



2021 Pennsylvania Clean Energy Employment Report

Table of Contents

Table of Contents	i
Executive Summary	1
Introduction.....	2
Pennsylvania Clean Energy Industry Overview.....	4
Overall Clean Energy Jobs	4
Full-Time Equivalent Clean Energy Jobs	7
Clean Energy Value Chain Employment	9
Detailed Clean Energy Sector Employment.....	11
Energy Efficiency	11
Clean Energy Generation	14
Alternative Transportation.....	17
Clean Grid & Storage.....	20
Clean Fuels	22
Clean Energy Hiring & COVID-19 Impacts.....	24
Clean Energy Demographics.....	28
Appendix A: Clean Energy Technology List.....	29
Appendix B: Research Methodology	31
Appendix C: Clean Energy Jobs by County.....	32

Executive Summary

At the end of 2020, there were just over 90,000 clean energy workers across Pennsylvania. Clean energy jobs in Pennsylvania declined by 7.4 percent compared to the 2020 Pennsylvania Clean Energy Employment report.¹ The shock of the global Coronavirus (COVID-19) pandemic resulted in job losses across the state. Overall, Pennsylvania's labor market declined by 6.3 percent—a loss of 376,217 jobs. The clean energy sector shed roughly 7,200 workers, representing almost two percent of total jobs lost between 2019 and 2020. The majority of job losses were concentrated in March through May, with modest employment growth witnessed throughout the remainder of 2020 from June through December. Between the last quarter of 2020 and the first quarter of 2021, Pennsylvania's clean energy industry continued its rebound, growing by just under one percent in three months. This steady economic recovery signals that the clean energy economy will likely continue to see growth throughout the remainder of 2021.

The following are key findings from this year's 2021 Pennsylvania Clean Energy Employment Report:

Clean energy employment declines in Pennsylvania were lower compared to the nationwide clean energy labor market and other clean energy economies in the Northeast. Between 2019 and 2020, clean energy employment in Pennsylvania declined by 7.4 percent. The state's clean energy labor market fared better compared to an overall nationwide decline of 9.1 percent in clean energy employment. Similarly, Pennsylvania's clean energy sector experienced a smaller percent decline compared to other states in the region, such as Massachusetts and Rhode Island.

Mirroring national trends, electric vehicle employment grew between 2019 and 2020. In fact, electric vehicles were the only sub-technology in Pennsylvania that had employment growth from 2019 through 2020. These firms created 125 new jobs for a growth rate of 7 percent in 12 months. By comparison, electric vehicle jobs grew across the nation by 7.8 percent, resulting in roughly 6,000 new jobs total.

Despite economywide job losses, employment in solar and alternative transportation remained fairly steady throughout 2020, while clean energy generation manufacturing and wholesale trade grew slightly. Changes for solar and alternative transportation fell within the margin of error, at less than 1 percent decline for each, indicating that total employment across solar and alternative transportation firms was relatively unchanged between the last quarters of 2019 and 2020. In fact, Pennsylvania's solar jobs market remained steady despite a nationwide decline of 8 percent, or almost 28,000 jobs lost. Clean energy generation manufacturing grew by 2.1 percent, or about 70 jobs, while wholesale trade also saw a slight increase of almost 80 jobs—a growth of 5.7 percent.

The energy efficiency sector saw the largest decline in employment between 2019 and 2020. These firms collectively lost more than 6,000 jobs—a decline of 8.5 percent in 12 months. Within the energy efficiency sector, employment losses were fairly evenly distributed across each of the sub-technologies: traditional HVAC, high efficiency HVAC and renewable heating and cooling, advanced materials, and ENERGY STAR® and efficient lighting technologies. By value chain² segment, energy efficiency construction

¹ The 2020 Pennsylvania Clean Energy Employment Report is based on data collected in Q4 2019.

² For more information and a description of value chain segments, please refer to page 9 of this report.

lost the most jobs, shedding about 4,000 workers, for a decline of 10.3 percent for energy efficiency construction jobs between 2019 and 2020.

Pennsylvania's clean energy sector is more diverse compared to statewide averages. Hispanic or Latinx workers account for 12.8 percent of the clean energy labor force, compared to only 6.4 percent of the statewide workforce. Similarly, 10.6 percent of clean energy workers in Pennsylvania were Veterans of the U.S. Armed Forces compared to a 4.6 percent statewide average. Asian workers are also more highly represented compared to the overall workforce. Almost six percent of the clean energy labor force are Asian workers, compared to 3.7 percent in the statewide labor market.

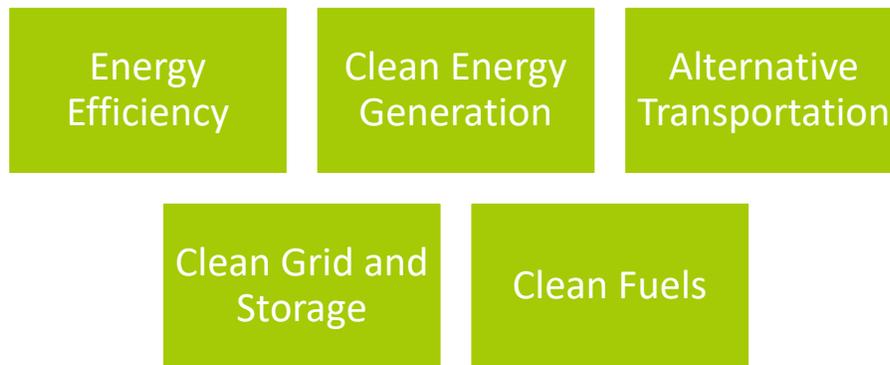
By the end of 2020, the majority of firms had brought back the workers they had furloughed or laid off. The majority of job losses occurred from March through May 2020, with steady job gains throughout the remainder of the year from June through December 2020. In fact, of surveyed clean energy employers that reported having to lay off or furlough staff as a result of COVID-19, about nine in ten (87 percent) reported that they had since brought back these workers by the end of 2020. Between the last quarter of 2020 and the first quarter of 2021, clean energy employment continued to grow by just under one percent.

Introduction

The Pennsylvania Department of Environmental Protection (DEP) commissioned BW Research to produce this follow-up to the 2020 Clean Energy Employment Report, tracking clean energy jobs across the state for each major technology sector featured in Figure 1 and their component sub-technologies.³ In addition to job estimates by technology and sub-technology, the report details clean energy employment by value chain segment and county. This year's report follows the global Coronavirus (COVID-19) pandemic; together with historical clean energy employment figures, 2020 data provides valuable information on the impacts of the pandemic-induced economic recession on Pennsylvania's clean energy labor market.

All data are based on the 2021 United States Energy and Employment Report (USEER) data collection effort, a joint project of the National Association of State Energy Officials and the Energy Futures Initiative.⁴ For a broader analysis of all energy-related employment, across both fossil fuel and renewable energy resources, please refer to the 2021 Pennsylvania Energy Employment Report.

FIGURE 1. CLEAN ENERGY SECTORS



About the Pennsylvania Department of Environmental Protection & Energy Programs Office

The DEP works to protect the state's air, land, and water from pollution; restore these natural resources; and provide for Pennsylvanians' health and safety through a cleaner environment. Advancing this mission, the DEP Energy Programs Office is the primary entity under the Governor's jurisdiction responsible for programs that promote knowledge and use of energy efficiency and energy conservation technologies as well as indigenous, clean, alternative fuels, including energy production and use technologies.

One of the core functions of the Energy Programs Office is to work with partners to gather data and develop resources to help policy makers, planners, and other leaders in Pennsylvania make informed and best-outcome energy decisions. To inform statewide planning and decision-making, BW Research was commissioned to build upon last year's Clean Energy Industry Report.

³ Clean energy employment is defined by the Energy Programs Office. For a list of sub-technologies that are considered clean energy-related for the purposes of this report, please refer to Appendix A.

⁴ <https://www.usenergyjobs.org/>

About BW Research Partnership

BW Research is a full-service consulting and research firm that specializes in workforce and economic development for public entities, including workforce investment boards, economic development agencies, cities, counties, and educational institutions. BW Research has substantial experience in developing customized research projects and a deep understanding of the clean energy sector and its employers, workforce, and supply chain dynamics. BW Research has designed and conducted over 500 studies for public, private, and not-for-profit agencies throughout the United States and internationally.

Acknowledgments: This material is based upon work supported by the United States Department of Energy, Office of Energy Efficiency and Renewable Energy, under State Energy Program Award Number EE0008293.

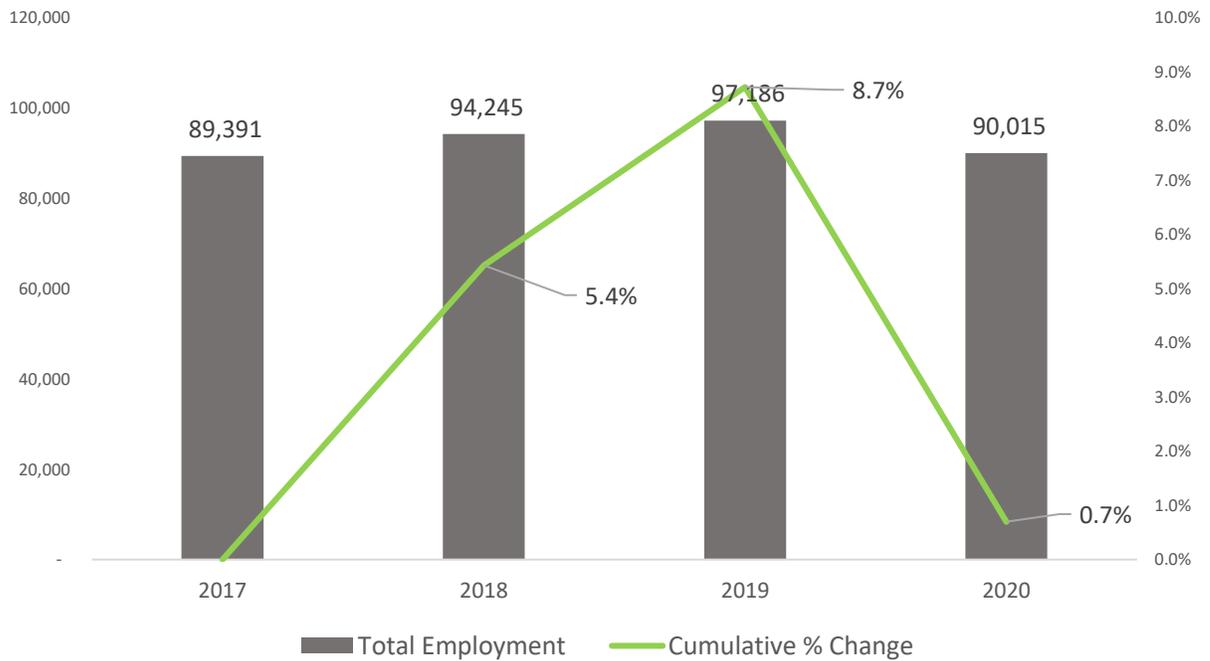
Pennsylvania Clean Energy Industry Overview

Overall Clean Energy Jobs

At the end of 2020, the clean energy labor market in Pennsylvania totaled just over 90,000 workers. Compared to 2017, clean energy jobs grew by almost one percent over three years. However, between 2019 and 2020, clean energy firms shed almost 7,200 jobs for a decline of 7.4 percent in 12 months.

Job losses in the clean energy sector are comparable to the overall statewide economy. From 2019 through 2020, according to latest available data from the Bureau of Labor Statistics, the statewide labor market declined by 6.3 percent—a loss of about 376,200 jobs. The clean energy sector accounted for roughly two percent of the roughly 376,200 total job losses.⁵

FIGURE 2. CLEAN ENERGY EMPLOYMENT IN PENNSYLVANIA, 2017-2020

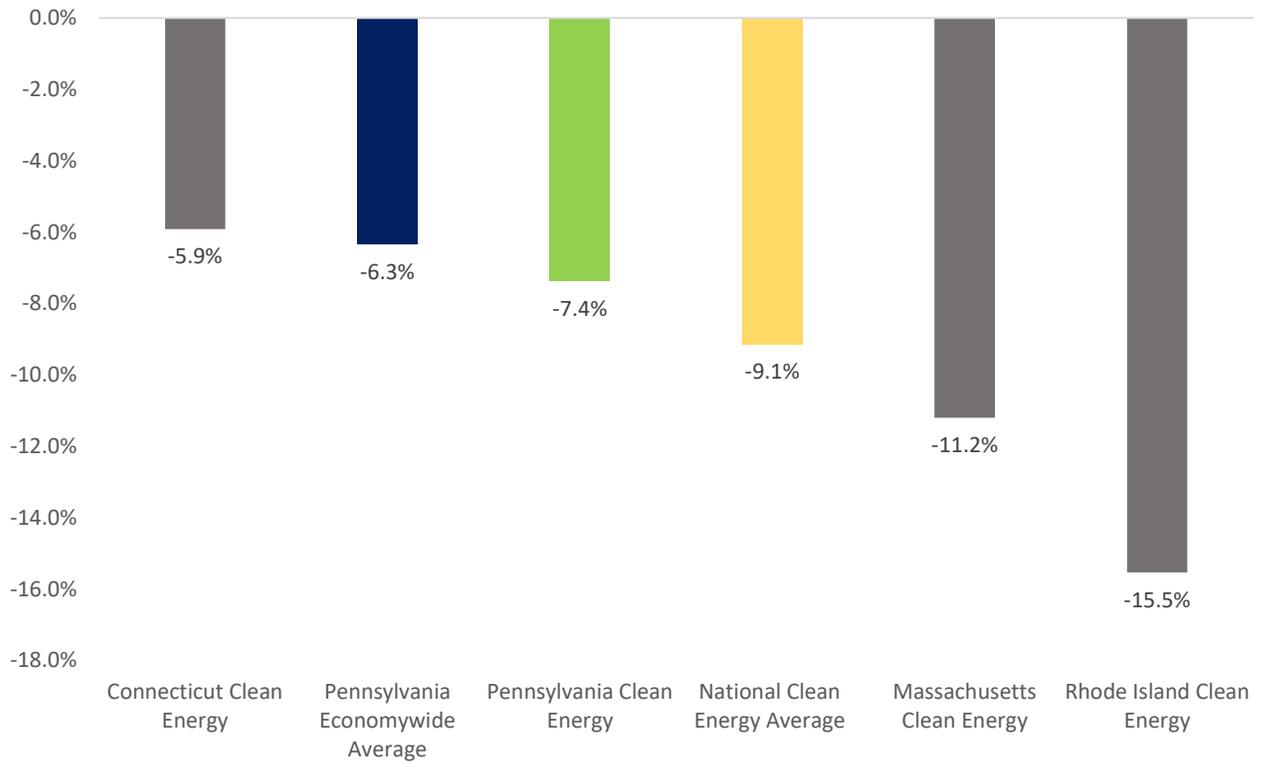


⁵ Total state-level employment is from the Bureau of Labor Statistics, Quarterly Census of Employment and Wages. Data was accessed in May 2021.

Clean energy employment losses in Pennsylvania were slightly lower compared to the national clean energy average and other states in the region, such as Massachusetts and Rhode Island. Nationally, clean energy jobs declined by 9.1 percent, compared to a rate of 7.4 percent in Pennsylvania. In Massachusetts and Rhode Island, clean energy employment declined by upwards of 11 percent.

Clean energy job loss in Pennsylvania was one percentage point higher than the state’s economywide job loss of 6.3 percent.

FIGURE 3. EMPLOYMENT CHANGE COMPARISONS, 2019-2020

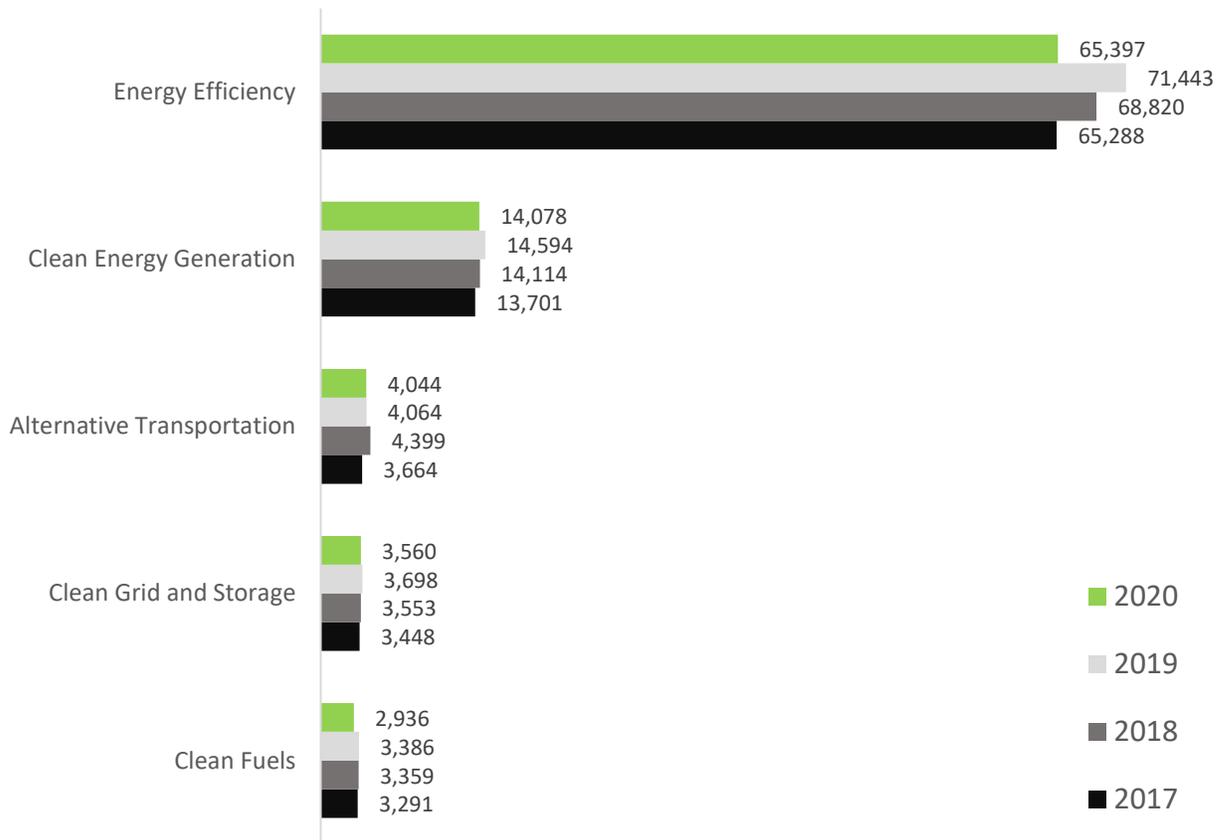


All clean energy technology sectors were hit by job losses during the pandemic, with the energy efficiency sector experiencing the largest absolute job losses while the clean fuels sector had the greatest relative job losses.

In total, energy efficiency firms shed just over 6,000 jobs between the last quarters of 2019 and 2020—a decline of 8.5 percent. The clean fuels sector saw employment decline by 13.3 percent or 450 jobs, while clean energy generation firms shed just over 500 workers for a decline of 3.5 percent.

Clean grid and storage firms lost about 140 jobs—a 3.7 percent decline while the alternative transportation sector remained fairly flat with less than percent of job losses.⁶

FIGURE 4. CLEAN ENERGY EMPLOYMENT BY SECTOR, 2017-2020



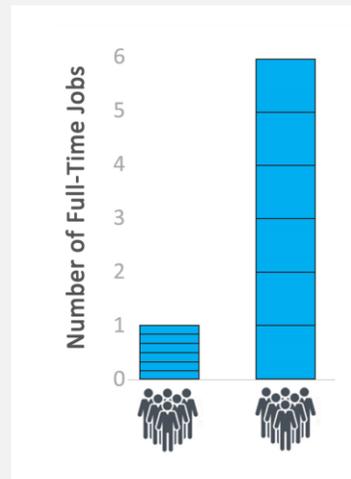
⁶ The change in employment for alternative transportation is within the margin of error and thus can be considered relatively flat or no change in employment from 2019 to 2020.

Full-Time Equivalent Clean Energy Jobs

Full-time equivalent (FTE) clean energy jobs represent a subset of total clean energy jobs from Figure 2 in the previous section. FTE jobs are a useful metric to identifying the extent of clean energy activity—installation, manufacturing, trade, or professional services—going on in a state. An increase in FTE jobs indicates that more clean energy workers are dedicating an increasing amount of their work week, or labor hours, to clean energy-specific activities. For instance, a traditional HVAC worker might have spent only a quarter of their work week installing or maintaining energy efficient HVAC technologies in 2017. But due to a growing demand for efficient heat pumps, that traditional HVAC worker would likely now be spending the majority of labor hours in a work week installing high efficiency heat pumps. This increase in clean energy-related activity per worker translates to more full-time equivalent clean energy jobs.⁷

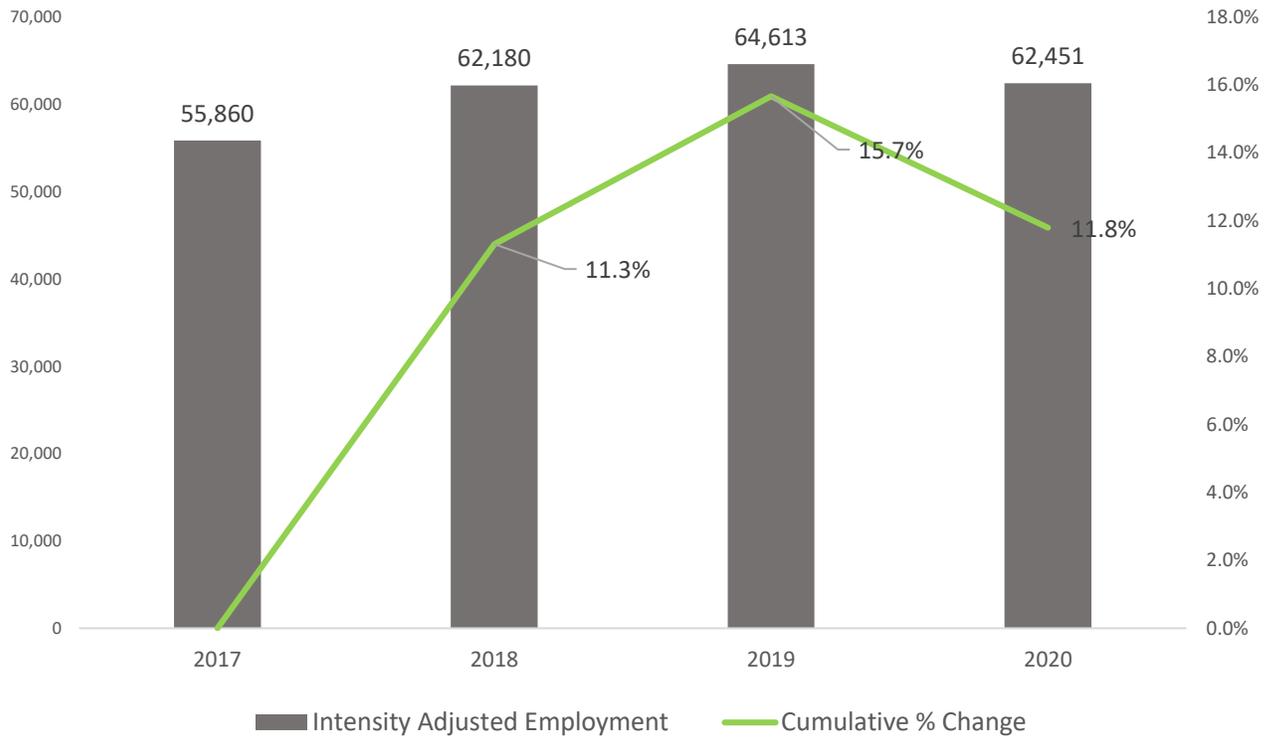
Between 2019 and 2020, FTE clean energy workers declined by 3.3 percent, or almost 2,200 jobs. Compared to 2017, however, FTE clean energy jobs remained almost 12 percent above the 2017 baseline.

An example can illustrate the importance of tracking FTE clean energy employment. If an HVAC firm had 6 installers in 2018 who occasionally installed heat pumps, and now has 6 installers who exclusively do so, there would be no change in the total number of clean energy workers reported. However, because the number of labor hours working with heat pumps has increased, FTE jobs would show a corresponding increase.



⁷ This metric measures the proportion of total labor hours dedicated to clean energy activities and is unrelated to the total number of hours worked in a week. A part-time clean energy employee who works 20 hours a week with 100 percent of these hours dedicated to clean energy activities would be counted as one FTE clean energy job.

FIGURE 5. INTENSITY-ADJUSTED CLEAN ENERGY EMPLOYMENT (FULL-TIME EQUIVALENT WORKERS), 2017-2020⁸



⁸ FTE clean energy jobs were extrapolated using a combination of state-level and census region data and weighted according to how much time workers were reported to spend on clean energy activities (0-49 percent, 50-99 percent, or 100 percent). For a full description of this methodology, please refer to Appendix B.

Clean Energy Value Chain Employment

Value chain jobs examine the clean energy economy by identifying the industries in which clean energy activities are concentrated in Pennsylvania. Doing so provides context for what type of policy or workforce development assistance is needed to support clean energy employers across the state. For example, a state with a high concentration of research and development activity in the alternative transportation sector might signal the need for more early-stage investment funding to support continued prototype development and technology testing. The major value chain segments examined include construction⁹, manufacturing¹⁰, wholesale trade¹¹, professional and business services¹², other services¹³, and utilities.

Construction and manufacturing continue to account for the majority of clean energy activity in the state (see Figure 6). Between 2019 and 2020, these two sectors saw the most job losses. The job losses in clean energy construction are related to the energy efficiency job losses experienced in the state. Just over half (53 percent) of all jobs in the energy efficiency sector are found in the construction industry. As such, the job losses in energy efficiency were mostly experienced in the construction segment of energy efficiency work. Overall, clean energy construction in Pennsylvania declined by just over 4,400 jobs, or 9.7 percent between 2019 and 2020. Clean energy manufacturing firms declined by 5.6 percent, a loss of almost 1,200 jobs, followed by professional and business services which declined by 6.6 percent or about 730 jobs.

⁹ Construction is comprised of all workers engaged in residential, commercial, and industrial building construction, contracting and electrical work, insulation and weatherization, or plumbing and heating, air conditioning, and ventilation work.

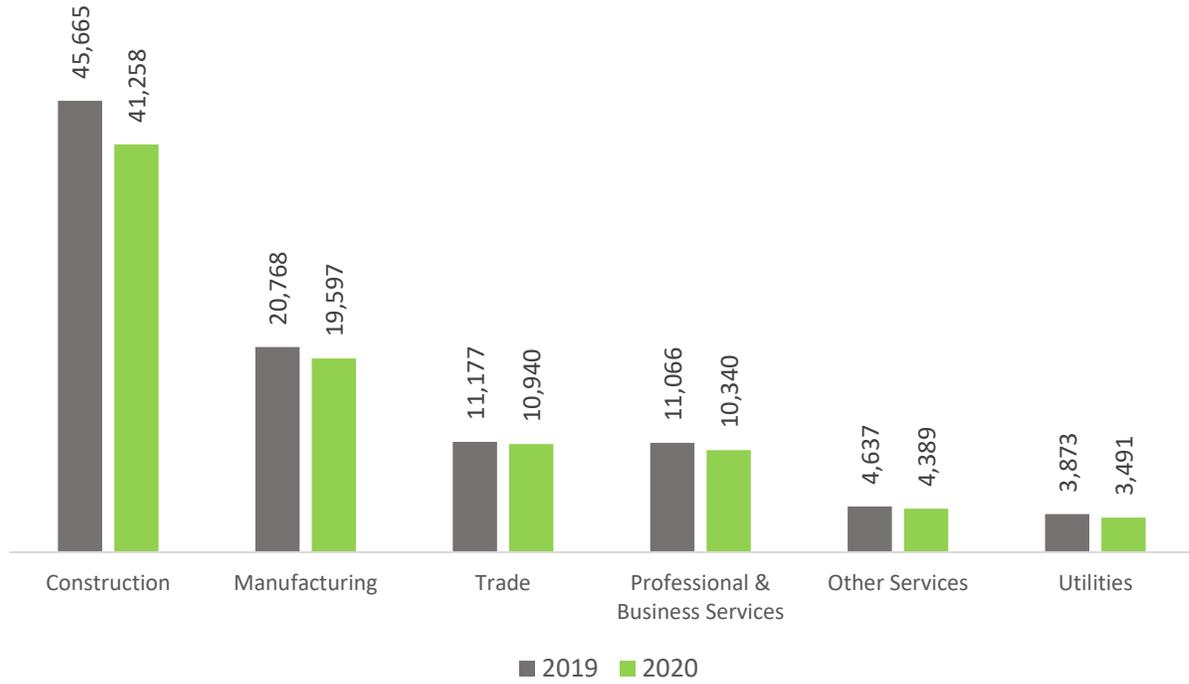
¹⁰ Manufacturing encompasses petrochemical, industrial gas, ethyl alcohol, or other basic organic chemical manufacturing as well as heating and air conditioning equipment manufacturing, engine and compressor manufacturing, semiconductor manufacturing, and energy efficient product, appliance, or lighting manufacturing, as well as motor vehicle and parts manufacturing.

¹¹ Wholesale trade includes fuel dealers, motor vehicle and parts wholesalers, electrical equipment and household appliance wholesalers, and other wholesale related to clean energy products and technologies.

¹² Professional business services include all finance, legal, consulting, engineering, research, or architectural support.

¹³ Other services is largely comprised of automotive repair and maintenance, but also includes organizational and non-profit work such as environment and conservation organizations, business associations, or advocacy organizations.

FIGURE 6. CLEAN ENERGY EMPLOYMENT BY VALUE CHAIN SEGMENT, 2019-2020



Detailed Clean Energy Sector Employment

Energy Efficiency

The energy efficiency sector encompasses all workers that were involved in the research, manufacture, sales, installation, repair, or professional service support of technologies and services designed to improve the efficiency of commercial, residential, and industrial buildings. Such sub-technologies include ENERGY STAR® appliances, lighting, and HVAC systems, advanced building materials and insulation technologies, solar thermal water heating and cooling, and other energy efficient technologies like recycled building materials or reduced water consumption products and appliances.

The American Council for an Energy-Efficient Economy (ACEEE) ranked Pennsylvania 19th in the nation in its support of energy efficiency policies and programs.¹⁴

The largest sub-technology within Pennsylvania’s energy efficiency sector, traditional HVAC,¹⁵ accounted for about three in ten energy efficiency workers at the end of 2020. Traditional HVAC employment declined by 8.2 percent, or about 1,620 jobs. Following traditional HVAC, the high efficiency HVAC and renewable heating and cooling sub-technology¹⁶ accounted for just under a quarter of jobs at the end of 2020. This sub-technology declined by just over eight percent as well, for a loss of about 1,370 jobs between 2019 and 2020.

Energy efficiency workers that spend most of their labor hours working with ENERGY STAR appliances and efficient lighting technologies comprised 21 percent of the energy efficiency labor force, followed by advanced building materials workers (18.9 percent) and other energy efficiency workers (9.5 percent).¹⁷ Between 2019 and 2020, ENERGY STAR and efficient lighting businesses declined by 8.3 percent, or 1,240 jobs, followed by advanced building materials which declined by 8.2 percent, or roughly 1,100 workers.

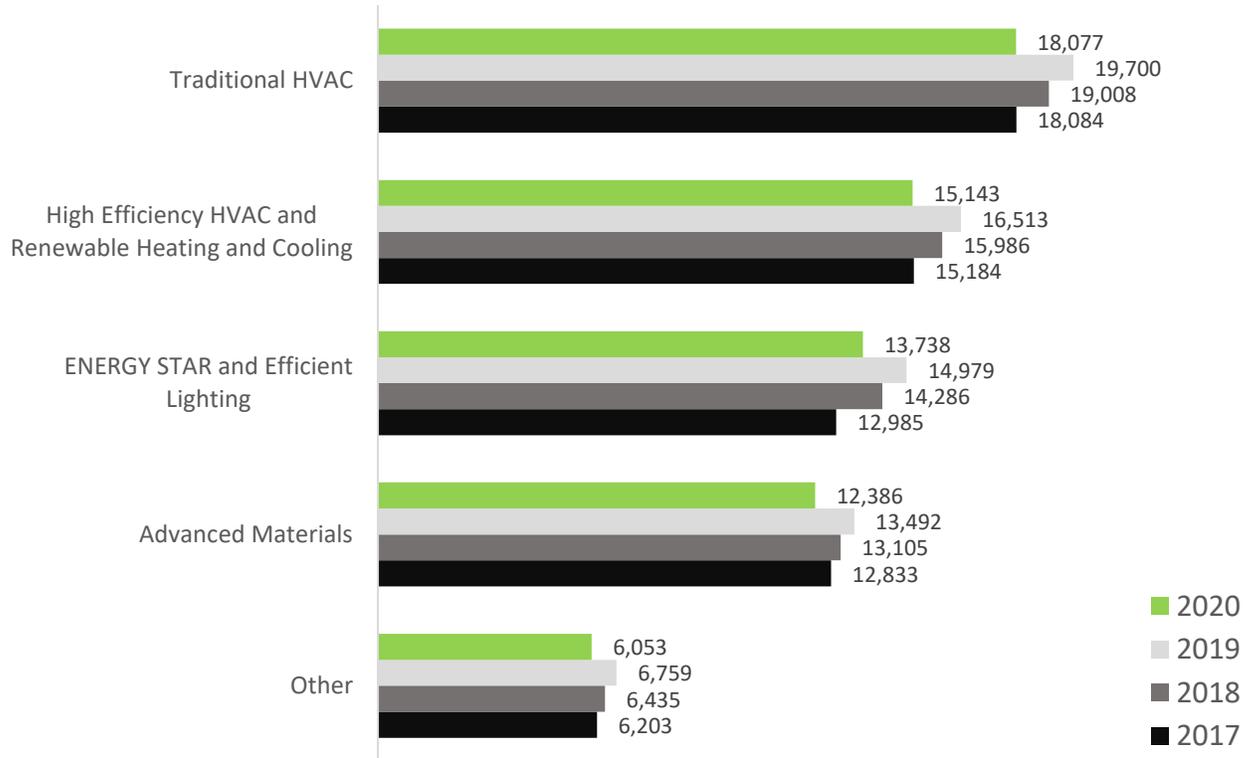
¹⁴ <https://database.aceee.org/state/pennsylvania>

¹⁵ Traditional HVAC workers are individuals that spend a portion of their labor hours on energy efficient HVAC technologies, but the majority of time on traditional HVAC technologies, while high efficiency HVAC workers spend the majority of their labor hours working with efficient HVAC technologies.

¹⁶ Renewable heating and cooling workers are involved with heating, ventilation and air conditioning (HVAC) from renewable energy sources, including solar thermal, or other work that increases the energy efficiency of HVAC systems.

¹⁷ The “other” energy efficiency sub-technology includes variable speed pumps, other design services not specific to a detailed technology, software not specific to a detailed technology, energy auditing, rating, monitoring, metering, and leak detection, policy, consulting, and non-profit work not specific to a detailed technology, LEED certification, or phase change materials.

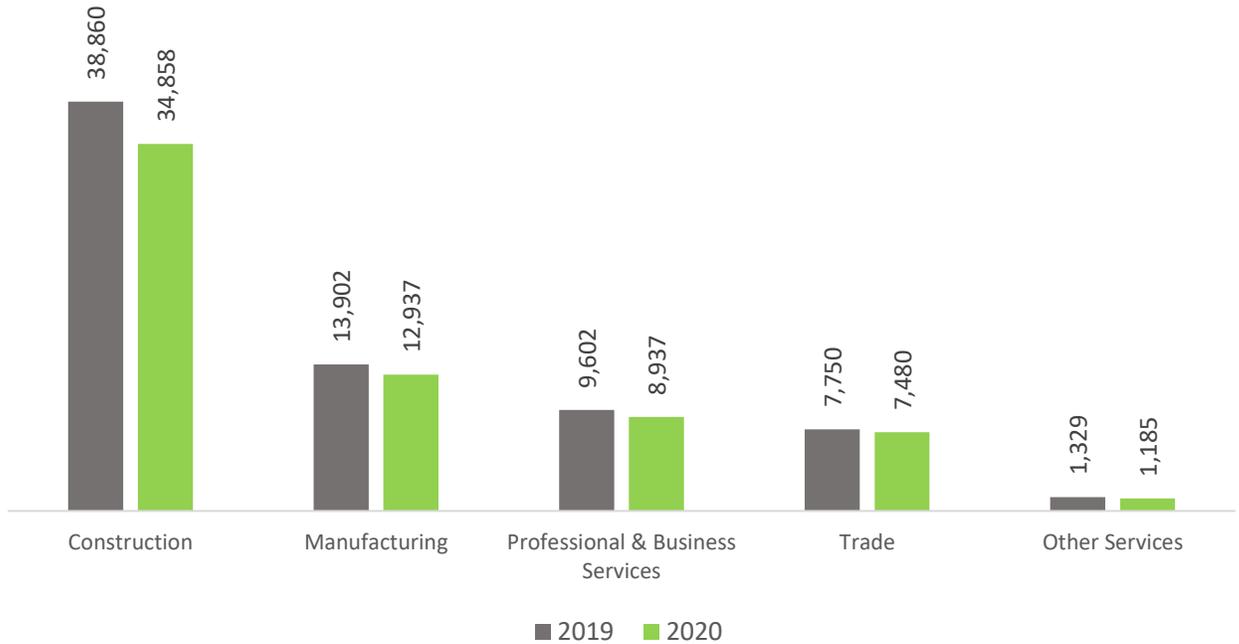
FIGURE 7. ENERGY EFFICIENCY EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020



In general, the energy efficiency sector in Pennsylvania was mostly comprised of construction workers; 53.3 percent of all jobs in energy efficiency were construction jobs and 19.8 percent were found in the manufacturing industry.

Energy efficiency construction declined by about 4,000 jobs, or 10.3 percent, followed by energy efficiency manufacturing, which shed roughly 970 jobs—a 6.9 percent decline. Professional and business services for energy efficiency firms declined by 670 jobs while the remaining value chain segments shed less than 300 workers each.

FIGURE 8. ENERGY EFFICIENCY JOBS BY VALUE CHAIN, 2019-2020



Clean Energy Generation

Clean energy generation jobs encompass all workers engaged in the research, development, production, manufacture, sales, installation, maintenance, repair, or professional service support of carbon-free electricity generating technologies. Such clean energy generation technologies include solar, wind, geothermal, bioenergy, hydropower, and nuclear electric power generation.

Clean energy generation jobs in Pennsylvania were mostly concentrated across solar, nuclear, and wind generation firms. Solar workers accounted for the largest share of clean energy generation workers—36.6 percent of the clean energy generation labor force. Compared to other sub-technologies in the clean energy economy, Pennsylvania’s solar firms saw employment remain fairly flat throughout 2020. The sector declined by less than half a percent or fewer than 20 jobs.¹⁸ Comparatively, across the nation, solar jobs declined by eight percent or almost 28,000 workers between 2019 and 2020.¹⁹

The nuclear generation workforce in Pennsylvania continued its steady decline, dating back to 2017. Overall, between 2017 and 2020, nuclear electric power generation jobs declined by just over 10 percent or roughly 480 jobs. Between 2019 and 2020 alone, this sub-technology declined by five percent, or almost 230 jobs. Nationally, nuclear electric power generation jobs declined by about five percent or roughly 3,000 jobs between 2019 and 2020.²⁰ The closure of Three Mile Island—a nuclear power plant in Pennsylvania—in September 2019 and the national shift towards more natural gas and renewable electric generation capacities signals continued job losses in the sector.

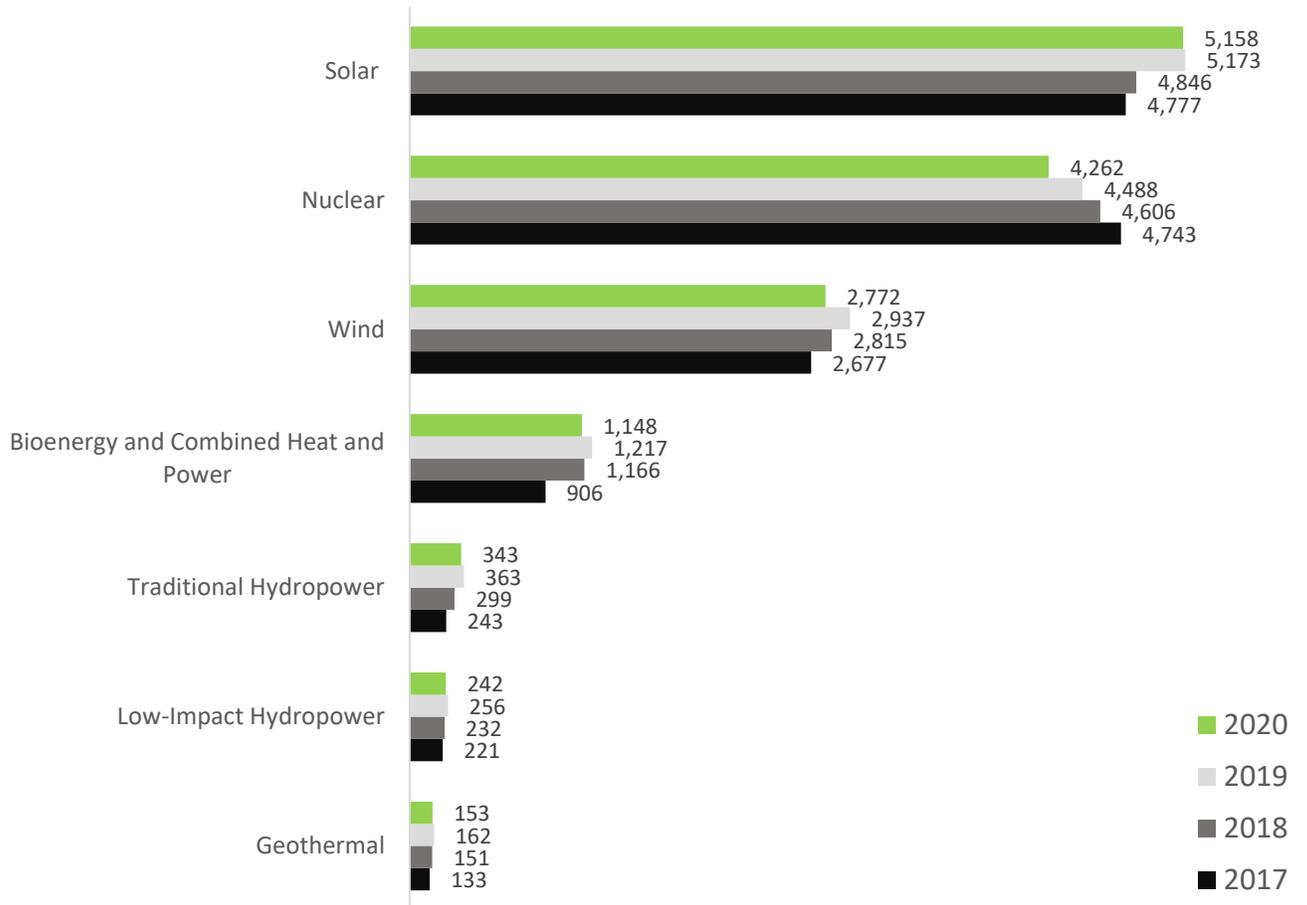
Wind energy employment in Pennsylvania declined by 5.6 percent, or just over 160 workers, while the remaining clean energy generation sub-technologies all shed fewer than 70 jobs each.

¹⁸ The change in employment for solar is within the margin of error and thus can be considered relatively flat or no change in employment from 2019 to 2020.

¹⁹ United States Energy and Employment Report, 2021. <https://www.usenergyjobs.org/>.

²⁰ *Id.*

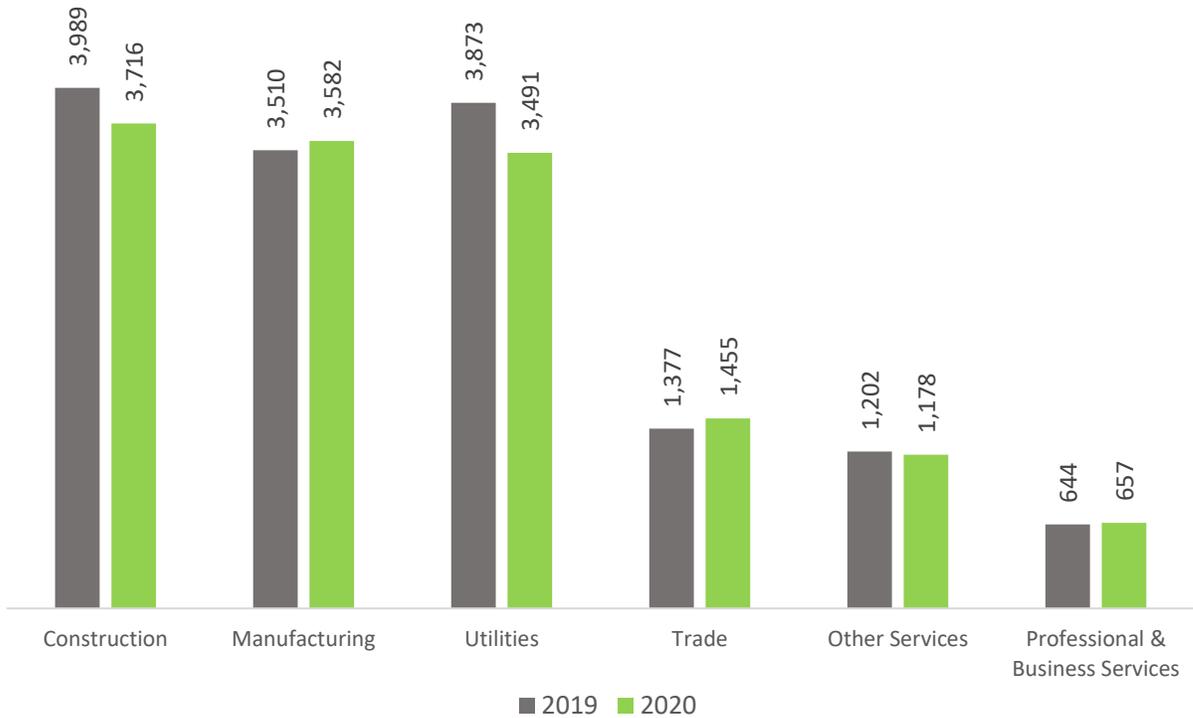
FIGURE 9. CLEAN ENERGY GENERATION EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020



Activity in the clean energy generation sector was comprised largely of construction (26 percent), manufacturing (25 percent), and utilities (25 percent). Between 2019 and 2020, the utilities sector shed the highest number of jobs, declining by almost 10 percent or roughly 380 workers. Clean energy generation construction firms shed 270 jobs, for a decline of 6.8 percent in 12 months.

Clean energy generation manufacturing grew by 2.1 percent, or about 70 jobs, while wholesale trade also saw a slight increase of almost 80 jobs—a growth of 5.7 percent.

FIGURE 10. CLEAN ENERGY GENERATION JOBS BY VALUE CHAIN, 2019-2020



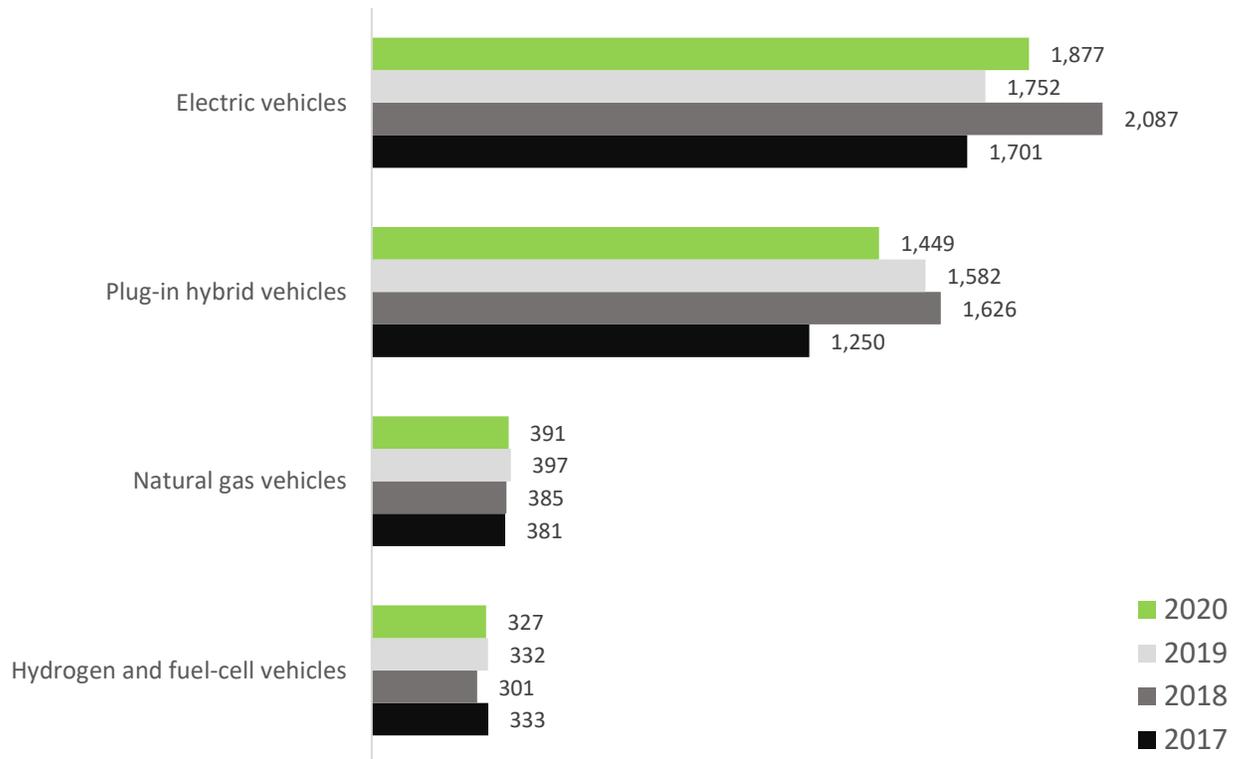
Alternative Transportation

The alternative transportation sector is comprised of workers that support the manufacture, sales, repair and maintenance, and professional business support—like legal, financial, engineering, or consulting services—of alternative transportation technologies. Alternative transportation includes technologies like plug-in hybrid, electric, natural gas, hydrogen, and fuel cell vehicles.

Jobs in the alternative transportation sector were mostly found in electric and plug-in hybrid vehicles. Electric vehicle companies—which manufacture, sell, service, or conduct research on vehicles that use one or more electric motors for propulsion with no onboard generator or non-electric motor—accounted for 46 percent of alternative transportation workers, or about 1,880 jobs at the end of 2020. Electric vehicles were the only sub-technology across all sectors to see employment growth between 2019 and 2020. Over these 12 months, electric vehicle jobs grew by 7.1 percent or 125 workers. This is similar to the national average; over the same time, electric vehicle jobs grew by 7.8 percent—just over 6,000 jobs—across the nation.

Pennsylvania also has significant employment in the plug-in hybrid sector. Plug-in hybrid vehicles use two or more distinct types of power, such as internal combustion engines and an electric motor that is powered by rechargeable batteries, or another energy storage device, that can be recharged by plugging it in to an external source of electric power. These firms accounted for 35.8 percent of workers, or about 1,450 jobs. Between 2019 and 2020, Pennsylvania’s plug-in hybrid workforce declined by 8.4 percent, resulting in the loss of roughly 130 jobs.

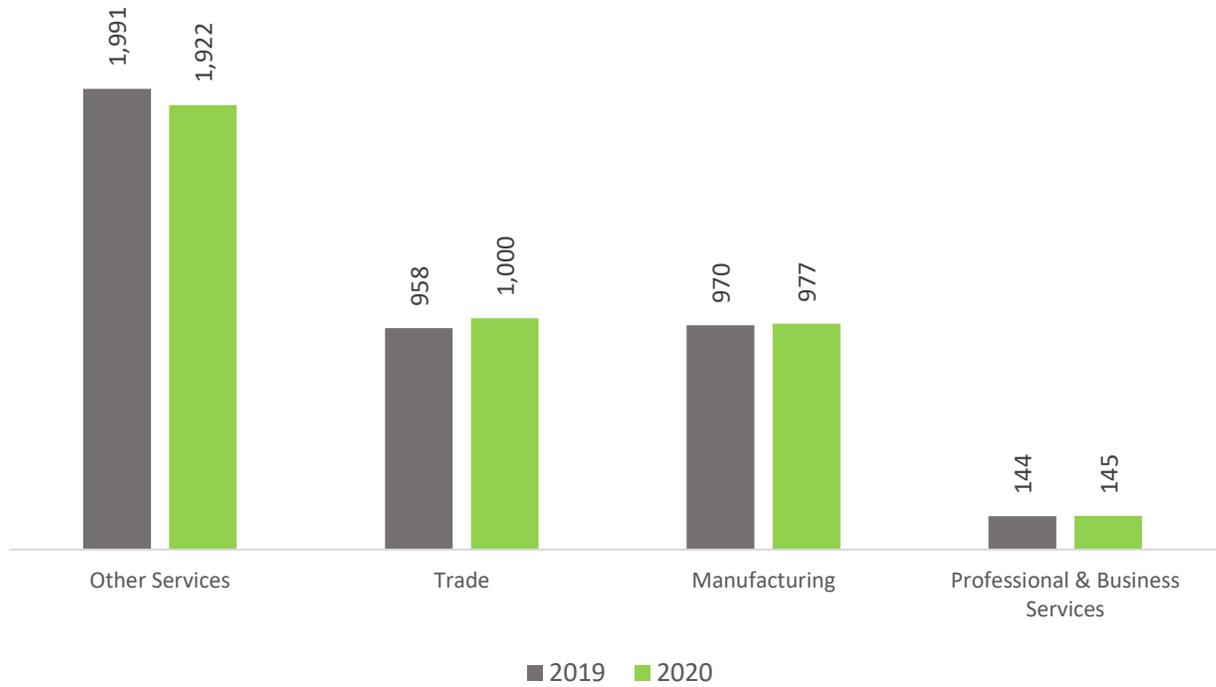
FIGURE 11. ALTERNATIVE TRANSPORTATION EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020



Alternative transportation activity remains concentrated in the other services industry sector, which largely consists of automotive repair and maintenance. Between 2019 and 2020, automotive repair and maintenance jobs declined by 3.5 percent, or 70 workers. Wholesale trade in the alternative transportation sector, however, increased by about 40 jobs, or 4.4 percent, over the same time. The remaining value chain segments of manufacturing and professional and business services remained fairly flat, with growth of less than one percent.²¹

²¹ The change in employment for these segments is within the margin of error and thus can be considered relatively flat or no change in employment from 2019 to 2020.

FIGURE 12. ALTERNATIVE TRANSPORTATION JOBS BY VALUE CHAIN, 2019-2020

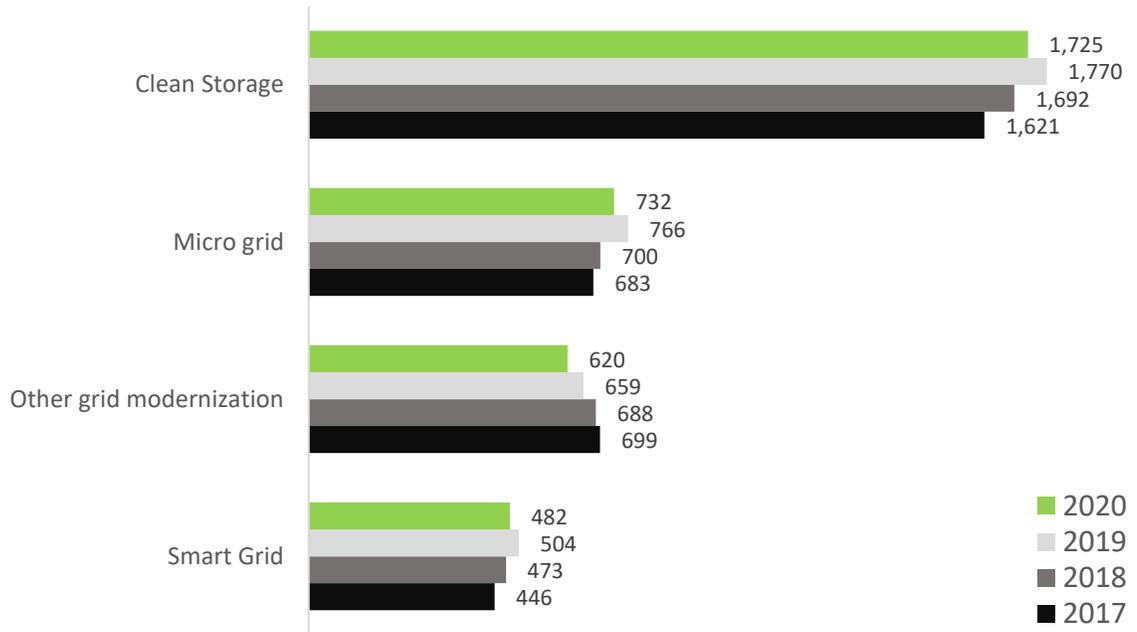


Clean Grid & Storage

For the purposes of this report, clean grid and storage workers include any individual that supports the deployment (construction), manufacture, wholesale trade, or legal, financial, and engineering services of the following technologies: smart grid, microgrids, and other grid modernization technologies such as electric vehicle charging infrastructure, as well as clean storage technologies.

Clean storage—which includes pumped hydropower storage²², battery storage²³, mechanical storage²⁴, thermal storage²⁵, biofuel storage (including ethanol and biodiesel), and nuclear fuel storage—accounted for almost half (48.4 percent) of the clean grid and storage workforce in Pennsylvania. The clean storage industry declined by 2.6 percent, from 1,770 to 1,725 workers between 2019 and 2020. Microgrid²⁶ firms employed roughly 730 workers across the state and declined by 30 jobs, or 4.3 percent, between 2019 and 2020. Smart grid²⁷ employment also declined by 4.3 percent, equating to the loss of roughly 20 jobs.

FIGURE 13. CLEAN GRID AND STORAGE EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020



²² Hydroelectric energy storage used by electric power systems for load balancing. This method stores the gravitational potential energy of water pumped from a lower elevation reservoir to a higher elevation.

²³ This includes battery storage for solar generation and lithium batteries, lead-based batteries, other solid-electrode batteries, vanadium redox flow batteries, and other flow batteries.

²⁴ This includes flywheels and compressed air energy storage.

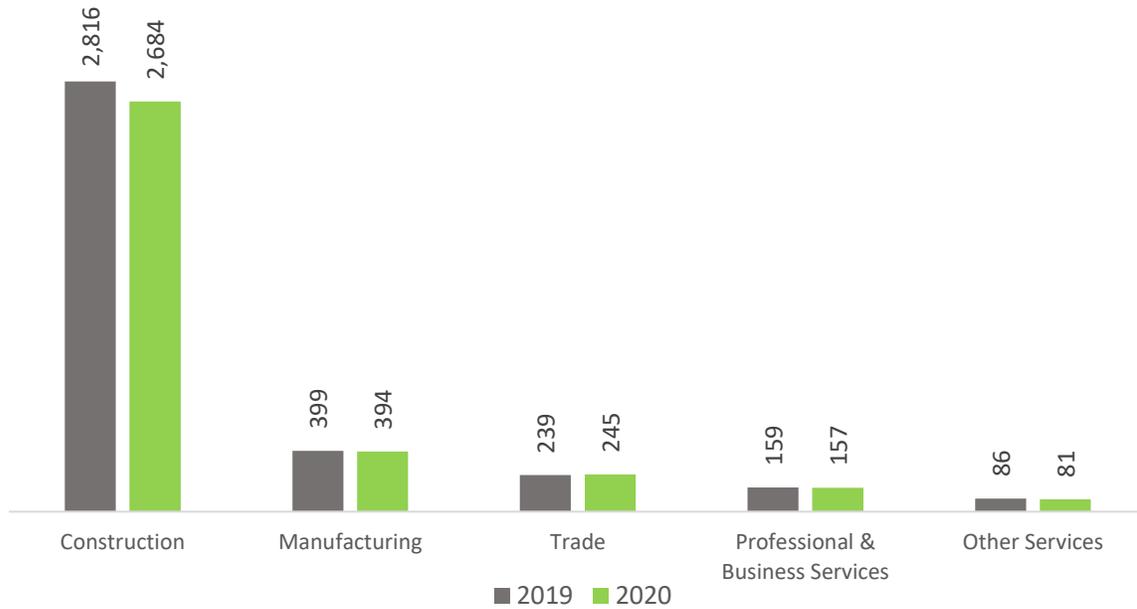
²⁵ Temporary storage of energy for later use when heating or cooling is needed.

²⁶ Microgrids are a group of interconnected loads and distributed energy resources within clearly defined electrical boundaries that act as a single controllable entity with respect to the grid.

²⁷ A smart grid is an electricity supply network that uses digital communications technology to detect and react to local changes in usage.

Clean grid and storage activity in Pennsylvania remains mostly concentrated in the construction industry. Just over three-quarters (75.4 percent) of the clean grid and storage workforce was engaged in the installation, maintenance, or repair of clean grid and storage technologies across the state. Between 2019 and 2020, clean grid and storage construction saw jobs decline by 4.7 percent, for a loss of just over 130 jobs. The remaining four value chain segments were relatively flat throughout the year.²⁸

FIGURE 14. CLEAN GRID AND STORAGE JOBS BY VALUE CHAIN, 2019-2020



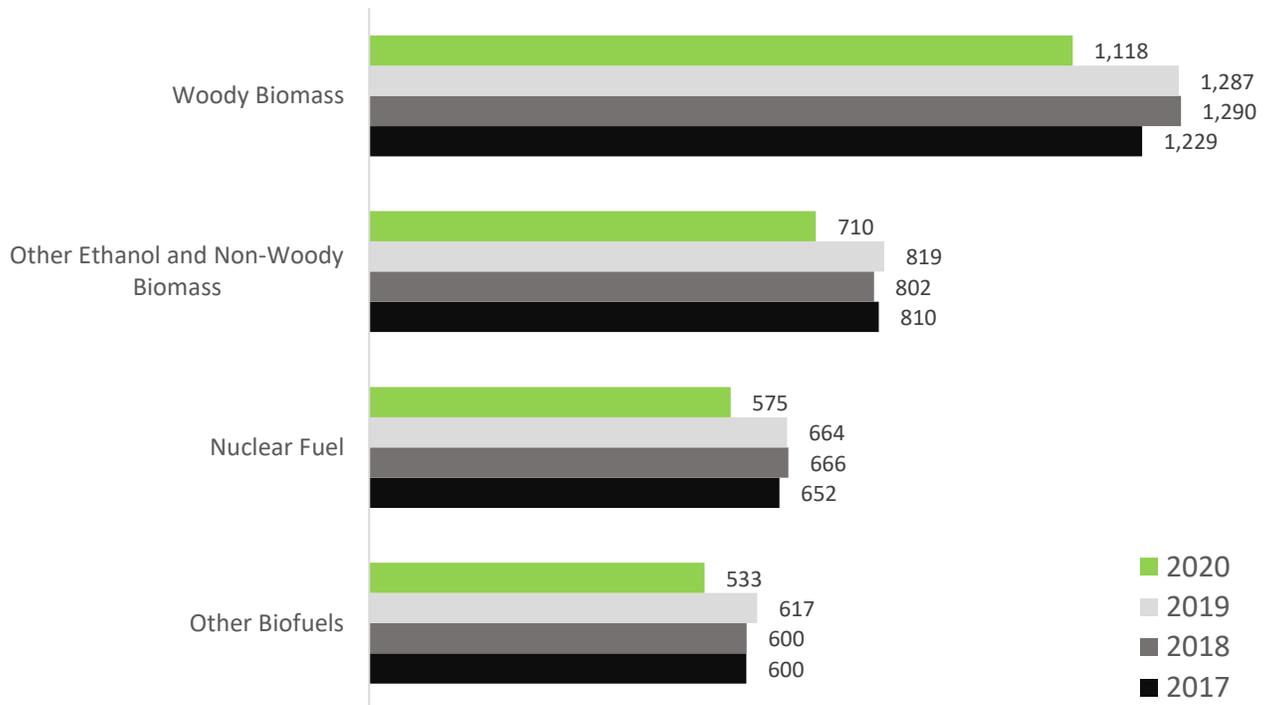
²⁸ The change in employment for these segments is within the margin of error and thus can be considered relatively flat or no change in employment from 2019 to 2020.

Clean Fuels

The clean fuels sector includes all workers involved in the production, distribution and sales, or professional and business service support for clean fuels and clean fuel technologies that use woody biomass, nuclear fuels, and other biofuels.

Collectively, the clean fuels sector lost 450 jobs between 2019 and 2020, a decline of 13.3 percent in 12 months. All sub-technologies declined by roughly 13 to 14 percent during this time, with woody biomass suffering the largest job losses—roughly 160 jobs lost—followed by other ethanol and non-woody biomass, which shed about 110 jobs, nuclear fuels (a loss of 90 jobs), and other biofuels (a loss of roughly 80 jobs).

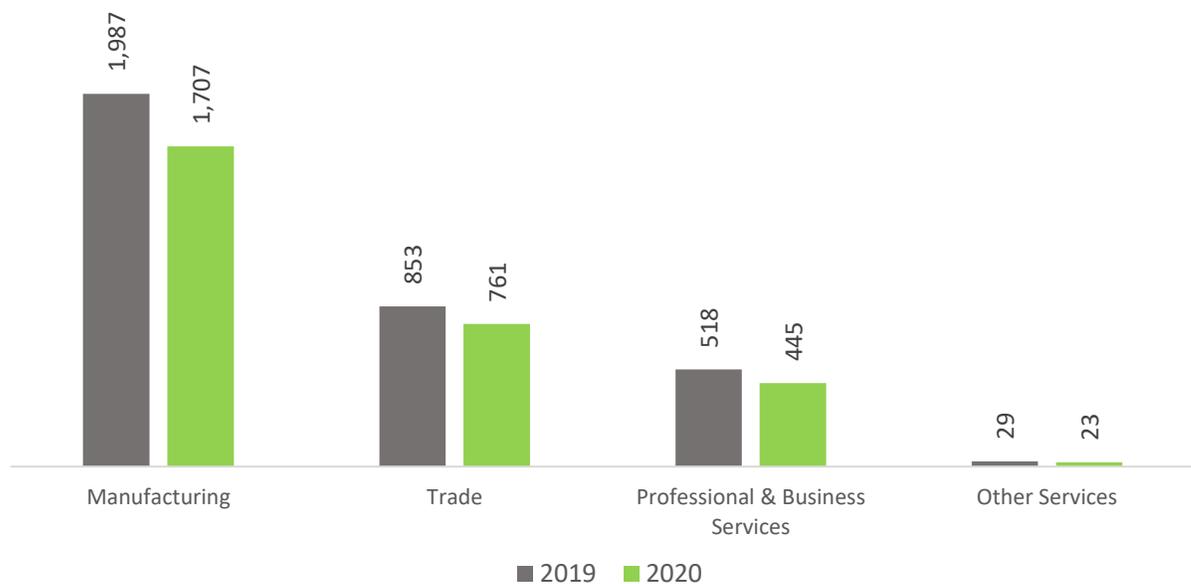
FIGURE 15. CLEAN FUELS EMPLOYMENT BY SUB-TECHNOLOGY, 2017-2020



Clean fuels manufacturing remains a strength in Pennsylvania. Over half (58.1 percent) of the clean fuels sector was dedicated to manufacturing. A portion of the clean fuels manufacturing jobs are the result of the state's biodiesel manufacturing plants and biodigesters²⁹, as well as the eight wood pellet manufacturing plants, which support a combined annual capacity of about 368,000 tons.

Clean fuels manufacturing declined by 14.1 percent between 2019 and 2020, a loss of 280 jobs. Wholesale trade in the clean fuels sector shed roughly 90 workers for a decline of 10.8 percent over the same time. Professional and business services declined by 14.1 percent, or about 70 workers, while employment in other services remained fairly flat.³⁰

FIGURE 16. CLEAN FUELS JOBS BY VALUE CHAIN, 2019-2020



²⁹ U.S. Energy Information Administration (EIA). Pennsylvania State Profile and Estimates. Last Updated August 2019.

³⁰ The change in employment for other services is within the margin of error and thus can be considered relatively flat or no change in employment from 2019 to 2020.

Clean Energy Hiring & COVID-19 Impacts

The following section includes additional detail on hiring activity and the impacts of COVID-19 on clean energy businesses throughout 2020. About eight in ten (78.8 percent) of surveyed clean energy businesses indicated that they had an adequate number of qualified clean energy employees to meet their current needs, while 21.2 percent reported that they did not.

Of the 21.2 percent of employers that reported they did not have an adequate supply of clean energy workers, just under three-quarters (71.4 percent) reported that they were either currently searching or had recently searched for new employees to fill open positions.

Of these employers that were hiring in 2020, 99.4 percent indicated some level of hiring difficulty. Just over a quarter (26 percent) reported that hiring had been “very” difficult in 2020. It should be noted that while it appears as if the rate of hiring difficulty increased, these findings are based on the small sample size of firms that indicated they both (a) had an insufficient supply of workers and (b) were currently searching or had recently searched for new employees to fill open positions. Given the unique circumstances and realities of employment and hiring in 2020 and the relatively small percentage of firms that reported hiring activity, it is best to take the hiring difficulty data for this year’s report as a point-in-time estimate and refrain from comparisons to previous years.

FIGURE 17. ADEQUATE WORKERS TO MEET CURRENT NEEDS, 2020

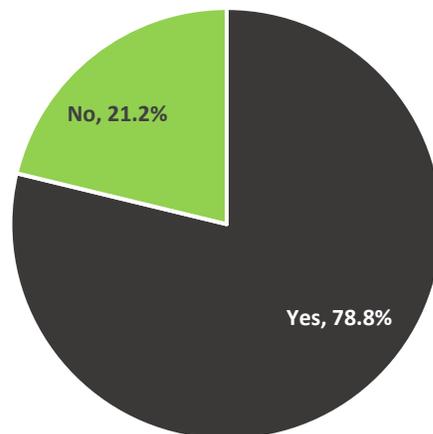
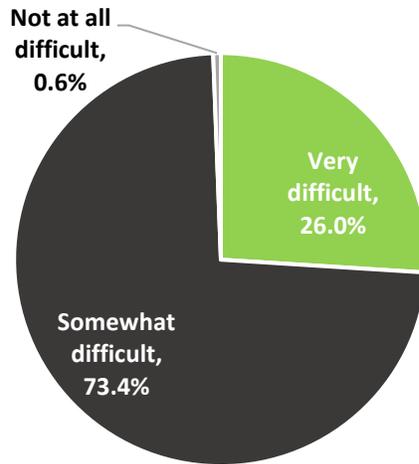


FIGURE 18. EMPLOYER-REPORTED HIRING DIFFICULTY, 2020



Just over a third of surveyed clean energy firms in Pennsylvania (36 percent) indicated that they had to layoff, furlough, or reduce the pay of their workers as a result of COVID-19. Of those businesses that had to take these measures, four in ten (37.8 percent) indicated that they had to reduce work hours, 31.4 percent reported temporary layoffs, 24.1 reported furloughing their clean energy employees, five percent indicated a reduction in pay or benefits, and less than two percent of employers reported that they had to permanently layoff their clean energy workers.

Notably, 86.7 percent of firms that had laid off or furloughed clean energy workers indicated that they had since brought back these employees by the last quarter of 2020. In fact, with the majority of job losses concentrated in March through May, the clean energy labor market has been making steady job gains throughout the remainder of 2020 from June through December. In the first quarter of 2021, clean energy employment grew by just under one percent.

FIGURE 19. COVID-19 WORKFORCE IMPACTS, 2020

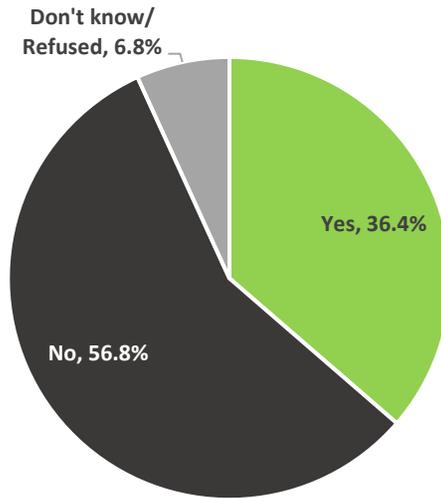
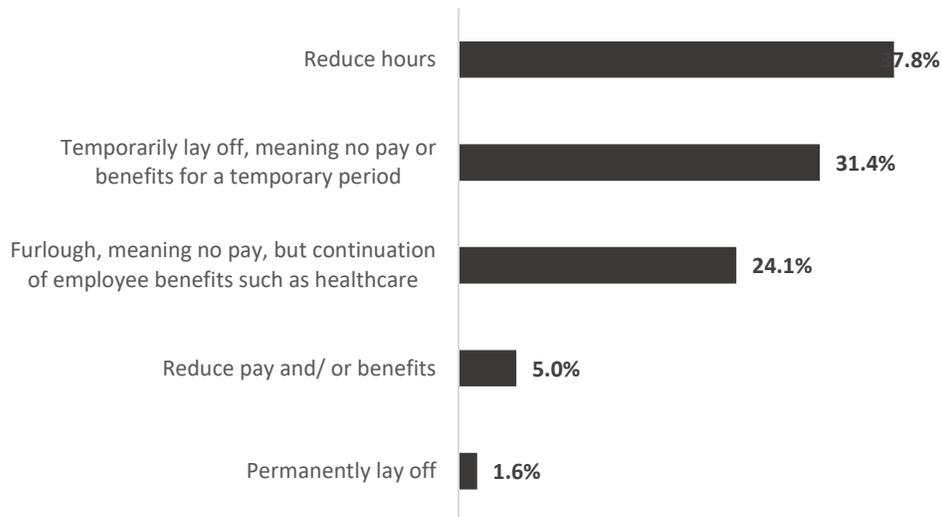
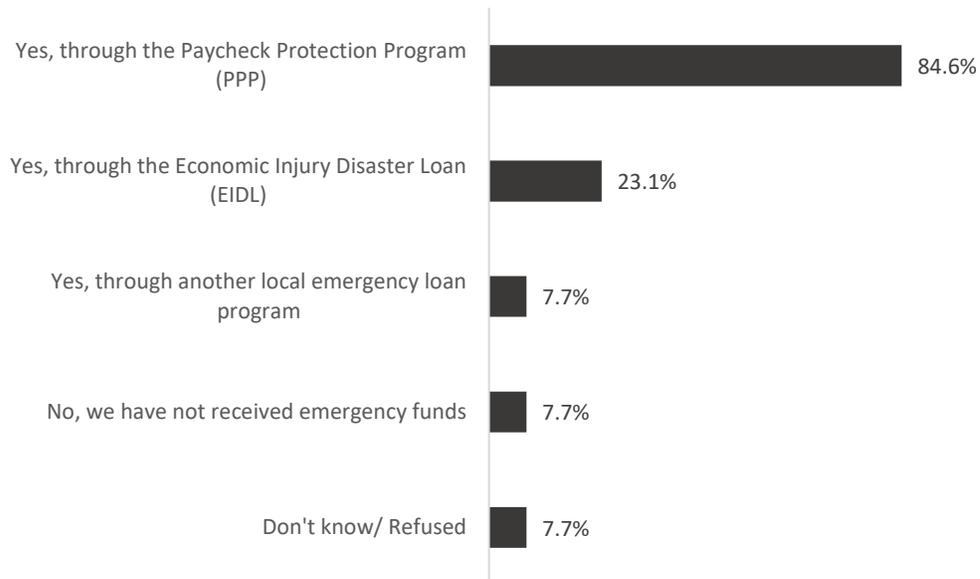


FIGURE 20. COVID-19 DETAILED WORKFORCE IMPACTS, 2020



About 85 percent of surveyed clean energy employers reported receiving financial support through the Paycheck Protection Program (PPP). Just under a quarter (23.1 percent) received assistance through the Economic Injury Disaster Loan (EIDL). About eight percent of surveyed clean energy businesses indicated receiving support through a local emergency loan program while another eight percent reported that they did not receive any emergency funds in 2020.

FIGURE 21. COVID-19 RELIEF PROGRAMS AND ASSISTANCE, 2020



Clean Energy Demographics

Pennsylvania’s clean energy economy remains a source of jobs for Hispanic or Latinx, Asian, and Veteran residents across the state. Similar to last year, data show that the clean energy labor market has a higher proportion of these demographic groups compared to the statewide average. In Pennsylvania, 12.8 percent of clean energy workers were Hispanic or Latinx compared to only 6.4 percent of the statewide workforce. Similarly, 10.6 percent of clean energy workers in Pennsylvania were Veterans of the U.S. Armed Forces compared to a 4.6 percent statewide average. There are also more Asian workers in the clean energy workforce (5.8 percent) compared to the statewide average (3.7 percent).

TABLE 1. CLEAN ENERGY WORKFORCE DEMOGRAPHICS, 2020³¹

	Pennsylvania Clean Energy	Pennsylvania Overall	US Clean Energy	US Overall
Male	77.4%	49.6%	72.6%	53.2%
Female	22.6%	50.4%	27.4%	46.8%
Hispanic or Latinx	12.8%	6.4%	16.5%	17.6%
Not Hispanic or Latinx	87.2%	93.6%	83.5%	82.4%
American Indian or Alaska Native	1.1%	0.3%	1.4%	1.0%
Asian	5.8%	3.7%	8.2%	5.9%
Black or African American	9.7%	11.6%	8.4%	13.2%
Native Hawaiian or other Pacific Islander	0.8%	0.1%	1.0%	0.3%
White	77.3%	82.8%	73.1%	77.6%
Two or more races	5.3%	1.5%	7.9%	1.9%
Veterans	10.6%	4.6%	9.0%	4.6%
55 and over	16.9%	25.7%	13.5%	22.1%

³¹ Demographic data is pulled from the United States Energy and Employment Report 2021 (USEER 2021) as well as JobsEQ workforce demographics for workers across all industries in Pennsylvania.

Appendix A: Clean Energy Technology List

A clean energy job is defined as any worker that is directly involved with the research, development, production, manufacture, distribution, sales, implementation, installation, or repair of components, goods, or services related to the following sectors of Clean Energy Generation; Clean Grid and Storage; Energy Efficiency; Clean Fuels; and Alternative Transportation. These jobs also include supporting services such as consulting, finance, tax, and legal services related to energy.

CLEAN ENERGY GENERATION

- Solar Photovoltaic Electric Generation
- Concentrated Solar Electric Generation
- Wind Generation
- Geothermal Generation
- Bioenergy/Biomass Generation
- Low-Impact Hydroelectric Generation, including wave/kinetic generation
- Traditional Hydroelectric Generation
- Nuclear Generation

CLEAN GRID & STORAGE

Electric Power Transmission and Distribution

- Smart Grid
- Microgrids
- Other Grid Modernization

Storage

- Pumped Hydropower Storage
- Battery Storage, including battery storage for solar generation
 - Lithium Batteries
 - Lead-Based Batteries
 - Other Solid-Electrode Batteries
 - Vanadium Redox Flow Batteries
 - Other Flow Batteries
- Mechanical Storage, including flywheels, compressed air energy storage, etc.
- Thermal Storage
- Biofuels, including ethanol and biodiesel
- Nuclear Fuel

ENERGY EFFICIENCY

- Traditional HVAC goods, control systems, and services
- High Efficiency HVAC and Renewable Heating and Cooling
 - ENERGY STAR Certified Heating Ventilation and Air Conditioning (HVAC), including boilers and furnaces with an AFUE rating of 90 or greater and air and central air conditioning units of 15 SEER or greater
 - Solar Thermal Water Heating and Cooling
 - Other Renewable Heating and Cooling (geothermal, biomass, heat pumps, etc.)
- ENERGY STAR® and Efficient Lighting
 - ENERGY STAR Certified Appliances, excluding HVAC
 - ENERGY STAR Certified Electronics (TVs, Telephones, Audio/Video, etc.)
 - ENERGY STAR Certified Windows and Doors
 - ENERGY STAR Certified Roofing
 - ENERGY STAR Certified Seal and Insulation
 - ENERGY STAR Certified Commercial Food Service Equipment
 - ENERGY STAR Certified Data Center Equipment
 - ENERGY STAR Certified LED Lighting
 - Other LED, CFL, and Efficient Lighting
- Advanced Building Materials/Insulation
- Other Energy Efficiency
 - Recycled Building Materials
 - Reduced Water Consumption Products and Appliances

CLEAN FUELS

- Other Ethanol/Non-Woody Biomass, including biodiesel
- Woody Biomass/Cellulosic Biofuel
- Other Biofuels
- Nuclear Fuel

ALTERNATIVE TRANSPORTATION

- Plug-In Hybrid Vehicles
- Electric Vehicles
- Natural Gas Vehicles
- Hydrogen Vehicles
- Fuel Cell Vehicles

Appendix B: Research Methodology

EMPLOYMENT, HIRING, & DEMOGRAPHIC DATA

Data for the 2021 Pennsylvania Clean Energy Industry Report is taken from the US Energy and Employment Report (USEER). The survey was administered by phone and web. The phone survey was conducted by ReconMR, and the web instrument was programmed internally. Each respondent was required to use a unique ID in order to prevent duplication.

The 2021 USEER survey in Pennsylvania resulted in more than 9,800 calls and 3,500 emails to potential respondents. More than 900 business establishments participated in the survey. These responses were used to develop incidence rates among industries as well as to apportion employment across various industry categories in ways currently not provided by state and federal labor market information agencies. The margin of error is +/-3.25 percent at a 95 percent confidence level.

The full research methodology for USEER may be found at: <https://www.usenergyjobs.org/>

FULL-TIME EQUIVALENT JOBS

Full-time Equivalent (FTE) jobs are extrapolated using state employment thresholds by technology weighted on census division and previous year's data. Employment thresholds are survey data from questions asking what percent of a firm's employment spends at least 50% of their time working on clean energy related activities and what percent spends all their time. Using the adjusted thresholds, employment by state is then split into three groups, those that spend all (100%) of their time on energy related activities, those that spend a majority (50-99%) of their time, and those that spend less than a majority (0-49%) of their time. These employment groups are weighted 0.25 on the less than a majority group, 0.75 on the majority group, and 1 on the 100% group. FTE jobs are the sum of these products.

Appendix C: Clean Energy Jobs by County

County Name	Total Clean Energy Jobs	Clean Energy Generation	Energy Efficiency
Allegheny County	12,087	2,388	8,961
Philadelphia County	8,743	1,095	6,875
Montgomery County	8,642	1,231	6,497
Lehigh County	7,218	190	6,349
Bucks County	4,872	901	3,388
Chester County	4,511	511	3,357
Lancaster County	4,258	881	2,974
York County	3,393	744	2,227
Delaware County	3,090	422	2,291
Berks County	3,133	1,410	1,593
Dauphin County	2,057	433	1,400
Westmoreland County	2,066	342	1,497
Cumberland County	1,690	159	1,261
Erie County	1,468	389	1,000
Butler County	1,395	133	1,041
Luzerne County	1,379	146	1,065
Washington County	1,361	73	1,079
Northampton County	1,189	69	937
Lackawanna County	1,150	112	765
Centre County	957	210	678
Beaver County	836	443	371
Blair County	730	54	502
Lycoming County	651	59	473
Franklin County	616	31	455
Lebanon County	571	78	369
Cambria County	549	58	402
Schuylkill County	515	86	335
Jefferson County	483	308	129
Mercer County	455	20	323
Adams County	451	167	245
Fayette County	436	32	281
Monroe County	416	27	306
Lawrence County	413	30	332
Somerset County	380	32	234
Northumberland County	374	43	208

Indiana County	344	39	240
Clearfield County	273	26	168
Columbia County	262	41	181
Crawford County	261	67	152
Bedford County	235	14	173
Carbon County	228	37	92
Greene County	215	9	163
Tioga County	219	14	119
Wayne County	215	11	178
Clinton County	204	26	103
Snyder County	194	14	134
Bradford County	178	9	127
Union County	169	75	94
Armstrong County	154	20	107
Venango County	151	15	104
Clarion County	148	25	88
McKean County	138	13	108
Huntingdon County	130	17	88
Mifflin County	128	11	87
Elk County	115	5	90
Perry County	116	7	77
Wyoming County	106	13	71
Susquehanna County	107	12	82
Pike County	98	20	65
Montour County	98	6	42
Warren County	91	9	53
Juniata County	60	6	42
Fulton County	56	9	30
Potter County	55	5	20
Sullivan County	22	9	13
Forest County	10	1	9
Cameron County	9	1	7
N/A	2,694	187	2,091
TOTAL	90,015	14,078	65,397