not have the time to pursue additional training, or that there are language barriers preventing them from accessing the necessary training and education.

FIGURE 32. OBSTACLES TO CAREER ADVANCEMENT



Getting relevant industry and work experience is the number one challenge for clean energy workers. Three-quarters of respondents (75 percent) rated this either a considerable challenge or somewhat of a challenge in finding employment in the clean energy industry. Seventy-two percent of respondents also rated getting the technical or hands-on training needed as a challenge to finding employment.

Getting comfortable and confident communicating with employers and hiring managers (73 percent), achieving the academic degree or certification required (70 percent), and developing resumes and related materials that demonstrate qualifications (69) were also cited as challenges by current workers.

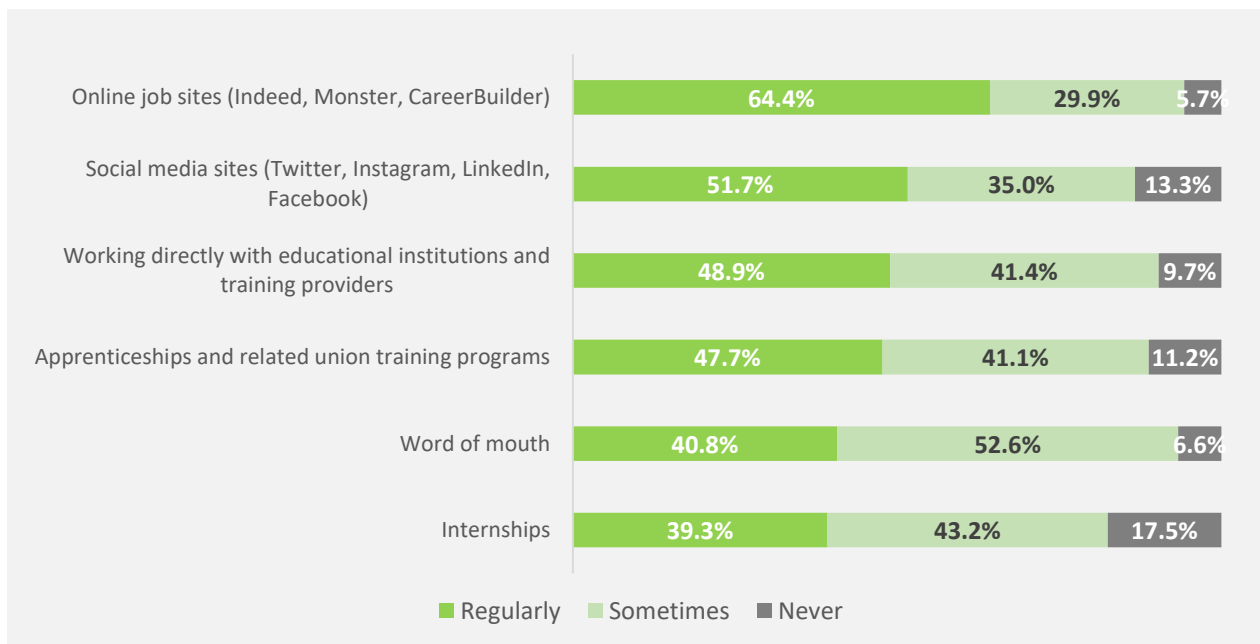


FIGURE 33. OBSTACLES TO FINDING EMPLOYMENT



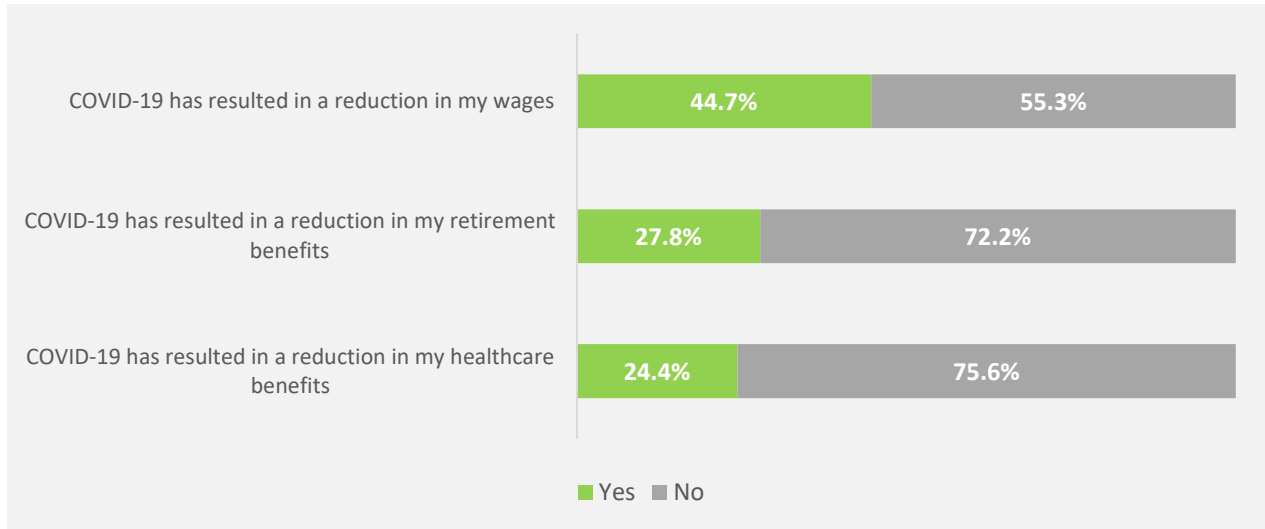
The majority of surveyed clean energy workers reported using online job sites regularly (64 percent) when searching for a new job, followed by social media (52 percent), and working directly with educational institutions (49 percent).

FIGURE 34. JOB SEARCH CHANNELS



Just under half (45 percent) of surveyed clean energy workers reported that COVID-19 resulted in a reduction in their wages; 28 percent indicated that the pandemic reduced their retirement benefits and another 24 percent reported that COVID-19 reduced their healthcare benefits.

FIGURE 35. COVID-19 IMPACTS TO WAGES & BENEFITS



## Conclusions & Future Considerations

Over the coming months and years in the aftermath of COVID-19, it will remain important to continue tracking the state of Pennsylvania's clean energy labor market. The upcoming 2021 Pennsylvania Clean Energy Employment Report will include more detail on changes to Pennsylvania's clean energy economy by technology sector and value chain segment. Despite unexpected job losses due to the global pandemic, the clean energy industry had exhibited strong growth prior to the economic downturn and will likely continue to grow as clean energy generation and deployment rises overall, both in Pennsylvania and across the nation. With these expectations in mind, it is important that the state has a skilled workforce ready to meet clean energy demand.

The clean energy economy can serve to help displaced workers in hard-hit industries like food service, retail, or hospitality to transition into higher-paying jobs with healthcare and retirement benefits. Partnerships that connect training organizations, workforce development agencies, and employers are vitally important to expand the current talent pipeline beyond word-of-mouth and connect jobseekers to valuable on-the-job training through apprenticeships and ultimately full-time employment.

In addition to the key findings and recommendations of this research, some additional areas of inquiries were raised from the data. The following is a list of additional considerations based on the research findings:

**A deeper dive into Pennsylvania's clean energy manufacturing industry**, including a more focused examination of additional manufacturing-specific occupations such as welders, industrial machinery mechanics, and supervisory roles for production occupations. Future research may consider understanding the needs of Pennsylvania's clean energy manufacturing industry, including production capacity, market reach, and business and workforce development needs in order to ensure the state's clean energy manufacturing sector is able to adequately supply both regional and national demand.

**A profile of Pennsylvania's wind industry.** Wind energy is also significant and growing in Pennsylvania. Wind energy has become the largest renewable source of electric power generation in Pennsylvania, accounting for 36 percent of renewable capacity in 2018.<sup>32</sup> Opportunities for wind turbine service technicians have grown by 85 percent between 2014 and 2019, resulting in 143 new jobs,<sup>33</sup> and Pennsylvania is home to a number of wind turbine component manufacturers.

**State-level policy research and economic impact analysis modeling.** Many businesses reported relying on the federal ITC to spur demand, and the expected reduction from 26 to 22 percent in 2021 was concerning for solar companies in particular. During executive interviews, employers reported that more

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<sup>32</sup> See generally: 2020 Pennsylvania Clean Energy Employment Report.

<http://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/2020EnergyReport/2020PA CEIR.pdf>.

<sup>33</sup> Source: Emsi Q4 2020, Data accessed February 2021.

state-level policy support would increase demand for clean energy goods and services, thereby creating additional jobs in the industry. Employers cited using policy examples from neighboring states that have a robust clean energy workforce, such as New Jersey, New York, and Massachusetts to spur clean energy job creation in Pennsylvania. Studies that identify the economic and labor market impacts of clean energy policies and funding could help to identify the job creation benefits of specific policy initiatives.<sup>34</sup>


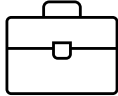
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<sup>34</sup> See generally: Build Back Better, Faster: How a Federal Stimulus Focusing on Clean Energy can Create Millions of Jobs and Restart America's Economy. <https://e2.org/wp-content/uploads/2020/07/E2E4-Build-Back-Better-Faster-Stimulus-Projection-Report-July-2020.pdf>

# Occupational Career Profiles

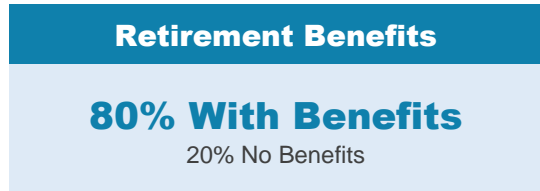
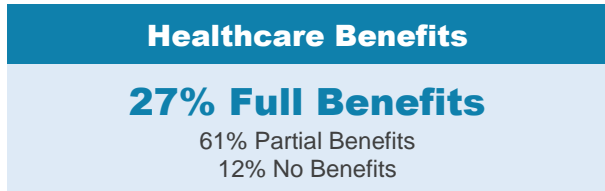
## Assemblers or Fabricators



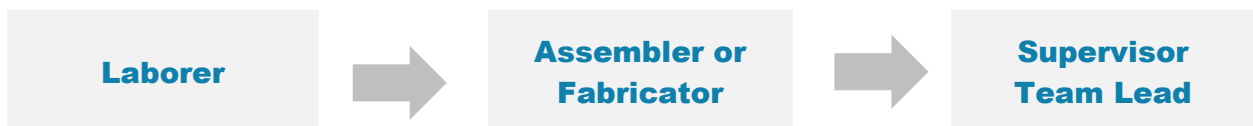
 <b>Entry-Level Education</b>	High school diploma or equivalent
 <b>On-the-Job Training</b>	Moderate-term on-the-job training

**COMMON CERTIFICATIONS**

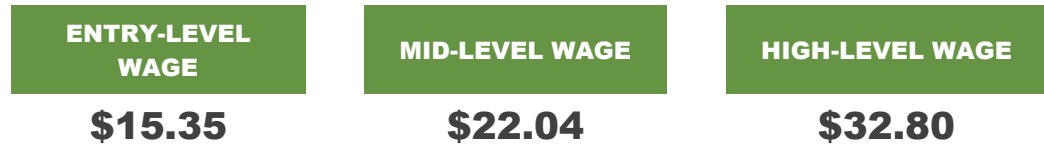
- Coil Processing FMA Certification
- Soldering Certification
- Electronics Assembly IPC Certification


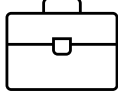


### Career Satisfaction



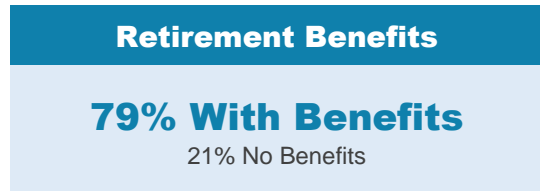
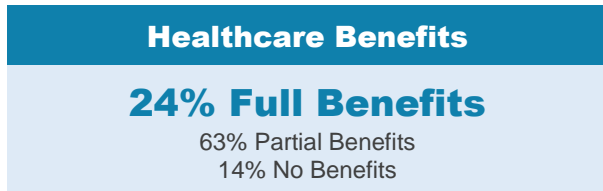
## Insulation Workers



 <b>Entry-Level Education</b>	No formal educational credential
 <b>On-the-Job Training</b>	Short-term on-the-job training

**COMMON CERTIFICATIONS**

- EPA Asbestos Training
- Energy Appraiser Certification


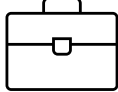


### Career Satisfaction



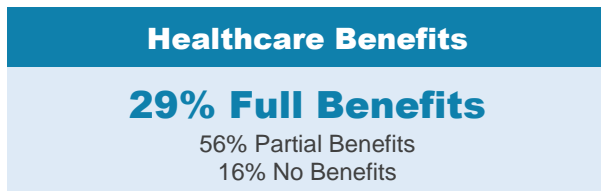
## HVAC Mechanics, Installers, or Technicians



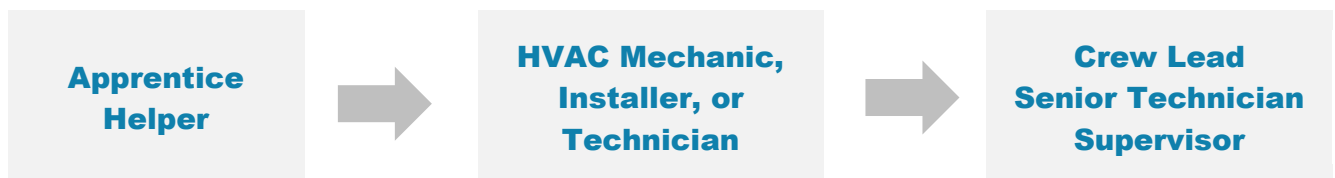
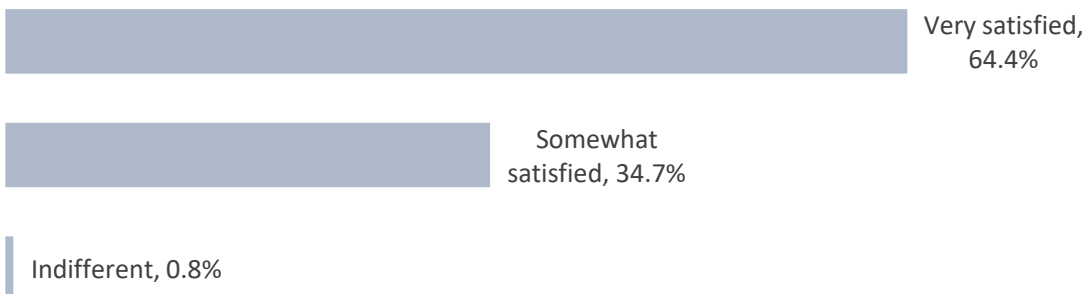
 <b>Entry-Level Education</b>	Postsecondary nondegree award
 <b>On-the-Job Training</b>	Long-term on-the-job training

**COMMON CERTIFICATIONS**

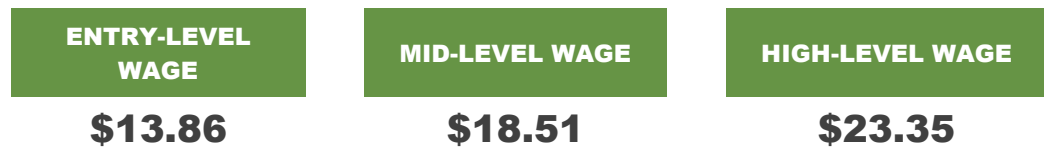
- EPA 608 Certification
- Local Licensing
- NATE Certification
- HVAC Excellence Certification


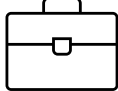


### Career Satisfaction



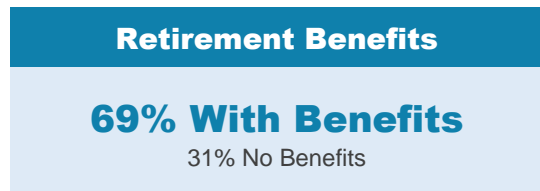
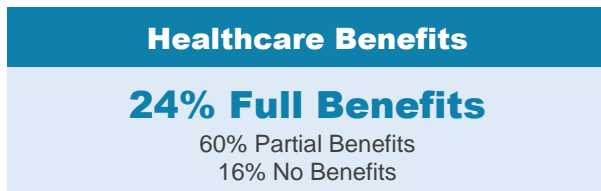
## Solar Photovoltaic Installers



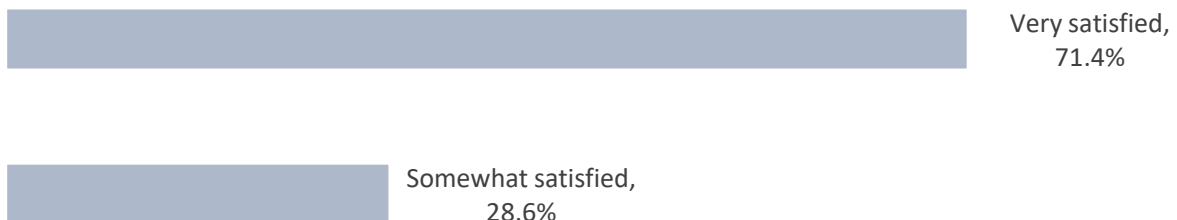
 <b>Entry-Level Education</b>	High school diploma or equivalent
 <b>On-the-Job Training</b>	Moderate-term on-the-job training

**COMMON CERTIFICATIONS**

- NABCEP
- OSHA 10

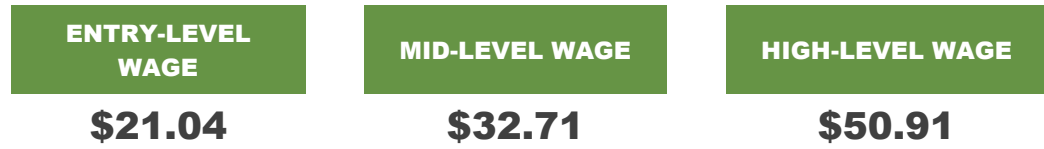



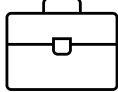
### Career Satisfaction





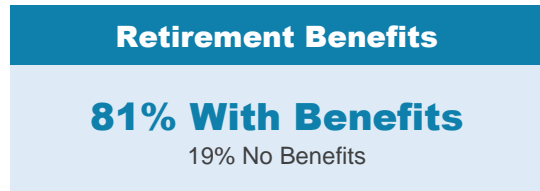
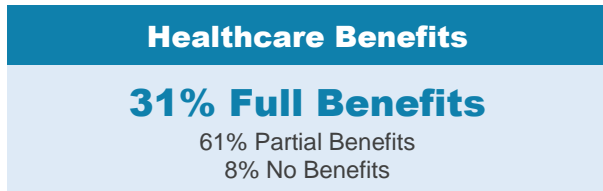
## Energy Auditors



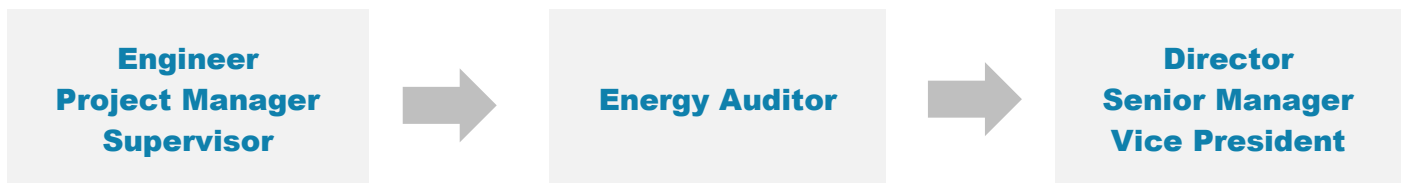
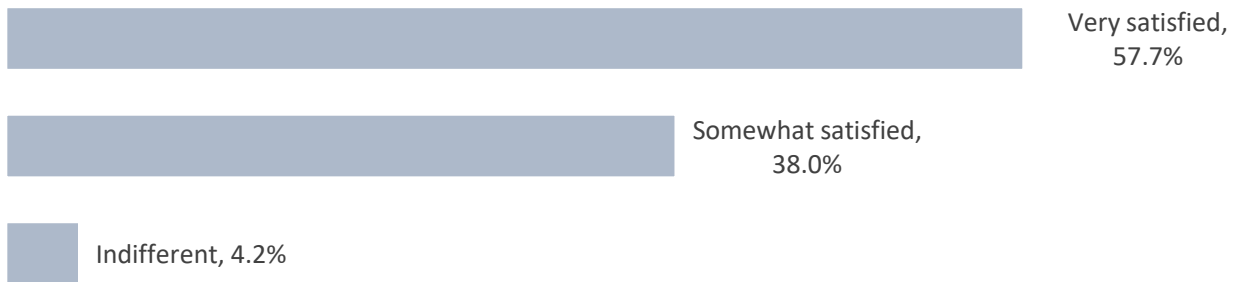
 <b>Entry-Level Education</b>	Bachelor's degree
 <b>On-the-Job Training</b>	None

**COMMON CERTIFICATIONS**

- Certified Energy Auditor (CEA)
- Certified Energy Manager (CEM)
- BPI Building Analyst


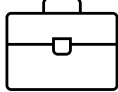


## Career Satisfaction



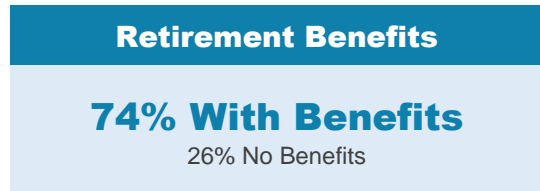
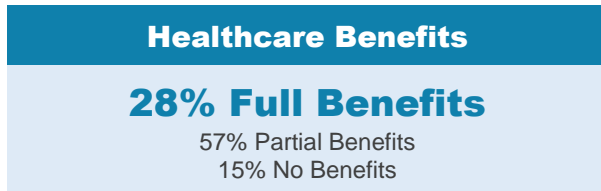
## Electricians



 <b>Entry-Level Education</b>	High school diploma or equivalent
 <b>On-the-Job Training</b>	Apprenticeship

**COMMON CERTIFICATIONS**

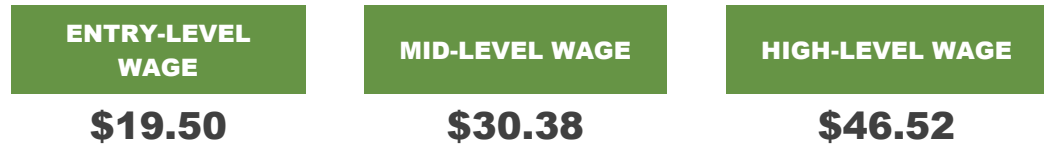
- Local Licensing
- NABCEP


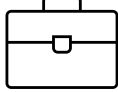


## Career Satisfaction

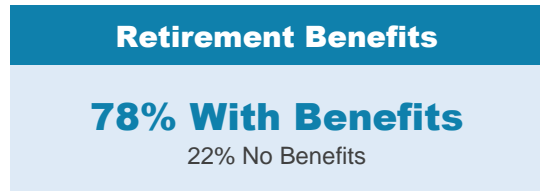
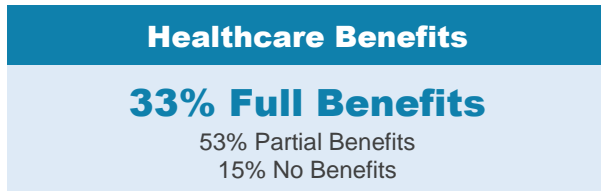


## Plumbers, Pipefitters, & Steamfitters

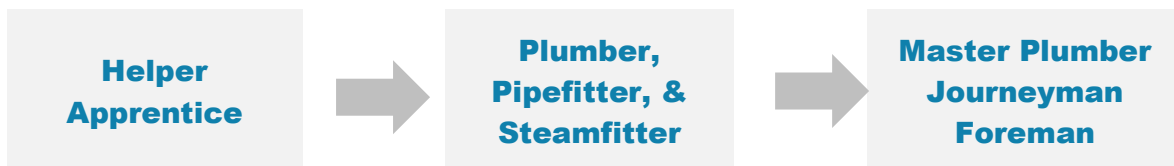


 <b>Entry-Level Education</b>	High school diploma or equivalent
 <b>On-the-Job Training</b>	Apprenticeship

**COMMON CERTIFICATIONS**  
n/a



### Career Satisfaction



## Appendix A: Survey Research Methodology

BW Research conducted employer interviews with clean energy organizations throughout Pennsylvania with an in-house phone bank. Employers were called between 8:30am and 5:30pm EST Monday through Friday. BW Research also programmed the online survey instrument in-house and distributed via email to a known database of clean energy firms in Pennsylvania.

The employer survey was fielded between September 1<sup>st</sup> and November 2<sup>nd</sup>, 2020 and resulted in 133 total completes. The margin of error for questions answered by all respondents is +/- 8.48 percent at the 95 percent confidence interval.

BW Research also conducted online surveys of current workers in Pennsylvania, New York, New Jersey, Ohio, Maryland, and Delaware that are employed in relevant clean energy occupations:

1. HVAC mechanic, installer, or technician
2. Energy auditor
3. Electrician
4. Assembler or fabricator
5. Solar photovoltaic installer
6. Insulation worker (floor, ceiling, and wall)
7. Plumber, pipefitter, or steamfitter

Current workers were recruited through third-party online panels of pre-screened potential respondents. The survey was designed and programmed in-house by BW Research.

The current worker survey was fielded between August 27<sup>th</sup> and October 4<sup>th</sup>, 2020. There were 331 respondents in total. The combined margin of error for the current worker survey is +/- 5.39 percent at the 95 percent confidence interval for questions answered by all respondents.

The research team also conducted executive interviews with individuals from the following organizations: Evoke Solar, Greenway Solar, Pennsylvania College of Technology, Solar States, Greenway Solar, Sunvestment, and EIS Solar.

## Appendix B: Training Inventory

The following is a list of all in-person clean energy workforce training programs in Pennsylvania. Not included or featured in this list are clean energy trainings offered online.

Program	Provider	Program Type	Occupational Focus	Sector	City
Building Construction	A. W. Beattie Career Center	Vocational/Technical School	Construction	Energy Efficiency	Allison Park
HVAC	A. W. Beattie Career Center	Vocational/Technical School	HVAC	Energy Efficiency	Allison Park
OSHA 30-Hour Construction	Adams County Technical Institute	Vocational/Technical School	Construction	Energy Efficiency	Gettysburg
Building Trades	Adams County Technical Institute	Vocational/Technical School	Construction	Energy Efficiency	Gettysburg
Electrical	Admiral Peary Area Vo-Tech School	Vocational/Technical School	Electrical	Energy Efficiency	Ebensburg
HVAC	Admiral Peary Area Vo-Tech School	Vocational/Technical School	HVAC	Energy Efficiency	Ebensburg
Engineering Technology	Admiral Peary Area Vo-Tech School	Vocational/Technical School	Engineering	Energy Efficiency	Ebensburg
HVAC Training	All-State Career	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
HVAC Training	All-State Career	Community/Junior College	HVAC	Energy Efficiency	Essington
Introduction to PV	Apprentice Training-Elec Ind. Local 98	Trade Association	Solar	Renewable Energy Generation	Philadelphia
HVACR	Beaver County Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Monaca
Electrical Occupations	Beaver County Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Monaca
Building Construction	Bedford County Technical Center	Vocational/Technical School	Construction	Energy Efficiency	Bedford
Mechatronics (Electromechanical Engineering)	Berks Career and Technology Center	Vocational/Technical School	Engineering	Energy Efficiency	Oley
Engineering Technology	Berks Career and Technology Center	Vocational/Technical School	Engineering	Energy Efficiency	Oley
HVACR	Berks Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Oley
Electrical Occupations	Berks Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Oley
Building Construction Occupations	Berks Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Oley
Building Construction Occupations - Adult Cert	Berks Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Oley
Electrical Occupations - Adult Cert	Berks Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Oley
HVACR - Adult Cert	Berks Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Oley

Electrical Construction	Bethlehem Area Vocational-Technical School	Vocational/Technical School	Construction	Energy Efficiency	Bethlehem
HVAC	Bethlehem Area Vocational-Technical School	Vocational/Technical School	HVAC	Energy Efficiency	Bethlehem
Electronic Technology	Bethlehem Area Vocational-Technical School	Vocational/Technical School	Electrical	Energy Efficiency	Bethlehem
BPI Air Conditioning & Heat Pump Professional certification	BPI	Trade Association	HVAC	Energy Efficiency	Williamsport
BPI Retrofit Installer Technician (RIT)	BPI	Trade Association	HVAC	Energy Efficiency	Williamsport
Electrical Apprenticeship Program	Bucks County Community College	Community/Junior College	Electrical	Energy Efficiency	Newtown
Electrical Occupations	Bucks County Technical High School	Vocational/Technical School	Electrical	Energy Efficiency	Fairless Hills
Civil Engineering Technology	Bucks County Technical High School	Vocational/Technical School	Engineering	Grid Modernization & Energy Storage	Fairless Hills
HVACR	Bucks County Technical High School	Vocational/Technical School	HVAC	Energy Efficiency	Fairless Hills
Electronics/Green Energy Technologies	Bucks County Technical High School	Vocational/Technical School	Electrical	Renewable Energy Generation	Fairless Hills
Mechatronics (Electromechanical Engineering)	Bucks County Technical High School	Vocational/Technical School	Engineering	Energy Efficiency	Fairless Hills
Air Conditioning/Electrical	Butler County Area Vocational-Technical School	Vocational/Technical School	HVAC	Energy Efficiency	Butler
Building Construction	Butler County Area Vocational-Technical School	Vocational/Technical School	Construction	Energy Efficiency	Butler
HVAC Option - Technical Trades	Butler County Community College	Community/Junior College	HVAC	Energy Efficiency	Butler
Electronics Technology	Butler County Community College	Community/Junior College	Electrical	Energy Efficiency	Butler
Electronics Technology - Occupational Track	Butler County Community College	Community/Junior College	Electrical	Energy Efficiency	Butler
Energy Technology	Butler County Community College	Community/Junior College	Electrical	Energy Efficiency	Butler
Engineering - AS	Butler County Community College	Community/Junior College	Engineering	Energy Efficiency	Butler
Engineering Technology with CADD	Butler County Community College	Community/Junior College	Engineering	Energy Efficiency	Butler
Manufacturing with Advanced Technology	Butler County Community College	Community/Junior College	Engineering	Energy Efficiency	Butler
Technical Trades - HVAC Option	Butler County Community College	Community/Junior College	HVAC	Energy Efficiency	Butler

HVACR	Carbon Career and Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	Jim Thorpe
Electrical Distribution and Automation	Carbon Career and Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	Jim Thorpe
Architecture Engineering and Construction Management (AECM)	Carnegie Mellon University	4-Year College or University	Construction	Energy Efficiency	Pittsburgh
Architecture Engineering and Construction Management (AECM)	Carnegie Mellon University	4-Year College or University	Construction	Energy Efficiency	Pittsburgh
Mechanical Engineering	Carnegie Mellon University	4-Year College or University	Engineering	Energy Efficiency	Pittsburgh
Civil and Environmental Engineering	Carnegie Mellon University	4-Year College or University	Engineering	Energy Efficiency	Pittsburgh
Electrical and Computer Engineering	Carnegie Mellon University	4-Year College or University	Engineering	Energy Efficiency	Pittsburgh
Building Trades	Central Montco Technical High School	Vocational/Technical School	Construction	Energy Efficiency	Plymouth Meeting
HVAC	Central Pennsylvania Institute of Science and Technology	Vocational/Technical School	HVAC	Energy Efficiency	Bellefonte
Solar Photovoltaic Technician	Central Pennsylvania Institute of Science and Technology	Vocational/Technical School	Solar	Renewable Energy Generation	Bellefonte
HVACR Technician	Central Pennsylvania Institute of Science and Technology	Vocational/Technical School	HVAC	Energy Efficiency	Bellefonte
HVAC	Central Westmoreland Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	New Stanton
Electrical Technology	Central Westmoreland Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	New Stanton
Construction Trades Technology	Central Westmoreland Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	New Stanton
Installing Apollo II PV Shingles	Certaineed Solar	Manufacturer	Solar	Renewable Energy Generation	Malvern
Solar and Roofing Presented	Certaineed Solar	Manufacturer	Solar	Renewable Energy Generation	Malvern
Electrical Construction Technology	CIT (Career Institute of Technology)	Vocational/Technical School	Electrical	Energy Efficiency	Easton
Building & Property Maintenance	CIT (Career Institute of Technology)	Vocational/Technical School	Construction	Energy Efficiency	Easton
Building Construction Technology	CIT (Career Institute of Technology)	Vocational/Technical School	Construction	Energy Efficiency	Easton
Heating, Ventilation, Refrigeration & Plumbing	CIT (Career Institute of Technology)	Vocational/Technical School	HVAC	Energy Efficiency	Easton
Construction Technology	Clarion County Career Center	Vocational/Technical School	Construction	Energy Efficiency	Shippenville

HVACR	Clearfield County Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Clearfield
Electrical Occupations	Clearfield County Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Clearfield
OSHA Construction (10-hour)	Cocciardi and Associates, Inc	Private Consulting/Training Firm	Construction	Energy Efficiency	Mechanicsburg
OSHA Construction (30-hour)	Cocciardi and Associates, Inc	Private Consulting/Training Firm	Construction	Energy Efficiency	Mechanicsburg
Building Trades Maintenance	Columbia-Montour AVTS	Vocational/Technical School	Construction	Energy Efficiency	Bloomsburg
Electrical Occupations	Columbia-Montour AVTS	Vocational/Technical School	Electrical	Energy Efficiency	Bloomsburg
HVAC	Columbia-Montour AVTS	Vocational/Technical School	HVAC	Energy Efficiency	Bloomsburg
Mechatronics (Electromechanical Engineering)	Columbia-Montour AVTS	Vocational/Technical School	Engineering	Energy Efficiency	Bloomsburg
Electrical Distribution	Community College of Allegheny	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
Heating & Air Conditioning Technology	Community College of Allegheny	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
Associate of Science in Electrical Construction Technology	Community College of Allegheny	Community/Junior College	Electrical	Energy Efficiency	Pittsburgh
Building Trades Technology	Community College of Beaver County	Community/Junior College	Construction	Energy Efficiency	Monaca
Applied Science and Engineering Technology	Community College of Philadelphia	Community/Junior College	Engineering	Energy Efficiency	Philadelphia
Architecture	Community College of Philadelphia	Community/Junior College	Architecture	Energy Efficiency	Philadelphia
HVAC	Connellsville Area Career and Technical Center	Vocational/Technical School	HVAC	Energy Efficiency	Connellsville
Electrical Occupations	Connellsville Area Career and Technical Center	Vocational/Technical School	Electrical	Energy Efficiency	Connellsville
Electrical Occupation	Crawford County Career and Technical Center	Vocational/Technical School	Electrical	Energy Efficiency	Meadville
Electrical Construction and Maintenance	Cumberland-Perry Area Vocational Technical School	Vocational/Technical School	Electrical	Energy Efficiency	Mechanicsburg
HVAC	Cumberland-Perry Area Vocational Technical School	Vocational/Technical School	HVAC	Energy Efficiency	Mechanicsburg
Automation, Robots, and Electronics	Cumberland-Perry Area Vocational Technical School	Vocational/Technical School	Engineering	Energy Efficiency	Mechanicsburg
Building Construction Technology	Dauphin County Technical School	Vocational/Technical School	Construction	Energy Efficiency	Harrisburg
Electrical Construction and Maintenance	Dauphin County Technical School	Vocational/Technical School	Electrical	Energy Efficiency	Harrisburg
Electronics Engineering	Dauphin County Technical School	Vocational/Technical School	Engineering	Energy Efficiency	Harrisburg
HVAC	Dauphin County Technical School	Vocational/Technical School	HVAC	Energy Efficiency	Harrisburg
Basic Residential Wiring	Delaware County Community College	Community/Junior College	Electrical	Energy Efficiency	Media



Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology /NATE (North American Technician Excellence)	Delaware County Community College	Community/Junior College	HVAC	Energy Efficiency	Media
BPI Building Analyst Training	Diagnostic Energy Auditors of Western Pennsylvania	Trade Association	Building Analyst	Energy Efficiency	Pittsburgh
BPI Healthy Homes Evaluator Training Course	Diagnostic Energy Auditors of Western Pennsylvania	Trade Association	Building Analyst	Energy Efficiency	Pittsburgh
Construction Management program	Drexel University	4-Year College or University	Construction	Energy Efficiency	Philadelphia
Engineering Technology	Drexel University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Architectural Engineering	Drexel University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Civil Engineering	Drexel University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Electrical Engineering	Drexel University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Construction Technology	Eastern Center for Arts and Technology	Vocational/Technical School	Construction	Energy Efficiency	Willow Grove
Electrical Technology	Eastern Center for Arts and Technology	Vocational/Technical School	Electrical	Energy Efficiency	Willow Grove
HVAC	Eastern Center for Arts and Technology	Vocational/Technical School	HVAC	Energy Efficiency	Willow Grove
Robotics and Automated Tech (Mechatronics)	Eastern Center for Arts and Technology	Vocational/Technical School	Engineering	Energy Efficiency	Willow Grove
Engineering and Manufacturing Technology	Eastern Westmoreland Career and Technical School	Vocational/Technical School	Engineering	Energy Efficiency	McChesneytown-Loyalhanna
Construction	Eastern Westmoreland Career and Technical School	Vocational/Technical School	Construction	Energy Efficiency	McChesneytown-Loyalhanna
Electrical - WESTERN CENTRAL PENNSYLVANIA ELECTRICIANS'	Electrical Joint Apprenticeship and Training Committee	Union	Electrical	Energy Efficiency	Beaver
Solar PV Basics	Energy Coordinating Agency	Non-Profit Organization	Solar	Renewable Energy Generation	Philadelphia
Building Energy Analyst	Energy Coordinating Agency of Philadelphia, Inc. (ECA)	Non-Profit Organization	Energy Management	Energy Efficiency	Philadelphia
Envelope Specialist	Energy Coordinating Agency of Philadelphia, Inc. (ECA)	Non-Profit Organization	Energy Management	Energy Efficiency	Philadelphia
Weatherization	Energy Coordinating Agency of Philadelphia, Inc. (ECA)	Non-Profit Organization	Weatherization	Energy Efficiency	Philadelphia
BPI Building Analyst Training	EnergyScore	Trade Association	Building Analyst	Energy Efficiency	Oxford

BPI Envelope Professional Training	EnergyScore	Trade Association	Construction	Energy Efficiency	Oxford
BPI HEP Energy Auditor Training	EnergyScore	Trade Association	Building Analyst	Energy Efficiency	Oxford
Electrical Engineering	Erie County Technical School	Community/Junior College	Electrical	Energy Efficiency	Erie
HVAC technician	Erie County Technical School	Community/Junior College	HVAC	Energy Efficiency	Erie
Construction Trades	Erie County Technical School	Community/Junior College	Construction	Energy Efficiency	Erie
Electrical Construction	Fayette County Career and Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	Uniontown
HVAC	Fayette County Career and Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	Uniontown
Introduction to Photovoltaics	Finishing Trades Institute of the Mid-Atlantic Region	Trade Association	Solar	Renewable Energy Generation	Philadelphia
Electrical Technology	Forbes Road Career & Technical Center	Community/Junior College	Electrical	Energy Efficiency	Monroeville
HVAC	Forbes Road Career & Technical Center	Community/Junior College	HVAC	Energy Efficiency	Monroeville
Electrical	Fortis	Community/Junior College	Electrical	Energy Efficiency	Forty Fort
HVAC	Fortis	Community/Junior College	HVAC	Energy Efficiency	Forty Fort
Building Construction Trades	Franklin County Career and Technical Center	Vocational/Technical School	Construction	Energy Efficiency	Chambersburg
Electrical Occupations	Franklin County Career and Technical Center	Vocational/Technical School	Electrical	Energy Efficiency	Chambersburg
HVAC	Franklin County Career and Technical Center	Vocational/Technical School	HVAC	Energy Efficiency	Chambersburg
Engineering Technology	Franklin County Career and Technical Center	Vocational/Technical School	Engineering	Energy Efficiency	Chambersburg
Mechatronics (Electromechanical Engineering)	Franklin County Career and Technical Center	Vocational/Technical School	Engineering	Energy Efficiency	Chambersburg
Electrical Trades	Greater Altoona Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Altoona
Electro Mechanical Engineering Technology	Greater Altoona Career and Technical Center	Vocational/Technical School	Engineering	Energy Efficiency	Altoona
Electrical Trades	Greater Altoona Career and Technical Center	Vocational/Technical School	Electrical	Energy Efficiency	Altoona
Electrical Technology program	Greater Johnstown Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Jonestown
Construction Technology course	Greater Johnstown Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Jonestown
CEM Training	Greater Philadelphia Chapter of the Association of Energy Engineers	Trade Association	Energy Management	Renewable Energy Generation	Exton
Electrical Occupations	Greene County Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Waynesburg
Building Construction	Greene County Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Waynesburg
BPI Building Analyst Classroom Training	GreenTraining USA	Community/Junior College	Building Analyst	Energy Efficiency	Philadelphia

and Certification Exams					
Architecture	Harrisburg Area Community College	Community/Junior College	Architecture	Energy Efficiency	Harrisburg
Architecture	Harrisburg Area Community College	Community/Junior College	Architecture	Energy Efficiency	York
Architecture - AAS	Harrisburg Area Community College	Community/Junior College	Architecture	Energy Efficiency	Harrisburg/York
Architecture - AAS	Harrisburg Area Community College	Community/Junior College	Architecture	Energy Efficiency	York
Engineering - AS	Harrisburg Area Community College	Community/Junior College	Engineering	Energy Efficiency	Harrisburg
Engineering - AS	Harrisburg Area Community College	Community/Junior College	Engineering	Energy Efficiency	Lancaster
HVACR	Harrisburg Area Community College	Community/Junior College	HVAC	Energy Efficiency	Harrisburg/York
HVACR	Harrisburg Area Community College	Community/Junior College	HVAC	Energy Efficiency	York
HVACR - AS	Harrisburg Area Community College	Community/Junior College	HVAC	Energy Efficiency	Harrisburg/York
HVACR - AS	Harrisburg Area Community College	Community/Junior College	HVAC	Energy Efficiency	York
Structural Engineering Technology	Harrisburg Area Community College	Community/Junior College	Engineering	Energy Efficiency	Harrisburg
Structural Engineering Technology - AS	Harrisburg Area Community College	Community/Junior College	Engineering	Energy Efficiency	Harrisburg
Electrical Technology	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	Electrical	Energy Efficiency	Harrisburg
Electrical Technology	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	Electrical	Energy Efficiency	York
Electrical Technology	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	Electrical	Energy Efficiency	York
Electrical Technology	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	Electrical	Energy Efficiency	Harrisburg
HVAC	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	HVAC	Energy Efficiency	Harrisburg
HVAC	Harrisburg Area Community College- Wildwood Campus	Community/Junior College	HVAC	Energy Efficiency	York
Construction Technology	Hazleton Area Career Center	Vocational/Technical School	Construction	Energy Efficiency	Hazle Township
Electrical Technology	Hazleton Area Career Center	Vocational/Technical School	Electrical	Energy Efficiency	Hazle Township
HVAC	Hazleton Area Career Center	Vocational/Technical School	HVAC	Energy Efficiency	Hazle Township
Electrical (Adult Program)	Huntingdon County Career & Tech	Vocational/Technical School	Electrical	Energy Efficiency	Mill Creek
HVAC (Adult Program)	Huntingdon County Career & Tech	Vocational/Technical School	HVAC	Energy Efficiency	Mill Creek
HVAC (Adult Program)	Huntingdon County Career & Tech	Vocational/Technical School	HVAC	Energy Efficiency	Mill Creek

Chester Joint Apprenticeship and Training Committee (CJATC)	IBEW and The National Electrical Contractors Association (NECA)	Union	Electrical	Energy Efficiency	Boothwyn
Apprenticeship Training (ATEI) IBEW Local 98	IBEW Local Union 98 and the Penn-Del-Jersey Chapter of NECA	Union	Electrical	Energy Efficiency	Philadelphia
HVACR	Indiana County Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Indiana
HVACR - Cert Track	Indiana County Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Indiana
JATC and IBEW 375 Apprenticeship and Training	JATC and IBEW 375	Union	Electrical	Energy Efficiency	Allentown
HVAC	Jefferson County-DuBois Area High School	Vocational/Technical School	HVAC	Energy Efficiency	Reynoldsville
HVAC (Adult Program)	Jefferson County-DuBois Area High School	Vocational/Technical School	HVAC	Energy Efficiency	Reynoldsville
Leadership in Energy and Environmental Design (LEED)	Jefferson County-DuBois Area High School	Vocational/Technical School	General Clean Energy	Energy Efficiency	Reynoldsville
Electronic Engineering Technology	Johnson College	Community/Junior College	Electrical	Energy Efficiency	Scranton
Electrical and Power Transmission	Jules E. Mastbaum High School	Vocational/Technical School	Electrical	Energy Efficiency	Philadelphia
OSHA 10 Hour Construction	Karl Environmental Group	Private Consulting/Training Firm	Construction	Energy Efficiency	Reading
OSHA 30 Hour Construction	Karl Environmental Group	Private Consulting/Training Firm	Construction	Energy Efficiency	Reading
Construction Trades	Keystone Central Vocational Technical School	Vocational/Technical School	Construction	Energy Efficiency	Mill Hall
HVAC EPA Certification	Lancaster County Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Brownstown
Electro-Mechanical Engineering Technology	Lancaster County Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Willow Street
Electrical Technician	Laurel College of Technology	Community/Junior College	Electrical	Energy Efficiency	Uniontown
Electrical Occupations	Lawrence County Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	New Castle
Construction Trades	Lawrence County Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	New Castle
Electrical (High School Students and Adults if room available)	Lebanon County Career and Technology Center	Community/Junior College	Electrical	Energy Efficiency	Lebanon
HVAC (High School Students and Adults if room available)	Lebanon County Career and Technology Center	Community/Junior College	HVAC	Energy Efficiency	Lebanon
Electrical Technology A.A.S. (ELT)	Lehigh Carbon Community College	Community/Junior College	Electrical	Energy Efficiency	Schnecksville
Electrical Engineering Technology A.A.S. (EET)	Lehigh Carbon Community College	Community/Junior College	Engineering	Energy Efficiency	Schnecksville

Electrical Technology Certificate	Lehigh Carbon Community College	Community/Junior College	Electrical	Energy Efficiency	Schnecksville
Electronics Certificate (ELEC)	Lehigh Carbon Community College	Community/Junior College	Electrical	Energy Efficiency	Schnecksville
Heating, Air Conditioning, and Refrigeration Technology A.A.S. (HAC)	Lehigh Carbon Community College	Community/Junior College	HVAC	Energy Efficiency	Schnecksville
Heating, Air Conditioning, and Refrigeration (HVACR) Technology Certificate (HACC)	Lehigh Carbon Community College	Community/Junior College	HVAC	Energy Efficiency	Schnecksville
Construction Technology A.A.S. (COT)	Lehigh Carbon Community College	Community/Junior College	Construction	Energy Efficiency	Schnecksville
Construction Technology Certificate (CONC)	Lehigh Carbon Community College	Community/Junior College	Construction	Energy Efficiency	Schnecksville
Mechanical Engineering Technology A.A.S. (MEC)	Lehigh Carbon Community College	Community/Junior College	Engineering	Energy Efficiency	Schnecksville
Electrical Technology	Lehigh Career and Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	Schnecksville
Heating / Air Conditioning & Refrigeration	Lehigh Career and Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	Schnecksville
HVAC - Adult Education	Lehigh Career and Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	Schnecksville
Residential Wiring & Electricity	Lehigh Career and Technical Institute	Vocational/Technical School	Electrical	Grid Modernization & Energy Storage	Schnecksville
HVACR Technician Fast Track	Lenape Tech Adult and Continuing Education	Community/Junior College	HVAC	Energy Efficiency	Ford City
Natural Resources Management	Lenape Technical High School	Vocational/Technical School	Energy Management	Renewable Energy Generation	Ford City
Construction Trades Technology	Lenape Technical High School	Vocational/Technical School	Construction	Energy Efficiency	Ford City
Electrical Construction Technology 1 Semester Program	Luzerne County Community College	Community/Junior College	Electrical	Energy Efficiency	Nanticoke
Electrical Construction Technology 1YR Program	Luzerne County Community College	Community/Junior College	Electrical	Energy Efficiency	Nanticoke
Electrical Construction Technology 2YR Program	Luzerne County Community College	Community/Junior College	Electrical	Energy Efficiency	Nanticoke
HVAC	Luzerne County Community College	Community/Junior College	HVAC	Energy Efficiency	Nanticoke
Electronics Engineering Technology	Luzerne County Community College	Community/Junior College	Engineering	Energy Efficiency	Nanticoke

Specialization in Electronics Engineering	Luzerne County Community College	Community/Junior College	Engineering	Energy Efficiency	Nanticoke
Heating and Air Conditioning Technology	Luzerne County Community College	Community/Junior College	HVAC	Energy Efficiency	Nanticoke
Sustainable Energy Technology	Luzerne County Community College	Community/Junior College	Energy Management	Renewable Energy Generation	Nanticoke
Construction	Lycoming Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Hughesville
Engineering	McKeesport Career and Technology Center	Vocational/Technical School	Engineering	Energy Efficiency	McKeesport
Electrical Occupations	Mercer County Career Center	Vocational/Technical School	Electrical	Energy Efficiency	Mercer
OSHA Training in Construction Industry 10 Hour	Mid-Atlantic Construction Safety Council	Trade Association	Construction	Energy Efficiency	Philadelphia
OSHA Training in Construction Industry 30 Hour	Mid-Atlantic Construction Safety Council	Trade Association	Construction	Energy Efficiency	Philadelphia
Electrical	Middle Bucks Institute of Technology	Vocational/Technical School	Electrical	Energy Efficiency	Jamison
HVAC	Middle Bucks Institute of Technology	Vocational/Technical School	HVAC	Energy Efficiency	Jamison
HVAC (Adult Night Program)	Middle Bucks Institute of Technology	Vocational/Technical School	HVAC	Energy Efficiency	Jamison
Construction Technology	Mon Valley Career and Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Speers
Electrical Power Technology	Mon Valley Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Speers
HVAC	Monroe Career and Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	Bartonsville
Electronics Technology (Engineering)	Monroe Career and Technical Institute	Vocational/Technical School	Engineering	Energy Efficiency	Bartonsville
Electrical Technology	Monroe Career and Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	Bartonsville
Engineering Technology	Montgomery County Community College	Community/Junior College	Engineering	Energy Efficiency	Blue Bell
A New Approach to Advanced Energy Storage	Morningstar Corporation	Manufacturer	Energy Storage	Grid Modernization & Energy Storage	Newtown
Get to know the newest technology in advanced solar inverter/chargers	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Management and data operations focused course	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Morningstar MultiWave inverter/charger--advanced programming	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown

Morningstar Solar Charge Controllers & Inverters	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Morningstar's Inverter-Charger for Off-grid Power & Backup/UPS	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Remote Communications with Morningstar LiveView	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Solar Charge Controllers & Inverters How to Choose the Right Controller tech	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Ten Things You Need to Know About MPPT Controllers	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
TriStar MPPT Charge Controller Design for Off-Grid and Grid-Tie Retrofit	Morningstar Corporation	Manufacturer	Solar	Renewable Energy Generation	Newtown
Electrical	New Castle School of Trades	Community/Junior College	Electrical	Energy Efficiency	New Castle
Refrigeration & A/C Technology program	New Castle School of Trades	Community/Junior College	HVAC	Energy Efficiency	New Castle
Industrial Electro-Mechanical Technology program	New Castle School of Trades	Community/Junior College	HVAC	Energy Efficiency	New Castle
Electrical and Industrial Maintenance program	New Castle School of Trades	Community/Junior College	HVAC	Energy Efficiency	New Castle
HVAC	North Montco Technical Career Center	Vocational/Technical School	HVAC	Energy Efficiency	Fairless Hills
Electrical Construction I	North Montco Technical Career Center	Vocational/Technical School	Electrical	Energy Efficiency	Lanedale
Electrical Construction II	North Montco Technical Career Center	Vocational/Technical School	Electrical	Energy Efficiency	Lanedale
OSHA 10-Hour Construction Outreach Training Program	Northampton Community College	Community/Junior College	Construction	Energy Efficiency	Monroe
OSHA 30-Hour Construction Outreach Training Program	Northampton Community College	Community/Junior College	Construction	Energy Efficiency	Monroe
Electrical Technology	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Electrical Technology	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Electrical Technology	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Electromechanical Technology Automated Systems	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Machine Repair - Automated Systems	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe

Electronics Technology Associate Degree	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Electronics Technology Specialized Diploma	Northampton Community College	Community/Junior College	Electrical	Energy Efficiency	Monroe
Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) Technology, Associate in Applied Science	Northampton Community College	Community/Junior College	HVAC	Energy Efficiency	Monroe
Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) Technology, Certificate	Northampton Community College	Community/Junior College	HVAC	Energy Efficiency	Monroe
Heating, Ventilation and Air Conditioning (HVAC) Technology, Specialized Diploma	Northampton Community College	Community/Junior College	HVAC	Energy Efficiency	Monroe
Building Construction Trades	Northern Tier Career Center	Vocational/Technical School	Construction	Energy Efficiency	Towanda
HVAC	Northern Tier Career Center	Vocational/Technical School	HVAC	Energy Efficiency	Towanda
HVAC	Northern Westmoreland Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	New Kensington
Electrical Construction	Northumberland County Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Fairview-Ferndale
Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology	Orleans Technical Institute	Community/Junior College	HVAC	Energy Efficiency	Philadelphia
Residential and Commercial Electricity	Orleans Technical Institute	Community/Junior College	Electrical	Energy Efficiency	Philadelphia
HVACR	Parkway West Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Oakdale
Electrical Systems Technology	Parkway West Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Oakdale
Heating, Ventilation, Air Conditioning, and Refrigeration	Penn Commercial Business/Technical School	Community/Junior College	HVAC	Energy Efficiency	Washington
Electrical - Specialized Electrician Program (Day Program)	Penn Commercial Business/Technical School	Community/Junior College	Electrical	Energy Efficiency	Washington
Electrical - Specialized Electrician Program (Evening Program)	Penn Commercial Business/Technical School	Community/Junior College	Electrical	Energy Efficiency	Washington
Energy and Sustainability Policy	Penn State	4-Year College or University	Policy	Renewable Energy Generation	University Park



Energy and Sustainability Policy	Penn State	4-Year College or University	Policy	Renewable Energy Generation	University Park
Sustainability Management and Policy	Penn State	4-Year College or University	Policy	Renewable Energy Generation	University Park
Solar Energy	Penn State	4-Year College or University	Solar	Renewable Energy Generation	University Park
Renewable Energy and Sustainability Systems	Penn State	4-Year College or University	General Clean Energy	Renewable Energy Generation	University Park
Energy Management and Policy	Penn State	4-Year College or University	Energy Management	Energy Efficiency	State College
Graduate Automotive Technology Education (GATE) Program	Penn State	4-Year College or University	Engineering	Alternative Transportation	State College
Electrician	Pennco Tech	Vocational/Technical School	Electrical	Energy Efficiency	Bristol
Heating, Ventilation, Air Conditioning & Refrigeration	Pennco Tech	Vocational/Technical School	HVAC	Energy Efficiency	Bristol
Electrical Construction (A.A.S.)	Pennsylvania College of Technology	Community/Junior College	Electrical	Energy Efficiency	Williamsport
Heating, Ventilation & Air Conditioning Design Technology (B.S.)	Pennsylvania College of Technology	Community/Junior College	HVAC	Energy Efficiency	Williamsport
Heating, Ventilation & Air Conditioning Technology (A.A.S.)	Pennsylvania College of Technology	Community/Junior College	HVAC	Energy Efficiency	Williamsport
Electrical Technology	Pennsylvania College of Technology	Community/Junior College	Electrical	Energy Efficiency	Williamsport
Engineering Design Technology	Pennsylvania College of Technology	Community/Junior College	Engineering	Energy Efficiency	Williamsport
BPI Building Analyst (with Certification Exams)	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Williamsport
BPI Multifamily Building Analyst	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Williamsport
Weatherization (QCI)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Williamsport
BPI Building Analyst (with Certification Exams)	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Latrobe
BPI Multifamily Building Analyst	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Latrobe
Weatherization (QCI)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Latrobe
Accelerated Weatherization Tactics (HEP 149)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Williamsport
Accelerated Weatherization Tactics (HEP 149)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Latrobe

ASHRAE 62.2-2016 (HEP 310)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Williamsport
ASHRAE 62.2-2016 (HEP 310)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Latrobe
Blower Door and Pressure Diagnostics (HEP 220)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Williamsport
Blower Door and Pressure Diagnostics (HEP 220)	Pennsylvania College of Technology	Community/Junior College	Weatherization	Energy Efficiency	Latrobe
NSSC Home Energy Professional Training Program	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Williamsport
NSSC Home Energy Professional Training Program	Pennsylvania College of Technology	Community/Junior College	Building Analyst	Energy Efficiency	Latrobe
Electric Utility Technology	Pennsylvania Highlands Community College	Community/Junior College	Electrical	Energy Efficiency	Johnstown
Energy Job Training	Philadelphia OIC	Non-Profit Organization	Solar	Renewable Energy Generation	Philadelphia
HVACR	Pittsburgh Public Schools - Allderdice HS	Vocational/Technical School	HVAC	Energy Efficiency	Pittsburgh
Engineering Technology	Pittsburgh Public Schools - Allderdice HS	Vocational/Technical School	Engineering	Energy Efficiency	Pittsburgh
HVAC Technology	Pittsburgh Technical College	Community/Junior College	HVAC	Energy Efficiency	Oakdale
Smart Building Technology	Pittsburgh Technical College	Community/Junior College	Energy Management	Energy Efficiency	Oakdale
Troubleshooting Low Voltage Wiring	PPATEC	Trade Association	Electrical	Energy Efficiency	Middletown
Advanced A/C & Heat Pump Troubleshooting	PPATEC	Trade Association	Electrical	Energy Efficiency	Middletown
Intro to Air Conditioning (4 Day Class)	PPATEC	Trade Association	Electrical	Energy Efficiency	Middletown
EPA 608 Certification Prep & Test	PPATEC	Trade Association	Electrical	Energy Efficiency	Middletown
OSHA 30 Hour Construction	Professional Training Associates	Private Consulting/Training Firm	Construction	Energy Efficiency	Duquesne
HVACR Certified Technician	Reading Area Community College	Community/Junior College	HVAC	Energy Efficiency	Reading
Engineering and Automation Technology	Reading Muhlenberg Career and Technology Center	Vocational/Technical School	Engineering	Energy Efficiency	Reading
Electrical Technology	Reading Muhlenberg Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Reading
Electrical Technology	Rosedale Technical College	Community/Junior College	Electrical	Energy Efficiency	Pittsburgh
Electrical Training (Evening Program)	Rosedale Technical College	Community/Junior College	Electrical	Energy Efficiency	Pittsburgh
HVAC	Rosedale Technical College	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh

HVAC (Evening Program)	Rosedale Technical College	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
Environmental Engineering - Renewable Energy Concentration	Saint Francis University	4-Year College or University	General Clean Energy	Renewable Energy Generation	Loretto
Electro-Mechanical Technology	Schuylkill Technology Center	Vocational/Technical School	Engineering	Energy Efficiency	Frackville
Electronics Technology	Schuylkill Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Frackville
Residential/Industrial Electricity	Schuylkill Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Frackville
Plumbing and Heating Technology	Schuylkill Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Frackville
Engineering Technology	Seneca Highlands Career and Technical Center	Vocational/Technical School	Engineering	Energy Efficiency	Port Allegany
Building Construction Occupations	Seneca Highlands Career and Technical Center	Vocational/Technical School	Construction	Energy Efficiency	Port Allegany
Electrical Occupations	Somerset County Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Somerset
Electrical Construction	Steel Center for CTE	Vocational/Technical School	Electrical	Energy Efficiency	Jefferson Hills
HVACR	Steel Center for CTE	Vocational/Technical School	HVAC	Energy Efficiency	Jefferson Hills
Electrical Systems Technology (Adult Education Program)	SUN Area Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	New Berlin
Electrical Systems Technology (Co-Op Program)	SUN Area Technical Institute	Vocational/Technical School	Electrical	Energy Efficiency	New Berlin
HVAC (Adult Education Program)	SUN Area Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	New Berlin
HVAC (Co-Op Program)	SUN Area Technical Institute	Vocational/Technical School	HVAC	Energy Efficiency	New Berlin
Building Property Maintenance Program	Susquehanna County Career & Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Springville
Engineering & Robotics	Technical College High School Pennock's Bridge Campus	Vocational/Technical School	Engineering	Energy Efficiency	West Grove
Bachelor of Science in Construction Engineering Technology (BSCET)	Temple University	4-Year College or University	Construction	Energy Efficiency	Philadelphia
Bachelor of Science in Construction Engineering Technology (BSCET)	Temple University	4-Year College or University	Construction	Energy Efficiency	Philadelphia
Engineering Technology	Temple University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Civil Engineering	Temple University	4-Year College or University	Engineering	Grid Modernization & Energy Storage	Philadelphia
Electrical Engineering	Temple University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia

Industrial and Systems Engineering	Temple University	4-Year College or University	Engineering	Energy Efficiency	Philadelphia
Environmental Engineering Major	Temple University	4-Year College or University	Engineering	Renewable Energy Generation	Philadelphia
Electrical Construction and Maintenance	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Heating, Air Conditioning, Ventilation and Refrigeration Maintenance Technology	Thaddeus Stevens College of Technology	Community/Junior College	HVAC	Energy Efficiency	Lancaster
Applied Science in Electrical Technology	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Electro-Mechanical Technology	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Electronic Engineering Technology	Thaddeus Stevens College of Technology	Community/Junior College	Engineering	Energy Efficiency	Lancaster
Engineering Computer-Aided Drafting (ECAD) Technology	Thaddeus Stevens College of Technology	Community/Junior College	Engineering	Energy Efficiency	Lancaster
Mechanical Engineering Technology	Thaddeus Stevens College of Technology	Community/Junior College	Engineering	Energy Efficiency	Lancaster
Construction Electrician	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Facilities Maintenance Technician	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Basic Industrial Maintenance Program	Thaddeus Stevens College of Technology	Community/Junior College	Electrical	Energy Efficiency	Lancaster
Plumbing and Heating program	The Career Technology Center of Lackawanna County	Vocational/Technical School	HVAC	Energy Efficiency	Scranton
Building Mechanics Trades program	The Career Technology Center of Lackawanna County	Vocational/Technical School	Construction	Energy Efficiency	Scranton
Electrical Construction and Maintenance	The Career Technology Center of Lackawanna County	Vocational/Technical School	Electrical	Energy Efficiency	Scranton
HVAC	Triangle Tech	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
HVAC	Triangle Tech	Community/Junior College	HVAC	Energy Efficiency	Greensburg
Maintenance Electricity & Construction Technology	Triangle Tech	Community/Junior College	Electrical	Energy Efficiency	Pittsburgh
Maintenance Electricity & Construction Technology	Triangle Tech	Community/Junior College	Electrical	Energy Efficiency	Greensburg
Maintenance Electricity &	Triangle Tech	Community/Junior College	Electrical	Energy Efficiency	DuBois

Construction Technology					
Maintenance Electricity & Construction Technology	Triangle Tech	Community/Junior College	Electrical	Energy Efficiency	Sunbury
Maintenance Electricity & Construction Technology	Triangle Tech	Community/Junior College	Electrical	Energy Efficiency	Bethlehem
Maintenance Electricity & Construction Technology program	Triangle Tech, Inc	Community/Junior College	Electrical	Energy Efficiency	Pittsburgh
Maintenance Electricity & Construction Technology program	Triangle Tech, Inc	Community/Junior College	Electrical	Energy Efficiency	Sunbury
Maintenance Electricity & Construction Technology program	Triangle Tech, Inc	Community/Junior College	Electrical	Energy Efficiency	Greensburg
Maintenance Electricity & Construction Technology program	Triangle Tech, Inc	Community/Junior College	Electrical	Energy Efficiency	Bethlehem
Refrigeration, Heating, Ventilation, & Air Conditioning Technology	Triangle Tech, Inc	Community/Junior College	HVAC	Energy Efficiency	Pittsburgh
Refrigeration, Heating, Ventilation, & Air Conditioning Technology	Triangle Tech, Inc	Community/Junior College	HVAC	Energy Efficiency	Greensburg
Carpentry & Construction Technology	Triangle Tech, Inc	Community/Junior College	Construction	Energy Efficiency	Bethlehem
Carpentry & Construction Technology	Triangle Tech, Inc	Community/Junior College	Construction	Energy Efficiency	Sunbury
Carpentry & Construction Technology	Triangle Tech, Inc	Community/Junior College	Construction	Energy Efficiency	Pittsburgh
Energy Science and Technology	University of Pittsburgh	4-Year College or University	General Clean Energy	Renewable Energy Generation	Bradford
Construction Technology	Upper Bucks County Technical School	Vocational/Technical School	Construction	Energy Efficiency	Perkasie
Electrical Technology	Upper Bucks County Technical School	Vocational/Technical School	Electrical	Energy Efficiency	Perkasie
HVACR	Upper Bucks County Technical School	Vocational/Technical School	HVAC	Energy Efficiency	Perkasie
Mechatronics (Electromechanical Engineering)	Upper Bucks County Technical School	Vocational/Technical School	Engineering	Energy Efficiency	Perkasie

HVAC	Venango Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Oil City
Electronics/Electricity	Venango Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Oil City
Building Construction Technology	Venango Technology Center	Vocational/Technical School	Construction	Energy Efficiency	Oil City
MS in Sustainable Engineering - Renewable Energy Track	Villanova	4-Year College or University	General Clean Energy	Renewable Energy Generation	Villanova
Electronics Technology	Warren County Career Center	Vocational/Technical School	Electrical	Energy Efficiency	Warren
Building Construction Occupations	Warren County Career Center	Vocational/Technical School	Construction	Energy Efficiency	Warren
Electrical Occupation	West Side Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Kingston
HVAC	West Side Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Kingston
Electrical	Western Area Career & Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Canonsburg
Electrical (Adult Program)	Western Area Career & Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Canonsburg
HVAC	Western Area Career & Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Canonsburg
HVAC (Adult Education Program/Evening)	Western Area Career & Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Canonsburg
Electrical Occupations	Western Montgomery Career and Technology Center	Vocational/Technical School	Electrical	Energy Efficiency	Royerford
HVAC	Western Montgomery Career and Technology Center	Vocational/Technical School	HVAC	Energy Efficiency	Royerford
Electrical - Western Pennsylvania Electrical Apprenticeship Program	Western Pennsylvania Electrical JATC and the Community College of Allegheny County (CCAC)	Union	Electrical	Energy Efficiency	Pittsburg
Heating, Ventilation, Air-Conditioning and Refrigeration (HVACR)	Westmoreland County Community College	Community/Junior College	HVAC	Energy Efficiency	Mt. Pleasant
Heating, Ventilation, Air-Conditioning and Refrigeration (HVACR)	Westmoreland County Community College	Community/Junior College	HVAC	Energy Efficiency	Mt. Pleasant
Heating, Ventilation, Air-Conditioning and Refrigeration (HVACR)	Westmoreland County Community College	Community/Junior College	HVAC	Energy Efficiency	Mt. Pleasant
Electrical Construction	Wilkes-Barre Area Career and Technical Center	Vocational/Technical School	Electrical	Energy Efficiency	Wilkes-Barre
HVACR	Wilkes-Barre Area Career and Technical Center	Vocational/Technical School	HVAC	Energy Efficiency	Wilkes-Barre
Power Plant Technology	Williamson College of the Trades	Community/Junior College	General Clean Energy	Renewable Energy Generation	Media
Electrician Apprenticeships for	Williamsport Joint Apprenticeship and Training Committee	Union	Electrical	Energy Efficiency	Montoursville

the Construction Industry					
Engineering and Advanced Manufacturing	York County School of Technology	Vocational/Technical School	Engineering	Energy Efficiency	York
Electrical Occupations	York County School of Technology	Vocational/Technical School	Electrical	Energy Efficiency	York
HVAC	York County School of Technology	Vocational/Technical School	HVAC	Energy Efficiency	York
HVAC - Adult Ed Dip	York County School of Technology	Vocational/Technical School	HVAC	Energy Efficiency	York
Pre-Apprenticeship Program	York Electrical Institute/IBEW local 228	Union	Electrical	Energy Efficiency	York
Pre-Apprenticeship Programs - Interim Credentials	York Electrical Institute/IBEW local 229	Union	Electrical	Energy Efficiency	York
HVACR	YTI Career Institute	Community/Junior College	HVAC	Energy Efficiency	York
Electrical Technology	YTI Career Institute	Community/Junior College	Electrical	Energy Efficiency	York
Electronics Engineering Technology	YTI Career Institute	Community/Junior College	Engineering	Energy Efficiency	York