2024

Delaware Clean Energy and Climate-Related Jobs Workforce Development Assessment

Produced for Delaware's Department of Natural Resources and Environmental Control, Division of Climate, Coastal and Energy

[bw] RESEARCH PARTNERSHIP

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Delaware Electric Cooperative

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Executive Summary

Delaware's workforce is poised for significant transformation as the state strives to meet its climate goals and expand its clean energy sector. Future job growth expectations include a significant increase in skilled positions related to renewable energy technologies, energy efficiency, and climate resilience.

Delaware's existing strengths, such as its workforce programs, well-regarded career and technical education and apprenticeship systems, and robust partnerships between businesses and educational institutions position the state well to meet these demands. The state's commitment to clean energy provides a solid foundation for job creation in this emerging sector. However, barriers such as geographic disparities in training access, a shortage of qualified applicants, a lack of targeted hiring initiatives for underrepresented groups, and insufficient wraparound support services present challenges to meeting this need. Addressing these barriers through targeted investments in training and education infrastructure and improved outreach and support services to underserved areas will be crucial for Delaware to fully capitalize on the potential growth in its clean energy and climate-related workforce.

To study clean energy and climate-related jobs in the state, as well as the capacity of the Delaware workforce ecosystem to support these jobs, the Division of Climate, Coastal and Energy within Delaware's Department of Natural Resources and Environmental Control (DNREC) contracted with BW Research Partnership (BW Research) to conduct this 2024 Workforce Development Assessment, with funding for this research provided by the United States Environmental Protection Agency (EPA).

This report details the state's current clean energy and climate-related employment landscape and the resulting employment impacts from federal and state investments. In addition, it highlights key strengths and current challenges in Delaware that could support or hinder the state's efforts to develop a workforce prepared for future opportunities. Overall, the 2024 Workforce Development Assessment of Delaware provides a foundation to support future collaboration among the many key stakeholders who will lead progress towards the state's climate goals.

Key Findings

This section summarizes the major findings from the various research methods completed while studying Delaware's clean energy and climate-related workforce. These findings include quantification of Delaware's current clean energy workforce, alongside projected growth resulting from federal and state investments in this sector. Additional findings highlight Delaware's strengths and barriers to meeting workforce needs, before concluding with a set of "strategies for action" to help the state bolster its workforce and prepare for future expansion.

Delaware's Clean Energy and Climate-Related Economy in 2022

The state's clean energy industries have strong momentum, with stable workforce growth seen across clean energy technologies. In 2022, Delaware's clean energy industry employed over 12,400 workers, with most involved in energy efficiency technologies and activities. Out of the total jobs in the state, the clean energy industry comprised 2.5% of the state's employment. Compared to the other U.S. states, Delaware has the 11th highest clean energy jobs share of total employment.[1] Between 2017 and 2019, the industry's employment increased by 3% and since the pandemic, the workforce grew by 4% from 2020 to 2022.

Among the 13 clean energy occupations selected for deeper analysis,[2] 10 are high-quality, skilled trades occupations. In Delaware, the clean energy workers in these trade professions represent a significant share of the total workers employed in the occupations, underscoring the already important role of the clean energy industry in supporting good jobs. Clean energy HVAC Technicians and Plumbers comprise the largest proportions, 43% and 40%, respectively, of total HVAC and Plumber jobs in the state; with Welders (23%), Carpenters (14%), Electricians (13%), and Construction Laborers (10%) following. The clean energy industry, with many trade occupations and union jobs, can serve as an important pathway for creating and supporting high-quality jobs.

Delaware's Clean Energy and Climate-Related Employment Projected Through 2030

BW Research projects greater levels of employment through 2030 in Delaware's clean energy and climate-related workforces from federal and state investments in clean energy, much of it in construction and maintenance roles. The economic impact analysis projects that Delaware's clean energy industry is expected to grow by 14% as a result of climate and clean energy investments, supporting almost 1,800 *new* jobs annually through 2030, up from 2022 employment in the industry.

Overall, these federal and state investments in clean energy and climate-related technologies and activities will support around 800 construction jobs annually over the next decade, 300 manufacturing jobs, and 300 professional and business services jobs. An additional 400 annually supported jobs are projected to contribute to the retail, trade, utilities, and repair and maintenance industries.

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[1] Clean energy employment for all states sourced from: Clean Jobs America 2023. E2. 2017-2022. https://e2.org/reports/clean-jobs-america-2023/ & The United States Energy and Employment Report. U.S. Department of Energy. 2022-2023. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer Total economy employment for all states sourced from U.S. Bureau of Labor Statistics.

[2] The 13 key occupations in this study include Construction Managers; Electrical Engineers; Construction Laborers; Carpenters; Electricians; Automotive Service Technicians; Computer Numerically Controlled Tool Operators; Plumbers, Pipefitters, and Steamfitters; Heating, Ventilation, and Air Conditioning Mechanics and Installers; Solar Photovoltaic Installers; Wind Turbine Service Technicians; Construction and Building Inspectors; and Electrical Power-Line Installers and Repairers.

The projected growth for Construction Laborers, Carpenters, and Electricians in the clean energy industry represents between 30% and 45% of the pre-existing U.S. Bureau of Labor Statistics growth expectations for these occupations.[3] Through 2030, there will be an additional 100 Construction Laborer jobs supported every year in the clean energy industry, from the existing 380 workers in Delaware in this occupation in 2022. Carpenters and Electricians will each see an additional 50 jobs supported annually over this time.

Stakeholder Insights

> *"We recognize there's a huge need around training to ensure we have young people ready to step into the new economy around green jobs and that we are creating the kind of systems and pathways for people who need upskilling and reskilling to move into those jobs."*

Employment growth in the 13 targeted clean energy occupations expands on Bureau of Labor Statistics growth projections for the state for these workers, considerably for some occupations. Meeting this growth with new workers is potentially manageable but requires the state to move intentionally and quickly to plan for this growth and build a pipeline of future workers.

Delaware's Clean Energy and Climate-Related Workforce Ecosystem Strengths

To develop the workforce necessary to meet this anticipated growth, Delaware can leverage several existing strengths, including its strong foundation of workforce programs and assets that target the key occupations. BW Research identified a total of 105 training and credentialing programs that serve the 13 key occupations, with 85 programs serving the eight occupations with the highest 2022 employment in this study. Programs for Automotive Service Technicians and Electricians make up the largest shares (17% and 14%, respectively) of the total identified programs.

Delaware has a large number of well-regarded vocational education programs, also called Career and Technical Education (CTE) programs, offered at the state's vocational technical school districts (votechs), community college, and industry associations. In fact, three-in-four (76%) clean energy business establishments hire from existing Delaware-based apprenticeship programs and approximately the same number (74%) indicated that participation in these programs improved workers' job performance. These institutions frequently partner with employers when

Stakeholder Insights

> *"Trade school apprentices are easier to bring in since they have better understanding of the jobs and are more committed."*

[3] Baseline growth projections are sourced from JobsEQ®, based on a four-quarter moving average and on Place of Work estimates, representing a 7-year demand projection from 2023Q4.

developing or modifying the curriculum of their programs. Votech schools host half (51%) of the publicly listed, Delaware-based training programs identified as serving the 13 key occupations.

Clean energy employers in Delaware already work closely with entities across the state's workforce and education system. Nine-in-ten surveyed clean energy firms partner with community or technical colleges (91%) and K-12 education providers (89%) to meet their workforce needs. Most (71%) also reported partnering with four-year colleges and universities. This high frequency of partnerships with employers demonstrates connectivity and strong workforce development networks in the state.

The state's clean energy businesses are very interested in creating new training programs and employment pipelines. More than eight-in-ten (82%) clean energy firms reported being interested in seeing new clean energy training programs that do not currently exist in Delaware, while almost nine-in-ten (87%) said they are interested in apprenticeship programs for their future employees. Overall, employer interest in these types of programs shows confidence in the abilities and usefulness of these programs that is not common nationwide.

Most workers in the 13 key occupations are covered by a Collective Bargaining Agreement, Project Labor Agreement, or are members of a labor union. According to the employer survey, 50% or more of the clean energy business establishments employing the key occupations, aside from Carpenters, reported that a majority of their workers are covered by a union-related agreement.[4] Coverage of workers ranges from 84% of clean energy firms with the majority of Electrical Engineers being covered and 81% with the majority of their Construction Laborers covered, to 43% of clean energy firms with most Carpenters covered. Jobs with higher rates of union coverage typically feature higher wages and better benefits. According to the U.S. Bureau of Labor Statistics, union jobs within construction and production occupations earn an average hourly wage greater than their non-union counterparts.[5]

Barriers to Delaware's Clean Energy and Climate-Related Workforce Development

Training and education challenges could hamper Delaware's effort to meet the rapid growth needs of key occupations from populations across the state. The training program inventory uncovered geographic variance that could limit the ability of all Delaware residents to access these jobs. There is a greater prominence and larger variety of training programs in New Castle County, as expected. However, residents of Kent or Sussex Counties will need to travel further distances to access the programs. These programs are also not located near U.S. Environmental Protection Agency (EPA)-defined Disadvantaged Communities (DACs), making access even more difficult for these populations. DACs are generally spread across the state, with larger geographic areas in Kent County which has the fewest number of training programs. In addition, there are not any in-person and in-state training programs offered for Solar Photovoltaic Installers and Construction and Building Inspectors (including Energy Auditors) in Delaware. There are also limited training offerings for Electrical Power-Line Installers and for Wind Technicians given that

[4] Data for this metric is based solely on our survey results, as no comprehensive databases are available for this specific information. However, the reported union rate level is consistent with findings in USEER.
[5] U.S. Bureau of Labor Statistics. Modeled Wage Estimates 2022. https://www.bls.gov/mwe/tables.htm

only one Delaware-based training course was found for each, though there are programs hosted outside of the state serving Delaware that are not captured in the inventory.

Clean energy business establishments in Delaware are struggling to find qualified applicants for entry-level roles in the key occupations of this workforce study. More specifically, over eight-in-ten (84%) surveyed clean energy firms reported "some" or "great" difficulty in hiring qualified workers. Two-thirds of firms agreed that applicants lack the training or education (68%) and prior work experience (68%) that they seek. Further, for the firms who employ Welders, seven-in-ten pointed to high turnover as a reason for these hiring challenges. Employers of Construction Managers frequently cited competition with other industries, while employers of Carpenters and Electrical Engineers often cited a lack of experience among applicants as the reason for difficulties in hiring for entry-level positions in these roles.

Most clean energy business establishments do not have hiring initiatives to target female, minority, or LGBTQ+ applicants. In the business survey, a sizable majority of firms reported not adopting initiatives to increase gender, ethnic, or racial minority representation among new hires. Of those firms who do have these types of initiatives, efforts to increase the number of ethnic or racial minority hires was the most frequently reported initiative (15%), compared to female (6%) or LGBTQ+ community (7%) efforts.

Delaware needs to share information about clean energy occupations in a more efficient and effective manner. Most (93%) surveyed clean energy establishments expressed interest in having better marketing initiatives to provide young people with greater awareness of the clean energy career fields. Students and young people want to be involved in clean energy and climate-related initiatives, but do not always have a clear understanding of where to start or what the work entails. Without a clear definition of clean energy and climate-related work among the various stakeholders across Delaware, including future workers, the state will struggle to bolster coordination and alignment on recruitment and workforce development programs and initiatives.

There is a pressing need for greater support for vocational technical schools and teachers and enhanced wraparound services. Vocational technical schools in Delaware serve as an important pipeline into the trade professions, many of which are clean energy jobs, but are struggling to increase capacity, obtain the necessary training supplies and equipment for students, and pay teachers competitive wages. Without these competitive wages, these schools also have trouble hiring enough teachers who can educate and train the pipeline of workers. Further, transportation, childcare, and workforce re-entry support services are three frequently discussed services that stakeholders say are needed in Delaware. The strain on vocational technical schools and the shortage of needed workforce support services both greatly hinder the state's ability to quickly grow the clean energy industry with ready and qualified workers.

Many Delaware stakeholders are actively planning or building programs to support a clean energy and climate workforce, but these efforts need considerable support, especially in terms of information sharing and coordination. There is a widespread sense of concurrent, siloed, and potentially duplicative efforts in Delaware in support of clean energy climate-related workforce activities. Stakeholders expressed a desire for better guidance and alignment of these efforts by a single entity who can set goals and strategies for the state in a more streamlined manner.

Strategies for Action in Delaware

The strategies assembled for this report are drawn from, and integrate, the wide range of learnings developed during this research process. They are organized into five buckets:

1. **Maximize and enhance Delaware's workforce ecosystem and training assets** to meet the needs of workers, educators, training entities, unions, and employers.
2. **Leverage and expand on existing partnerships** more directly for clean energy and climate-related occupational needs, while integrating clean energy employers into the workforce system.
3. **Ensure more equitable access to employment opportunities** for all Delaware workers to encourage greater diversity of future workers by gender and race.
4. **Build workforce pipelines** by engaging students and young workers about opportunities in clean energy.
5. **Improve leadership and coordination across state-government in ways that better align** workforce partners, organized labor, educators, and employers, and build confidence in Delaware's long-term commitment to meeting its clean energy workforce needs.

1 Maximize and enhance Delaware's workforce ecosystem and training assets to meet the needs of workers, educators, training entities, unions, and employers.

Focus near-term workforce development strategies on specific occupations found in current clean energy and climate technologies. Prioritize programs that expand the pipelines of future workers in high demand occupations with additional resources and support.

Continue to monitor clean energy and climate-related employment trends to prepare for future workforce gaps and develop new training and education initiatives. There is still uncertainty around which types of technologies will be

deployed in Delaware, complicating the state's efficient development of a comprehensive workforce strategy. Over time, Delaware should integrate market research and research on skills training and education pathways of various technologies into its strategy for developing new programs to meet the state's needs and goals.

Direct resources and capacity building to address geographic and occupational variance and gaps within training programs. The training inventory and other research methods highlight areas where gaps exist in the state's current training landscape. Delaware should prioritize future workforce development efforts based on where these gaps in demand exist.

Commission ongoing research to stay abreast of workforce development needs for clean energy and climate initiatives, including regularly monitoring trends in clean energy deployment, workforce system training capacity, apprenticeship opportunities, and updating training inventories. Better tracking of important data such as technology deployment and investment, historical and current employment, training enrollment and completions, and outcomes from energy workers transitioning into new industries will be critical for improved planning and coordination among the state's energy sector and workforce stakeholders.

2 Leverage and expand on existing partnerships more directly for clean energy and climate-related occupational needs, while integrating clean energy employers into the workforce system.

Build on Delaware's strong apprenticeship system, especially its capacity and connection to employers, and provide additional resources for both apprenticeship and pre-apprenticeships programs. Pre-apprenticeship programs provide important experience and exposure to career fields in the skilled trades as well as expand pipelines into apprenticeships. However, pre-apprenticeship programs are less prevalent in Delaware than apprenticeship programs. Meanwhile, vocational technical schools, which host a vast number of apprenticeship programs, are at maximum capacity and struggling to support new pipelines of students. Expanding pre-apprenticeship programs, especially within disadvantaged and historically marginalized communities, while increasing resources for vocational technical school capacity can support the state's long-term clean energy occupational and deployment needs.

Leverage existing employer engagement and interest in Delaware's workforce system while expanding this approach to clean energy companies who are not as involved in workforce issues. Although some clean energy employers are already engaged in workforce development, nurturing these existing relationships, and fostering new ones in a more structured manner will generate stronger connections, coordination, and action. Regular convening opportunities can increase employer

engagement in mentorship and outreach initiatives. The state must also continue to demonstrate its strong commitment to clean energy and climate endeavors and send signals to the business community on where the state seeks progress.

Work closely with organized labor, an important and valuable partner in expanding Delaware's clean energy and climate-related workforce. Mutual information sharing about clean energy investments and initiatives, occupational skills, and training requirements, and expected worker demand will create stronger relationships and more intentional workforce initiatives.

3 Ensure more equitable access to employment opportunities for all Delaware workers to encourage greater diversity of future workers by gender and race.

Support hiring initiatives that expand gender and racial diversity of those hired in clean energy and climate-related fields. Outreach and awareness campaigns, career navigation resources and specialists, flexible training program formats, and additional wraparound support service offerings are key actions for increasing interest in and accessibility to clean energy career opportunities for historically excluded Delaware residents.

Address the need for greater wraparound support that assists those from disadvantaged communities in overcoming barriers to joining the workforce. Promoting holistic job training programs and providing stipends to job seekers who participate in workforce programs are important steps in addressing workforce barriers. Other barriers for individuals entering or transitioning into the clean energy workforce vary from lack of transportation, an absence of documentation, limited childcare, and language challenges. Longer-term strategies to support job seekers include identifying transportation deserts; coordinating low-cost and convenient transportation methods; streamlining returning citizens' ability to re-enter the workforce; and strategizing with childcare providers to increase childcare options.

4 Build workforce pipelines by engaging students and young workers about opportunities in clean energy.

Increase exposure to clean energy and climate-related topics across all school grades (K-12). Delaware education partners are already exploring opportunities to integrate clean energy, climate, environment, and sustainability curriculum into public school classes. Additional resources could build out and expand these curricula areas, and provide for more teacher training, equipment, education resources for guidance counselors and parents or guardians, and short-term hands-on experience opportunities for students.

Improve recruitment and retention of new workers by addressing misconceptions about the trades and highlighting the high-quality jobs and long-term careers that the trades can offer. Improving the marketing of trades can help to eliminate the biases against skilled trades and non-college pathways for young people and adults. Better connecting the passion and values of clean energy and climate-related technologies to the work activities of key occupations may further increase excitement among Delaware students, job seekers, and workers about these options.

Expand opportunities for in-person experiences and on-the-job training and development. The state of Delaware should prioritize training and hands-on experience opportunities for key occupations that will see high demand through clean energy and climate-related technologies. Coordination between training providers, educators, and industry employers can help to ensure that the options available meet the needs of the industry, as well as ensuring that the incoming workforce is better prepared for the job requirements.

Prioritize and increase resources and support programs for Delaware Career and Technical Education involving clean energy and climate-related occupations, especially targeting well-regarded, heavily oversubscribed vocational-technical schools. Vocational technical schools need greater funding and support to increase their ability to serve students interested in the skilled trades and other vocational tracks. Providing additional funding or other resources to these institutions so that they can obtain training equipment and hire additional teachers, and administrative staff can ultimately increase the number of students they can enroll each year. This is a critical step for building Delaware's clean energy workforce. Federal funding opportunities may be available for supporting schools' recruitment efforts of teachers in vocational education, or Career and Technical Education (CTE), fields. This recruitment of administrators and teachers, including from groups of recently retired workers or current industry workers, will allow these Delaware schools to increase capacity and expand the pipeline of clean energy and climate-related workers.

5 Improve leadership and coordination across state-government in ways that better align workforce partners, organized labor, educators, and employers, and build confidence in Delaware's long-term commitment to meeting its clean energy workforce needs.

Provide clarity on decision-making and leadership in setting workforce goals, targets, and timelines and establish coordination and decision-making structures that provide platforms for engagement on clean energy and climate-related workforce issues. This should include aligning agencies around explicit workforce goals and training goals, developing collaboratives and partnerships within and outside the state, developing a statewide entity focused on clean energy workforce needs, and extensive tracking of progress.

Explore establishing a dedicated entity to drive progress. Stakeholders believe a single, centralized entity could improve coordination and increase clarity of decision-making and convene critical stakeholders. The state's Workforce Development Board is well-positioned for this work due to its unique expertise and capacity to address workforce needs.

Stakeholder Insights

> *"Having leadership from the top... to point out what our priorities are, is helpful in thinking about standing up unique programs that don't overlap."*

Glossary

ORGANIZATIONS/ENTITIES	
ABBREVIATION	**DEFINITION/MEANING**
BW RESEARCH	BW Research Partnership
BLS	U.S. Bureau of Labor Statistics
DNREC	Delaware's Department of Natural Resources and Environmental Control (DNREC)
EPA	U.S. Environmental Protection Agency
VOTECH	Vocational Technical Education & Training Institutions
WDB	Workforce Development Board

PEOPLE & PLACES	
ABBREVIATION	**DEFINITION/MEANING**
DE	Delaware
HVAC TECHNICIANS	Heating, Ventilation, and Air Conditioning Mechanics and Installers
MACH2	Mid-Atlantic Clean Hydrogen Hub
PLUMBERS	Plumbers, Pipefitters, and Steamfitters
SOLAR INSTALLERS	Solar Photovoltaic Installers
WELDERS	Welders, Cutters, Solderers, and Brazers
WIND TECHNICIANS	Wind Turbine Service Technicians

ECONOMIC IMPACT MODELING	
ABBREVIATION	**DEFINITION/MEANING**
IEO	Initial Employment Output
SEO	Secondary Employment Output

GENERAL	
ABBREVIATION	**DEFINITION/MEANING**
ARRA	American Recovery and Reinvestment Act
CTE	Career Technical Education
DAC	Disadvantaged Community
EJ & LC	Environmental Justice and Local Communities

HVAC	Heating, Ventilation, and Air Conditioning
IRA	Inflation Reduction Act
K-12	School education levels Kindergarten through 12th grade
LQ	Location Quotient
NAICS	North American Industry Classification System
PBS	Professional and Business Services; also called Professional Services
RGGI	Regional Greenhouse Gas Initiative
USEER	United States Energy and Employment Report

Introduction

The State of Delaware has increasingly carved a leadership role in addressing the impacts of climate change and boosting clean energy development throughout the state. Recent accomplishments include the enactment of the Climate Change Solutions Act of 2023, which sets greenhouse gas emission targets for the state, and the 2024 Energy Solutions Act, which establishes a framework for offshore wind projects off the coast of Delaware. This, coupled with decades of other climate and energy conservation action, has led to a growing Delaware clean energy economy centered around energy efficiency that employs about 2.5% of Delaware's overall workforce.

The recent passage of federal legislation, such as the Inflation Reduction Act and the Bipartisan Infrastructure Law, along with connected funding opportunities at both the federal and state levels, has the potential to supercharge an already-expanding Delaware clean energy and climate-related economy. These investments in climate-friendly technologies are anticipated to drive significant job growth in many occupations across the state.

However, in the coming decade, those occupations are likely to see significant workforce demand from other market drivers such as expanded investment in infrastructure repair and build-out, and new housing development. There is a risk that the near-term supply of workers for these newly created jobs will be limited, potentially leading to project delays, higher costs, and unmet climate goals. Additionally, workers in these occupations tend not to reflect the broader diversity of the overall U.S. workforce, which limits the life-and-community-changing potential of high-quality clean energy and climate-related jobs.

This 2024 Workforce Development Assessment was commissioned by Delaware's Department of Natural Resources and Environmental Control (DNREC) Division of Climate, Coastal and Energy and conducted by BW Research Partnership (BW Research). This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement #95316201 to the State of Delaware, DNREC.

DNREC is responsible for implementing the state's 2023 Climate Change Solutions Act and coordinates the state's action and policy development for addressing climate change. The Climate Change Solutions Act sets a goal for the state to reduce greenhouse gas emissions by 50% from 2005 levels by 2030 and reach net-zero emissions by 2050. Significantly, Delaware achieved a 30% reduction in greenhouse gas emissions from 2005 levels in 2020. To meet the remaining reduction goals, it is critical that the state has a ready and trained workforce to carry out and maintain key emission reduction technologies.

Key research objectives for this assessment, as outlined by DNREC, were to explore the availability of Delaware's workforce to meet its climate goals, and if these anticipated jobs will be accessible to underserved communities and workers. This assessment also sought to identify skills transition and needs, training requirements, workforce development strategies, and local resources necessary to address any identified workforce shortages. Finally, through the stakeholder engagement process underlying this research, DNREC sought to establish a common framework of needs and priorities for Delaware's clean energy and climate-related workforce that could support greater coordination and collaboration among the state's climate and workforce stakeholders.

Report Structure

The first chapter of this report looks at Delaware's current and projected clean energy and climate-related workforce, at both a high-level industry lens and a detailed occupational lens, along with the workforce gap the state must work to close over the coming years. The next two chapters discuss the key strengths and challenges that exist within the current workforce ecosystem in Delaware, and the final chapter highlights recommendations for the state to consider across future efforts and opportunities.

Methodology

BW Research used economic impact modeling to estimate the number of anticipated jobs that will be created as a result of federal and state investments associated with Delaware's Climate Action Plan and Climate Change Solutions Act over the next 10 years. Investments from the Inflation Reduction Act legislation, the Energize Delaware and Regional Greenhouse Gas Initiative programs, and the Mid-Atlantic Clean Hydrogen Hub were analyzed and categorized according to the type of clean energy technology to which they contribute. BW Research leveraged existing modeling data capturing federal investments into climate-related and clean energy activities and supplemented that with economic impacts projected from state investments. These were translated into projected employment supported by these investments over the next decade.

BW Research implemented primary and secondary research methods to understand Delaware's clean energy and climate-related workforce ecosystem. Primary research included a survey of relevant Delaware employers on their hiring trends and challenges, fielded in May and June of 2024 with 54 completions, as well as stakeholder engagement through 15 virtual one-on-one meetings, six virtual energy stakeholder meetings hosted by Senator Stephanie Hansen, and one in-person workshop. The survey was sent to clean energy firms that had completed the United States Energy and Employment Report (USEER) survey effort in 2022, known clean energy firms identified by DNREC, an online panel of relevant businesses through a third party, and a sample of firms known to work within the relevant industry codes (NAICS) from Crunchbase. The one-on-one meetings occurred between April and June of 2024, each approximately 30 minutes. BW Research listened to six of Senator Hansen's stakeholder meetings that occurred from April through June of 2024.

Through secondary research, BW Research gathered data on Delaware's current workforce, including employment trends, demographics, and wages as well as raining programs offered in the state to support key occupations in the clean energy and climate-related economy. BW Research utilized data from the U.S. Bureau of Labor Statistics; JobsEQ, an online labor market research tool; the U.S. Department of Labor; the National Center for Education Statistics; the Delaware Department of Education; and other online resources to conduct this secondary research.

Delaware's Clean Energy and Climate-Related Workforce

This section details current clean energy employment across five major technology sectors, including energy efficiency, electric power generation, alternative transportation, grid and storage, and fuels. Jobs are also explored by value chain segments, or activities and processes within the economy, encompassing construction, manufacturing, trade, professional services,[6] utilities, agriculture & forestry, and other.[7] Each lens provides a unique understanding of the clean energy and climate-related sector growth and development, highlighting the types of energy products or services and economic activities that are concentrated in the sector.

In addition to using technology and value chain lenses, this report also explores clean energy jobs by occupation. While there are numerous occupations related to the climate and clean energy economy, 13 key occupations[8] were selected for deeper analysis. The list was initially developed by BW Research based on previous workforce assessments in other regions. It was then curated through discussion with the DNREC team, the employment projection estimates, and other analyses in this report. This occupational analysis is another way of viewing employment within the clean energy and climate-related sectors. Workers in these key occupations may contribute to multiple technologies and value chains. For instance, Electricians may support the construction of building structures, the manufacturing of solar panels, or research needs for electric vehicle technologies, among other activities.

The 13 key occupations include: Construction Managers; Electrical Engineers; Carpenters; Construction Laborers; Electricians; Plumbers, Pipefitters, and Steamfitters; Solar Photovoltaic Installers; Construction and Building Inspectors; Automotive Service Technicians; Heating, Air Conditioning, and Refrigeration Mechanics and Installers; Electrical Power-Line Installers and Repairers; Wind Turbine Service Technicians; and Welders, Cutters, Solderers, and Brazers. Other clean energy and climate-related jobs can be studied in future efforts for a more robust examination of the sector's jobs in Delaware's economy.

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[6] Professional business services include all finance, legal https://www.matchfacts.app/en-US/, consulting, engineering, research, or architectural support.

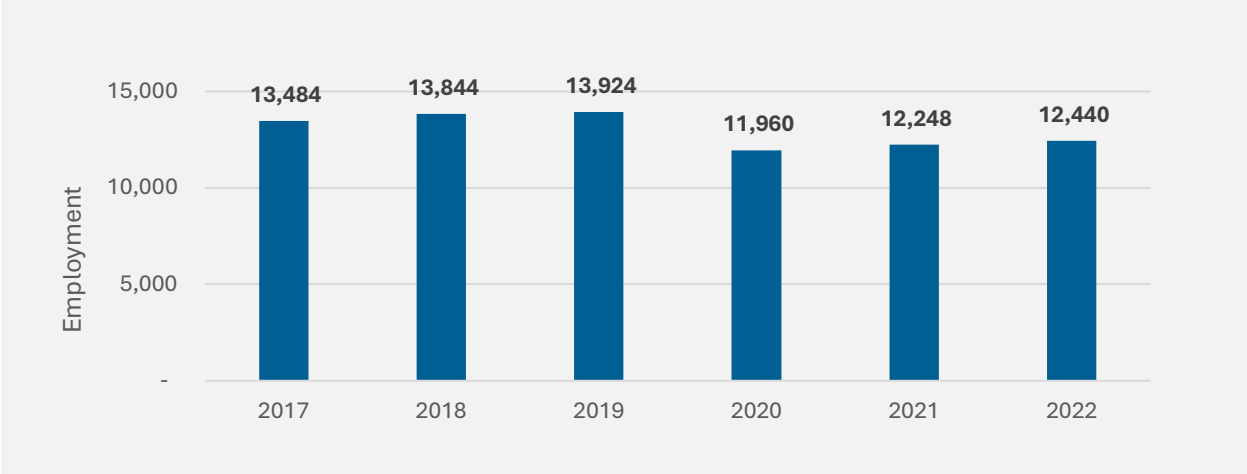
[7] Other services are largely comprised of automotive repair and maintenance, and also includes organizational and non-profit work such as environment and conservation organizations, business associations, or advocacy organizations.

[8] Initially, 14 occupations were selected as targeted, or key, occupations, but one, Landscape Architects, was eliminated in this final report due to an employment projection of zero additional jobs in this occupation resulting from the investments.

The Existing Clean Energy Economy

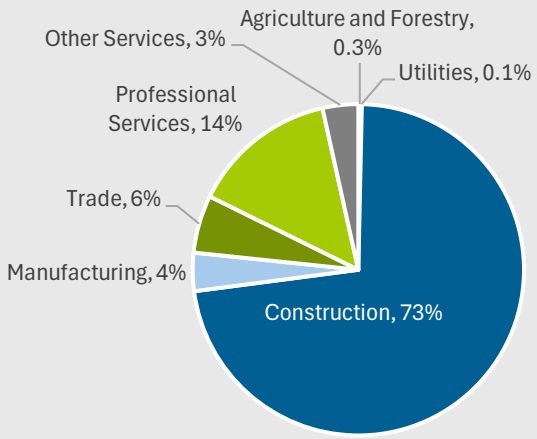
There is strong momentum within Delaware's clean energy economy with recent job growth seen across sectors.[9] Delaware's clean energy industry makes up 2.5% of total employment in the state, with over 12,400 workers in 2022 (Figure 1).[10] Close to three-quarters (73%) of these clean energy jobs are considered to be part of the construction industry. As of 2022, the smallest value chain, utilities, employs only 0.1% of clean energy jobs in the state (Figure 2).[11]

Figure 1. Clean Energy Employment in Delaware, 2017-2022[12]



[9] Appendix B lists the energy technologies considered clean technologies that are included in this jobs study.
[10] Total economy data sourced from JobsEQ®, based on a four-quarter moving average and on Place of Work estimates.
[11] This report uses data from the 2023 Clean Jobs America report from E2 and 2023 United States Energy and Employment Report (USEER) reporting on 2022 employment since the 2024 iterations of these reports with 2023 data was not available at the time of the analysis.
[12] Source: Clean Jobs America 2023. E2. 2017-2022. https://e2.org/reports/clean-jobs-america-2023/ & The United States Energy and Employment Report. U.S. Department of Energy. 2022-2023. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer

Figure 2. Clean Energy Employment in Delaware by Industry, 2022[13]

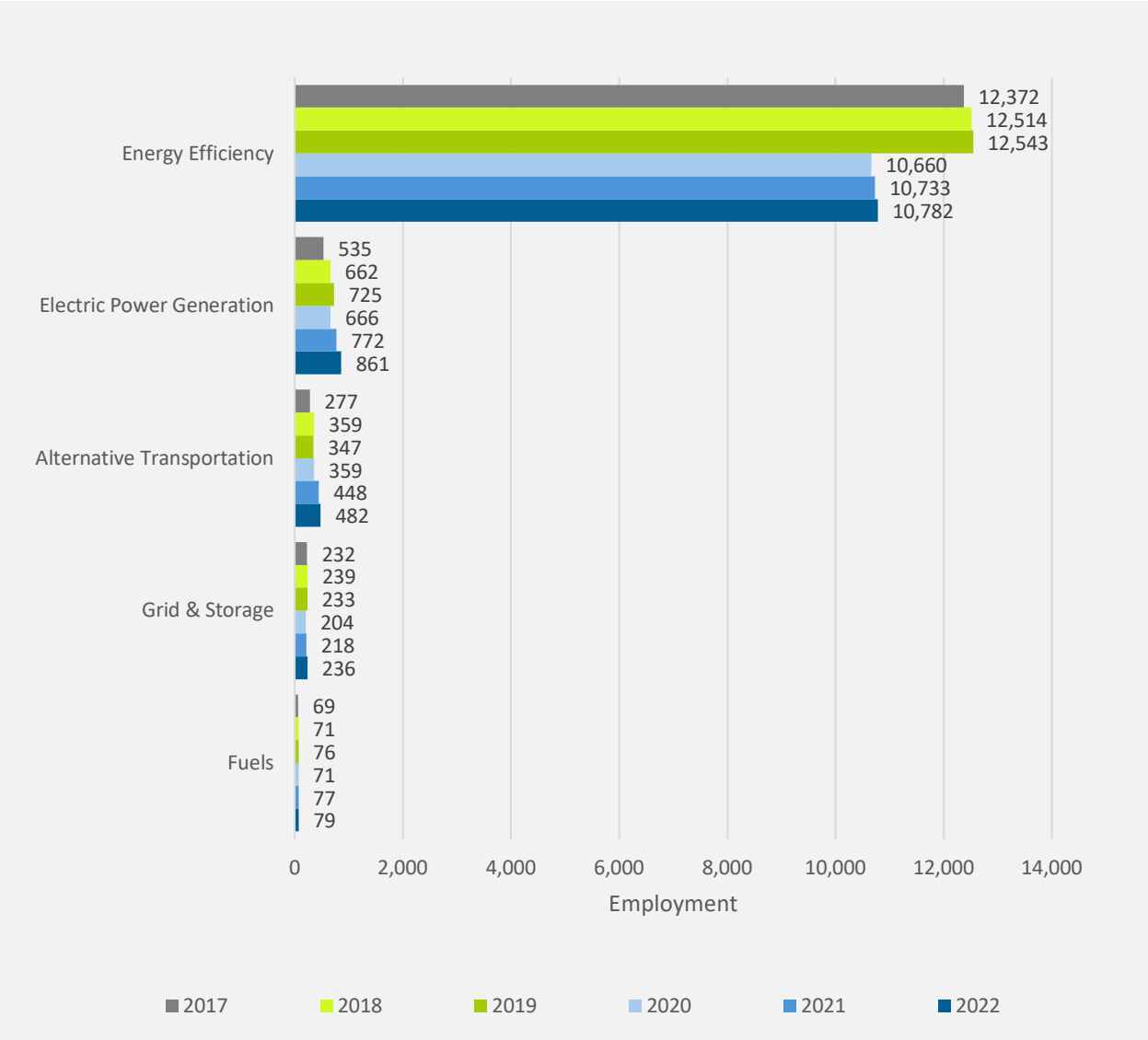


The largest sector in Delaware's clean energy industry is energy efficiency. This sector employed nearly 10,800 workers in 2022, representing almost 87% of the state's total clean energy employment. The energy efficiency sector has consistently been the state's largest clean energy sector, though employment in this sector decreased 13% from 2017 to 2022. Aside from energy efficiency, all other clean energy sectors have surpassed their pre-pandemic employment levels, as of 2022 (Figure 3).[14]

[13] Source: Clean Jobs America 2023. E2. 2017-2022. https://e2.org/reports/clean-jobs-america-2023/ & The United States Energy and Employment Report. U.S. Department of Energy. 2022-2023. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer

[14] Appendix C contains clean energy employment data within each major clean energy sector.

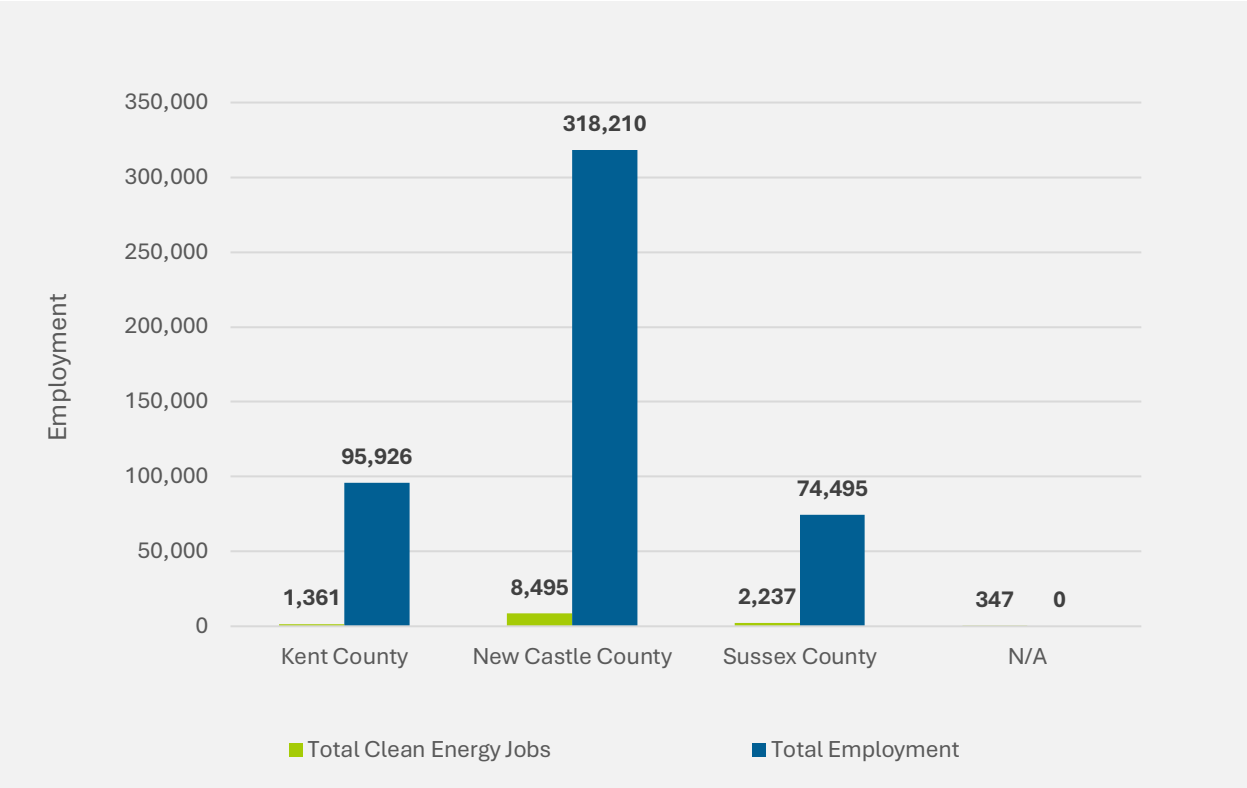
Figure 3. Clean Energy Employment in Delaware by Technology, 2017-2022[15]



New Castle County holds the largest share of clean energy jobs within Delaware, with 68% of the state's clean energy workforce located within the county. Sussex County and Kent County represent 18% and 11% of the state's clean energy workforce, respectively. While New Castle County's clean energy employment concentration aligns with that of the state's overall workforce (64%), Sussex County has the smallest proportion of clean energy jobs but makes up a larger proportion of total state jobs compared to Kent County (Figure 4).

[15] Source: Clean Jobs America 2023. E2. 2017-2022. https://e2.org/reports/clean-jobs-america-2023/ & The United States Energy and Employment Report. U.S. Department of Energy. 2022-2023. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer

Figure 4. Clean Energy Jobs in Delaware by County, 2022[16]



Occupational Outlook of Clean Energy Employment

Given Delaware's greenhouse gas emission reduction and clean energy strategies, 13 occupations were identified as targeted or key occupations to study for the future of Delaware's clean energy and climate-related workforce, covering five different occupational groups (Table 1).[17]
These occupations were selected based on several occupational criteria, including:

- Occupations currently in high demand in Delaware's climate and clean energy industries
- Projected high growth rates of specific occupations based on this research's modeling effort
- Higher barriers to occupational entry
- Employer reports of difficulty recruiting or retaining specific occupations
- Limited current supply of these occupations in the state, especially in terms of Location Quotient (i.e., compared to national averages).

[16] Source: Clean Jobs America 2023. E2. 2017-2022. https://e2.org/reports/clean-jobs-america-2023/ & The United States Energy and Employment Report. U.S. Department of Energy. 2022-2023. https://www.energy.gov/policy/us-energy-employment-jobs-report-useer
Employment categorized as "N/A" are clean energy jobs that cannot be allocated to a specific county
[17] Initially, 14 occupations were selected as key occupations, but one, Landscape Architects, was eliminated in this final report due to an employment projection of zero additional jobs in this occupation resulting from the investments.

The occupations selected for inclusion in this report represent many of the most important occupations for the state necessary to meet its climate and clean energy goals. This prioritization can support greater focus in terms of funding and programming to educate, train, and recruit for these occupations, especially in underserved communities and among under-represented populations. It can also facilitate targeted public awareness and communications efforts, by providing a selection of occupations to focus public education efforts.

Table 1. Key Occupations and Corresponding Occupational Groups for Delaware's Clean Energy and Climate-Related Workforce Development Assessment[18]

OCCUPATION NAME	SOC CODE	OCCUPATIONAL GROUP	DESCRIPTION
Construction Managers	11-9021	Management	"Oversee and coordinate construction and maintenance activities, including planning, budgeting, and scheduling. Manage specialized areas like carpentry or plumbing and supervise subordinate staff."
Electrical Engineers	17-2071	Architecture and Engineering	"Research, design, develop, test, or supervise the manufacturing and installation of electrical equipment."
Carpenters	47-2031	Construction and Extraction	"Construct, erect, install, or repair structures and fixtures; building frameworks; and wood stairways, window and door frames, and hardwood floors."
Construction Laborers	47-2061	Construction and Extraction	"Perform tasks involving physical labor at construction sites. May operate hand and power tools of all types…May clean and prepare sites, dig trenches, set braces… May assist other craft workers."
Electricians	47-2111	Construction and Extraction	"Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service streetlights, intercom systems, or electrical control systems."
Plumbers, Pipefitters, and Steamfitters (Plumbers)	47-2152	Construction and Extraction	"Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Includes sprinkler fitters."
Solar Photovoltaic Installers (Solar Installers)	47-2231	Construction and Extraction	"Assemble, install, or maintain solar photovoltaic (PV) systems on roofs or other structures…May include measuring, cutting, assembling, and bolting structural framing and solar modules. May perform minor electrical work such as current checks."
Construction and Building Inspectors[19]	47-4011	Construction and Extraction	"Inspect structures using engineering skills to determine structural soundness and compliance with specifications, building codes, and other regulations."
Automotive Service Mechanics	49-3023	Installation, Maintenance, and Repair	"Diagnose, adjust, repair, or overhaul automotive vehicles."

[18] Occupational descriptions are sourced from May 2023 Occupation Profiles of the U.S. Bureau of Labor Statistics. Accessed 28 August 2024. https://www.bls.gov/oes/current/oes_stru.htm

[19] This occupation includes energy auditors and HERS raters.

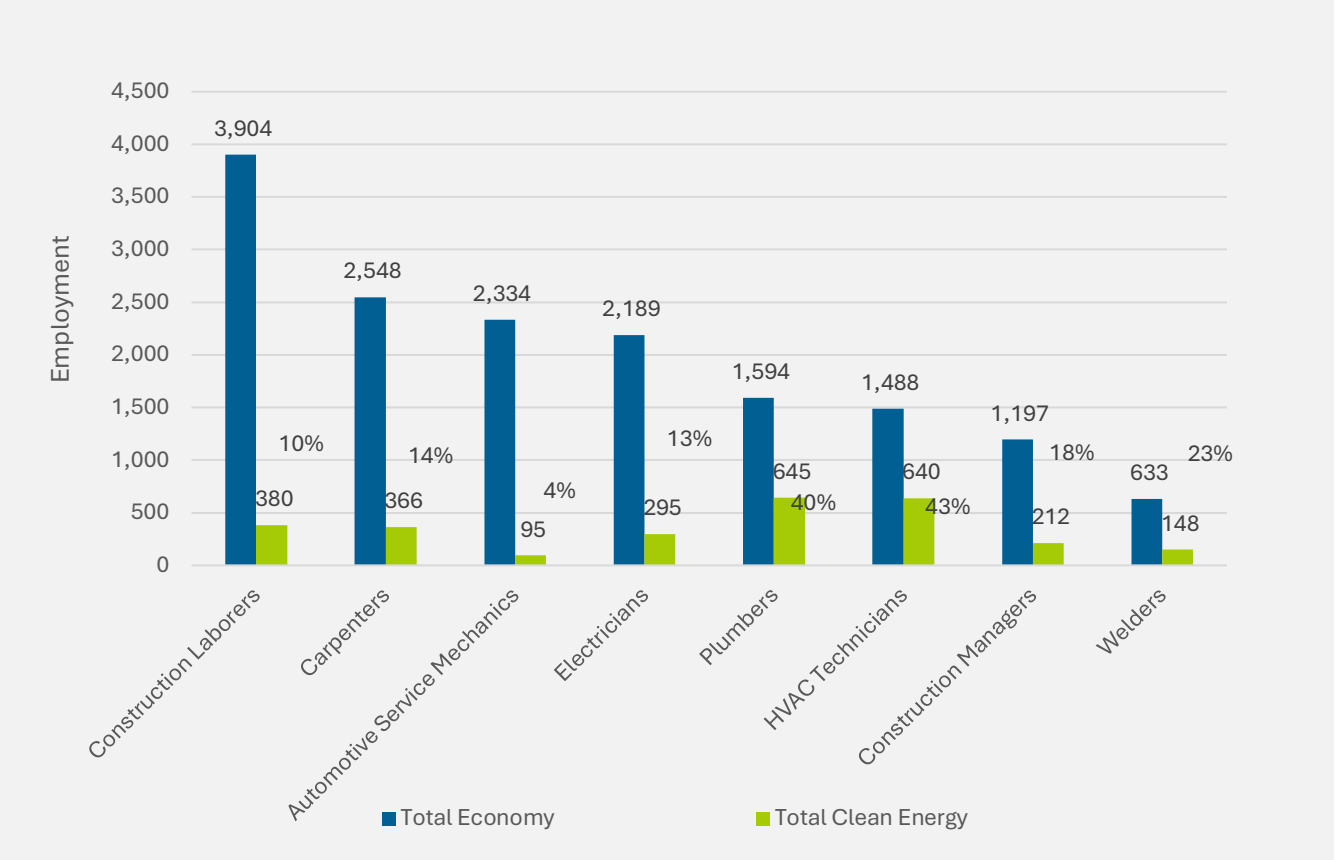
Heating, Air Conditioning, and Refrigeration Mechanics and Installers (HVAC Technicians)	49-9021	Installation, Maintenance, and Repair	"Install or repair heating, central air conditioning, HVAC, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves."
Electrical Power-Line Installers and Repairers	49-9051	Installation, Maintenance, and Repair	"Install or repair cables or wires used in electrical power or distribution systems. May erect poles and light or heavy-duty transmission towers."
Wind Turbine Service Technicians (Wind Technicians)	49-9081	Installation, Maintenance, and Repair	"Inspect, diagnose, adjust, or repair wind turbines."
Welders, Cutters, Solderers, and Brazers (Welders)	51-4121	Production	"Use hand-welding, flame-cutting, hand-soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products."

Current Occupational Employment

Construction Laborers are the most common key occupation in the state, followed by Carpenters. Delaware's overall workforce had almost 490,000 employees in the last quarter of 2022. There were over 3,900 Construction Laborers and more than 2,500 Carpenters employed in the state in 2022. The smallest among the targeted occupations is Wind Technicians, with only 16 employees statewide.

Many clean energy-related occupations comprise a sizable proportion of total employment of those occupations in the state. Among the 13 occupations, only Solar Installers and Wind Technicians are wholly clean energy jobs. Within the remaining 11 occupations, only a portion of the workers are employed in the clean energy economy, the largest being HVAC Technicians with 40% classified as clean energy workers. The share of clean energy Automotive Service Mechanics to total Automotive Service Mechanics in Delaware across all industries is the smallest compared to the other key occupations (Figure 5).

Figure 5. Total and Clean Energy Employment of the Eight Largest Key Occupations in Delaware, 2022[20]



Expected Growth in Delaware's Clean Energy and Climate-Related Economy

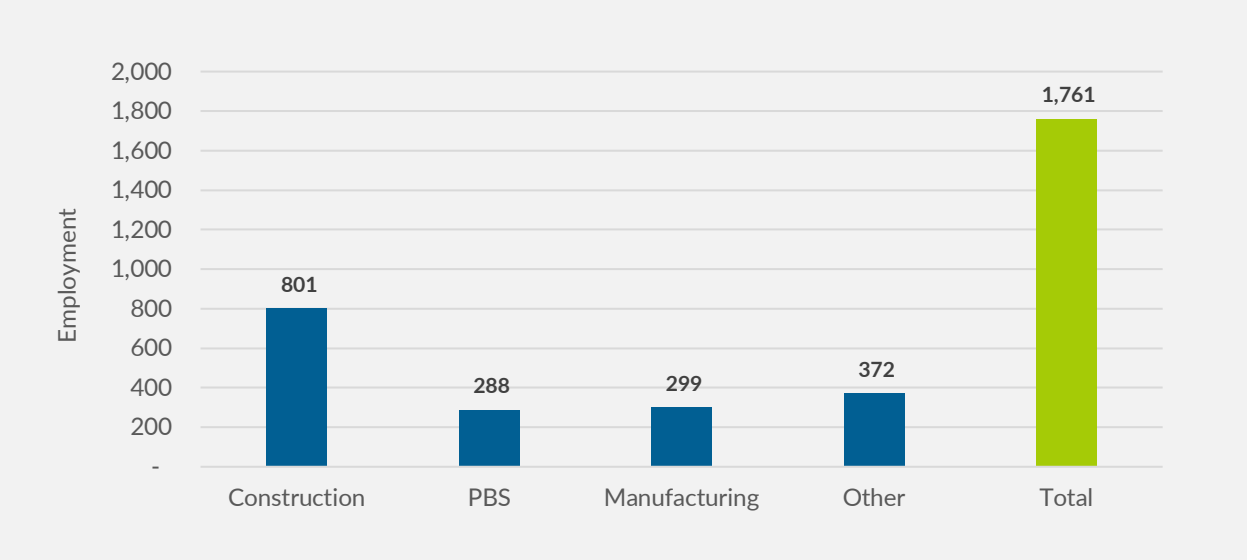
The Initial Employment Outputs (IEO) provide snapshot figures of annually supported employment over the next 10 years resulting from federal and state investments in Delaware. Employment estimates are derived from previous modeling conducted to estimate the economic impacts of federal investment in climate policies and updated to include Delaware-specific funds from the Regional Greenhouse Gas Initiative (RGGI) that contribute to Energize Delaware and other programs as well as the Mid-Atlantic Clean Hydrogen Hub (MACH2). Impacts include direct and indirect employment impacts by value chain and industry while Secondary Employment Outputs (SEO) present direct and indirect employment impacts at the occupational level. The "Appendix A: Methodology" section below includes a detailed methodology for all research in this report, with methodology for these employment projections starting on page 78.

[20] Total economy data sourced from JobsEQ®, based on a four-quarter moving average and on Place of Work estimates.
Total clean energy data is estimated from energy-specific national staffing patterns developed by BW Research applied to Delaware clean energy employment from the U.S. Energy and Employment Report. See "Appendix A: Methodology" for more details on these calculations.

IEO employment projections include breakdowns by construction, professional and business services (PBS),[21] manufacturing, and other supply chains. [22] These projections are also broken out into the six sectors receiving the federal and state investments: buildings,[23] power,[24] industrial,[25] transportation,[26] environmental justice and local communities (EJ & LC),[27] and hydrogen fuel technology.[28]

BW Research projects substantial employment growth, or almost 1,800 additional jobs annually, from federal and state investments in climate and clean energy through 2030, much of it in construction and maintenance occupations (46%).[29] PBS is expected to support the fewest additional jobs (16%) during this time frame (Figure 6).

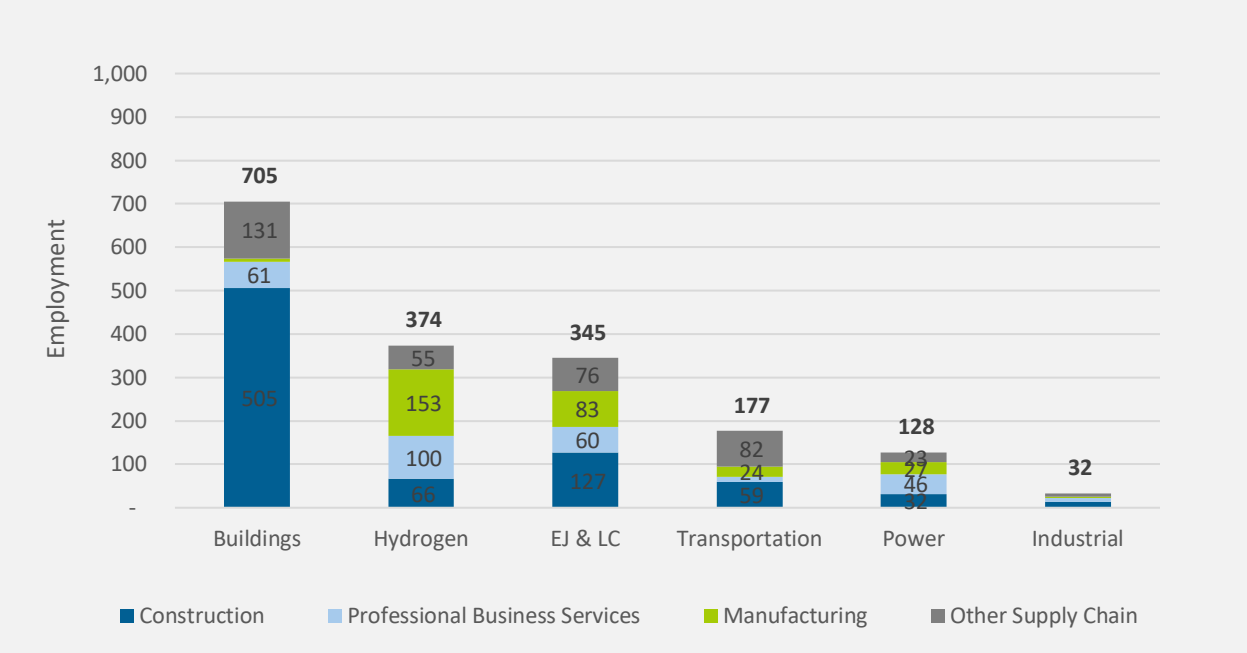
Figure 6. Clean Energy and Climate-Related Employment Projections in Delaware by Value Chain, through 2030



[21] Professional and Business Services includes finance, legal, consulting, engineering, research, or architectural support.
[22] Other Supply Chain includes employment in the retail and wholesale trade, utilities, and automobile and other equipment repair and maintenance industries.
[23] The buildings sector involves building decarbonization activities through increasing energy efficiency measures or increasing the utilization of renewable energy sources in buildings
[24] The power sector relates to investments in renewable electric power generation and clean transmission, distribution, and storage technologies.
[25] The industrial sector projections consider investments into manufacturing facilities for clean fuels, electric vehicles (EVs), REPG component parts, and more.
[26] The transportation sector involves investments into the adoption of vehicles running on low carbon fuels or electricity sources and into charging and alternative fueling infrastructure to support those vehicles.
[27] The EJ & LC sector relates to policies that are driving investments targeted at supporting environmental justice communities, tribes, and low-income and disadvantaged communities (LIDACs), or are specific carve outs for local communities or organization.
[28] The hydrogen sector relates to the MACH2 hydrogen hub investments for the development of hydrogen fuel.
[29] See "Appendix A: Methodology" section with details on BW Research's methodology for employment projections.

Figure 7 shows the projected jobs supported annually through 2030 resulting from federal and state investments into the following six sectors: buildings, power, industrial, transportation, EJ & LC, and hydrogen fuel technology. The building sector is expected to support 40% of these 1,800 jobs, with construction jobs comprising the majority. Almost 400 hydrogen fuel technology jobs and over 300 EJ & LC jobs will also be supported by these investments, annually through 2030 (Figure 7).

Figure 7. Clean Energy and Climate-Related Employment Projections in Delaware by Sector, through 2030[30]



Expected Growth of Occupational Employment

Based on projected federal and state climate investments, BW Research anticipates additional growth representing over 50% of the pre-existing demand expectations for 2030 in four key occupations, including Welders, Electrical Power-Line Installers and Repairers, Construction and Building Inspectors, and Plumbers. Between 25% and 50% growth is expected for six other key occupations, including for Construction Laborers, Carpenters, Electricians, HVAC Technicians and Mechanics, Construction Managers, and Electrical Engineers (Table 3).[31] In total, among the targeted occupations, 375 jobs are projected to be supported annually through 2030 in Delaware.

Through 2030, Delaware is projected to add 100 annually supported Construction Laborer jobs to the existing 380 workers in this occupation in 2022, a growth of 26%. Carpenters and Electricians will both add over 50 annually supported jobs, increasing their 2022 employment by 15% and 18%,

[30] See "Appendix A: Methodology" section with details on BW Research's methodology for employment projections.
[31] See "Appendix A: Methodology" section on page 13 with details on BW Research's methodology for employment projections.

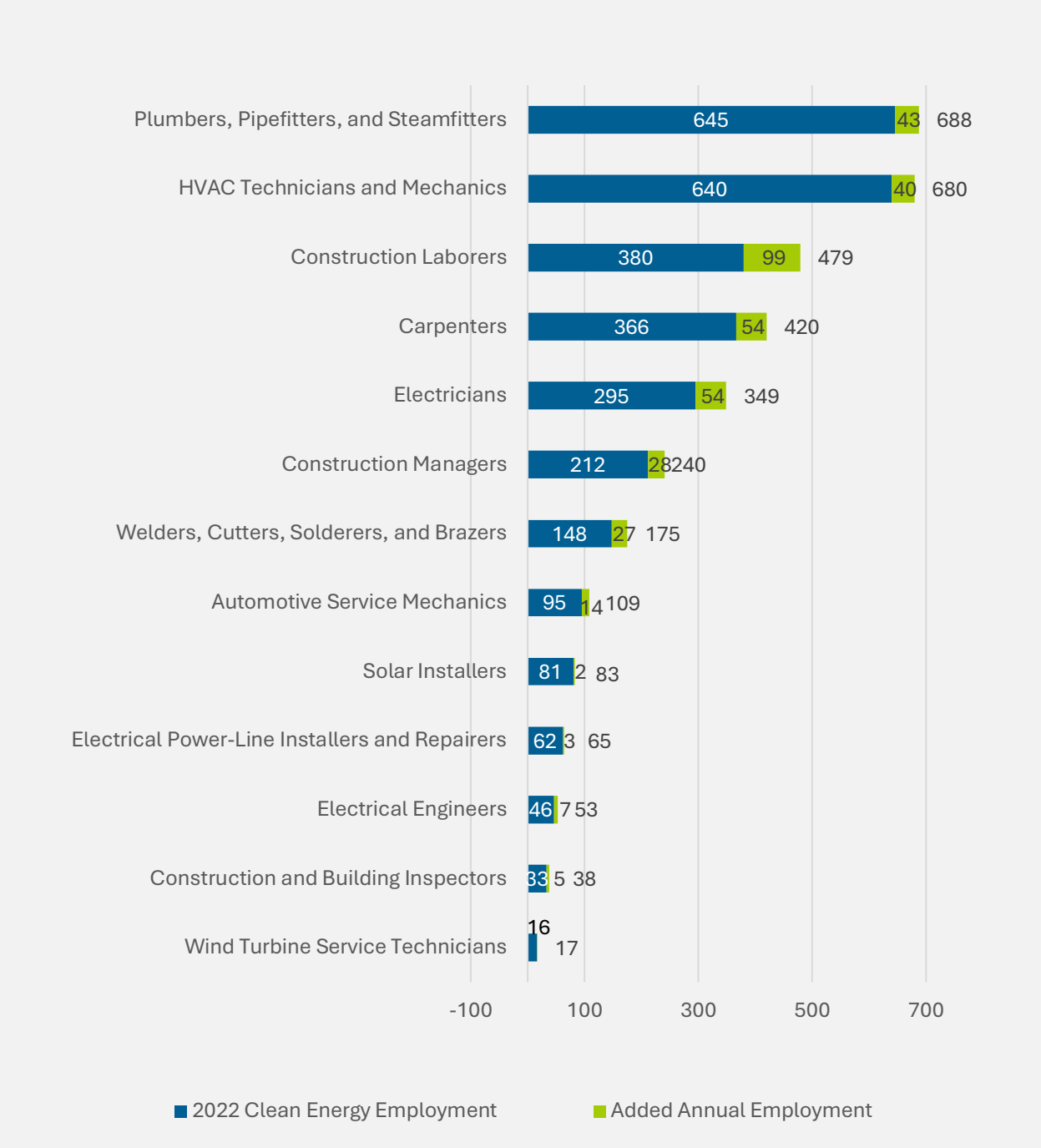
respectively. Welders are also projected to increase employment by 18% from 2022 estimates with almost 30 additional jobs supported annually. While Plumbers and HVAC Technicians were the highest employed key occupations in 2022, with almost 650 workers each, they will support approximately 40 additional jobs annually through 2030, both growing by less than 10% (Figure 8).

More than half (54%, or 54 jobs) of the additional Construction Laborer jobs will be within the buildings sector and 28 will be jobs in the environmental justice and local communities (EJ & LC) sector.[32] Similarly, the buildings sector is expected to employ most jobs added in the Carpentry (82%), Electrical (72%), Construction Management (68%), Plumbing (65%), and HVAC (65%) occupations (Figure 9).

The hydrogen and EJ & LC sectors will also hold a portion of these additional jobs among the targeted occupations. Added hydrogen jobs will total nearly 50 jobs and be most prominent among Electricians (10 jobs), Welders (10 jobs), Plumbers (seven jobs), HVAC Technicians (seven jobs), and Electrical Engineers (four jobs). Like the hydrogen sector, EJ & LC jobs will represent approximately 50 of the total estimated jobs to be supported annually, through 2030, primarily within the Construction Laborer (28 jobs) and Welder (seven jobs) occupations (Figure 9).

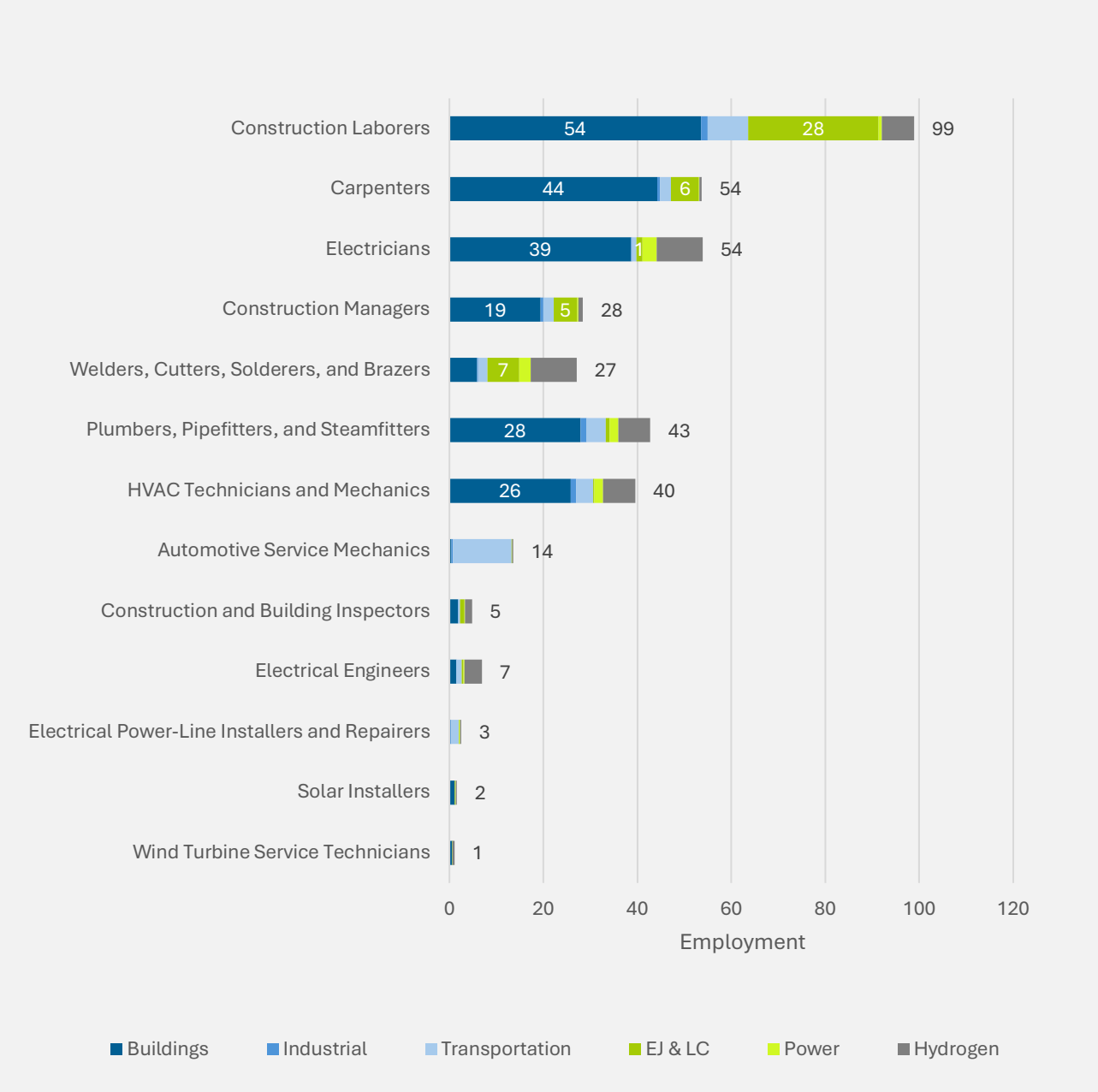
[32] The EJ & LC sector relates to policies that are driving investments targeted at supporting environmental justice communities, tribes, and low-income and disadvantaged communities (LIDACs), or are specific carve outs for local communities or organization.

Figure 8. 2022 Employment Compared to Additional Annual Supported Employment of Key Occupations in Delaware's Clean Energy Workforce[33]



[33] Clean energy 2022 employment data is estimated from energy-specific national staffing patterns developed by BW Research applied to Delaware clean energy employment from the U.S. Energy and Employment Report. See "Appendix A: Methodology" for more details on these calculations.

Figure 9. Additional Annual Supported Employment of Key Occupations in Delaware's Clean Energy and Climate Workforce Through 2030, by Sector



Feasibility of Closing the Employment Gap in Delaware Through Existing Capacity

Multiple factors play a role in assessing the projected employment demand gap.[34] Historical growth patterns, unemployment rates, Location Quotients (LQs),[35] and the ages of the current workers in each target occupation are important considerations for Delaware's ability to grow accordingly.

In addition to these datapoints, the projected growth relative to the existing workforce alongside hiring challenges that employers face and the training and education requirements for the jobs may reflect another layer of constraint on the workforce ecosystem.

Historical Growth, Unemployment, Location Quotient, and Age Considerations

Occupational unemployment rates can shed light on a potential pool of workers who may be able to re-enter the workforce easily in response to the increased demand. The state's overall unemployment rate, as of the end of 2023, was 4.2% and **six of the 13 occupations had an unemployment rate higher than the state, with Construction Laborers having the largest rate at 8.2%** (Table 2). This indicates that there is a current worker pool for these occupations and provides a positive outlook on the state's expansion within the clean energy and climate-related industry. The educational and training requirements for these positions, however, may pose a barrier to some of the unemployed workers and are explored further below.

Plumbers, HVAC Technicians, and Construction and Building Inspectors are the only three occupations with an LQ greater than 1.00, indicating a relative specialty in these fields in Delaware, though they also have unemployment rates lower than the state overall. Construction and Building Inspectors have the lowest unemployment rate (0.4%) of all the target occupations as well as the largest concentration of current workers 55 years of age or older (44.5%). Thus, Delaware may face a more urgent need to recruit workers into this occupation as their current workforce begins to enter retirement phases and there is a smaller pool of workers from which they can recruit (Table 2).

With regards to historical growth, Automotive Service Mechanics and Electrical Power-Line Installers and Repairers actually saw a decline in employment from 2017 to 2023, with Automotive Service Mechanics losing almost 200 workers, or a 7.4% decline (Table 2).

[34] BW Research focuses on a worker demand side gap, with the assumption that the statewide market has reached an approximate equilibrium in its current state, and issues related to leakage (either technology, occupationally, or geographic) will hamper any longer-term supply-side analysis at the state level.
[35] Location Quotient (LQ) for occupations represents the concentration of workers in a specific region compared to the national average. A LQ with a value greater than 1.00 indicates a region with a higher concentration of workers employed in the occupation, or a greater specialization of that type of work, compared to the overall U.S.

Table 2. Historical Growth, Unemployment Rate, Location Quotients, and Ages of Key Occupations in Delaware's Overall Economy[36]

6-DIGIT SOC CODE	OCCUPATION NAME	HISTORICAL GROWTH (2017-2023Q4)	UNEMPLOYMENT RATE, 2023Q4	LQ, 2023Q4	SHARE OF CURRENT WORKERS AGED 55 YEARS AND OVER[37]
Delaware Overall Workforce		32,906	4.2%	1.00	26.0%
47-2061	Construction Laborers	406	8.2%	0.89	19.7%
47-2031	Carpenters	37	6.0%	0.87	19.5%
49-3023	Automotive Service Mechanics	-187	2.2%	0.96	20.7%
47-2111	Electricians	361	2.6%	0.96	22.3%
47-2152	Plumbers, Pipefitters, and Steamfitters	168	2.9%	1.05	23.2%
49-9021	HVAC Technicians and Mechanics	349	2.3%	1.19	21.5%
11-9021	Construction Managers	112	2.5%	0.77	31.8%
51-4121	Welders, Cutters, Solderers, and Brazers	17	4.5%	0.47	21.2%
47-4011	Construction and Building Inspectors	83	0.4%	1.21	44.5%
17-2071	Electrical Engineers	32	1.6%	0.85	34.4%
49-9051	Electrical Power-Line Installers and Repairers	-11	5.0%	0.72	13.3%
47-2231	Solar Photovoltaic Installers	32	11.8%	0.79	10.1%
49-9081	Wind Turbine Service Technicians	4	6.6%	0.41	26.6%

Growth Relative to Existing Workforce Considerations

The projected growth through 2030 in Delaware's total and clean energy economies separately do not exceed 26% for these targeted occupations. Table 3 compares Delaware's 2022 employment in both the clean energy sector and the overall economy, seven-year estimated

[36] Source: JobsEQ®. 2023Q4. Based on a four-quarter moving average. Historical growth, unemployment, and LQ data are based on Place of Work estimates. Age data are based on Place of Residence estimates.
[37] Concentrations of current workers in other age groups for key occupations can be found in Appendix B.

employment demand[38] for the state's overall economy, and additional clean energy employment projections from the federal and state investments. Within the clean energy sector, the largest growth rate is seen within the Construction Laborer occupation, representing a 26% rise in employment.

Table 3. Total and Clean Energy Economies in Delaware, 2022 Baseline and Projected[39] [40]

6-DIGIT SOC CODE	OCCUPATION NAME	TOTAL ECONOMY	CLEAN ENERGY SECTOR	TOTAL ECONOMY	CLEAN ENERGY SECTOR	TOTAL ECONOMY	CLEAN ENERGY SECTOR
		2022Q4 EMPLOYMENT		7 YEAR CUMULATIVE DEMAND	ADDITIONAL ANNUAL BW PROJECTED GROWTH	GROWTH AS A % OF 2022 BASELINE	
Delaware Overall Workforce		489,518	12,440	23,226	1,761	5%	14%
47-2061	Construction Laborers	3,904	380	280	99	7%	26%
47-2031	Carpenters	2,548	366	121	54	5%	15%
49-3023	Automotive Service Mechanics	2,334	95	95	14	4%	15%
47-2111	Electricians	2,189	295	170	54	8%	18%
47-2152	Plumbers, Pipefitters, and Steamfitters	1,594	645	71	43	4%	7%
49-9021	HVAC Technicians and Mechanics	1,488	640	111	40	7%	6%
11-9021	Construction Managers	1,197	212	84	28	7%	13%
51-4121	Welders, Cutters, Solderers, and Brazers	633	148	28	27	4%	18%
47-4011	Construction and Building Inspectors	495	33	4	5	1%	15%
17-2071	Electrical Engineers	490	46	26	7	5%	15%
49-9051	Electrical Power-Line Installers and Repairers	267	62	3	3	1%	5%

[38] This baseline growth is the expected growth of the key occupations across all industries in Delaware, without accounting for the federal and state clean energy investments included in the employment modeling efforts of this report, as reported by JobsEQ and using U.S. Bureau of Labor Statistics data.

[39] Total economy data is sourced from JobsEQ®. 2023Q4. Based on a four-quarter moving average and on Place of Work estimates

Clean energy 2022 employment data is estimated from energy-specific national staffing patterns developed by BW Research applied to Delaware clean energy employment from the U.S. Energy and Employment Report. See "Appendix A: Methodology" for more details on these calculations.

[40] The forecasted occupational demand detailed here represents occupational growth, or new workers added to the economy, and does not account for occupational separations, or workers transferring to different occupations in the workforce and workers exiting the workforce. Therefore, the occupational demand reported here should be interpreted as a measure of the expansion of overall number of jobs and should not be interpreted as the number of new job openings.

47-2231	Solar Photovoltaic Installers	81	81	15	2	19%	2%
49-9081	Wind Turbine Service Technicians	16	16	4	1	25%	6%

Compared to 2022 employment, Delaware mostly has moderate gaps in clean energy employment across the key occupations (Table 4). At most, Wind Technicians will see a growth of 31% from 2022 employment, followed by Solar Installers, rising by 21% in annually supported jobs, though both occupations employed less than 100 workers in the industry in 2022. Of the remaining occupations, Construction Laborers, Electricians, and HVAC Technicians are expected to see the largest percentage growth (10%) from 2022 levels. Relative to historical growth, however, the growth projections for Welders and Electrical Engineers are most concerning, representing over 100% of historical growth.

Legend for Table 4 Gap Analysis of Key Occupations

Severe	Demand exceeds supply ***and*** this gap is 10% or more of the existing workforce
Moderate	Demand exceeds supply but the gap is less than 10% of the existing workforce
Mild	Supply exceeds demand

Table 4. Employment Gap Analysis of Key Occupations[41]

6-digit SOC Code	Occupation Name	Total Projected Added Demand Through 2030[42]	Total Projected Added Demand as a % of Historical Growth[43]	Total Projected Added Demand as a % of 2022 Employment	Status Based on 2022 Employment
Delaware Overall Workforce		24,987	76%	5%	Moderate
47-2061	Construction Laborers	379	47%	10%	Severe
47-2031	Carpenters	175	-269%	7%	Moderate
49-3023	Automotive Service Mechanics	109	47%	5%	Moderate
47-2111	Electricians	224	54%	10%	Severe
47-2152	Plumbers, Pipefitters, and Steamfitters	114	44%	7%	Moderate
49-9021	HVAC Technicians and Mechanics	151	28%	10%	Severe

[41] The forecasted occupational demand detailed here represents occupational growth, or new workers added to the economy, and does not account for occupational separations, or workers transferring to different occupations in the workforce and workers exiting the workforce. Therefore, the occupational demand reported here should be interpreted as a measure of the expansion of overall number of jobs and should not be interpreted as the number of new job openings.

[42] This is the sum of the projected growth in Delaware's overall economy obtained from JobsEQ (based on U.S. Bureau of Labor Statistics' projection estimates) for each occupation and BW Research's average annual occupational modeling outputs in Delaware's clean energy sector from recent federal and state investments.

[43] Negative percentages are a result of historical employment declines in certain occupations.

11-9021	Construction Managers	112	-6%	9%	Moderate
51-4121	Welders, Cutters, Solderers, and Brazers	55	162%	9%	Moderate
47-4011	Construction and Building Inspectors	9	7%	2%	Moderate
17-2071	Electrical Engineers	33	165%	7%	Moderate
49-9051	Electrical Power-Line Installers and Repairers	6	-55%	2%	Moderate
47-2231	Solar Photovoltaic Installers	17	33%	21%	Severe
49-9081	Wind Turbine Service Technicians	5	63%	31%	Severe

Overall, Delaware's clean energy and climate-related industry has some challenges ahead with meeting employment demands resulting from targeted federal and state investments. Occupations with severe employment gaps, low unemployment rates, low LQs, and hiring challenges may hinder growth. Solar Installers and Wind Technicians have very low LQs in Delaware (0.79 and 0.41, respectively), indicating a low rate of specialization in these fields in the state, while HVAC Technicians and Electricians have unemployment rates (2.3% and 2.6%, respectively) lower than the state overall (4.2%). A high share (42%) of HVAC Technician employers also reported "great" difficulty in hiring for these roles. Construction Laborers have a high unemployment rate, but half of the surveyed firms indicated "some" hiring difficulty, which may indicate a disconnect between what employers seek in applicants and what the current workforce offers.

While the employment gap in comparison to 2022 levels is only moderate for Construction Managers, Construction and Building Inspectors, and Electrical Engineers, their current workforces have higher shares of workers who will look to retire in the next decade (with workers aged 55 years and over representing 32%, 45%, and 34%, respectively, of the total employed in these occupations, Table 2). This is compounded by low unemployment rates for Construction Managers, Construction and Building Inspectors, and Electrical Engineers (2.5%, 0.4%, and 1.6%, respectively). Further, employers frequently reported at least some hiring challenges for these occupations. Delaware may struggle to meet the demand for these roles as a result of these factors.

Hiring Difficulty Considerations

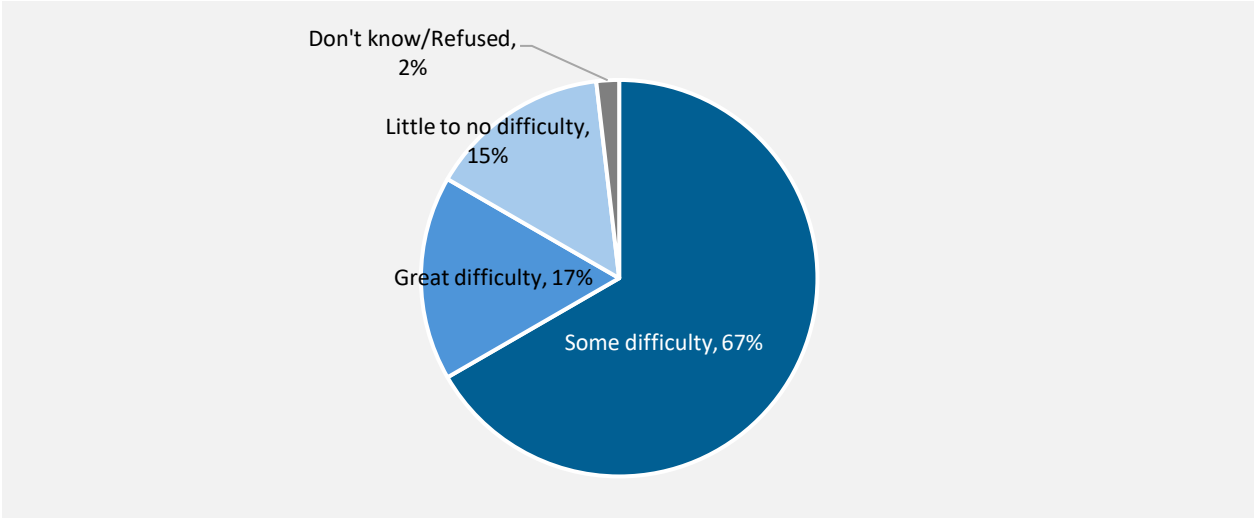
BW Research conducted a survey of climate and clean energy employers in Delaware.[44] Most (70%) of the employers who responded to the survey were in New Castle County. Kent County held the next largest proportion (23%) of respondents. In addition, the greatest share of surveyed firms

[44] Appendix A contains details on this survey methodology.

(37%) reported being in business between six and ten years. Only 2% have been in business for less than three years.[45]

Assessing difficulty in hiring among employers can highlight potential bottlenecks or constraints on the ability for a workforce to grow as the industry demands. There are multiple reasons employers may experience a high rate of hiring difficulty, such as low interest in the jobs available among local workers, low wages and limited benefits offered in the line of work, or a disconnect between what employers are looking for in their workers and what the available pool of workers have attained in terms of skills, education, or experience. In Delaware, most (67%) surveyed firms indicated they have "some" difficulty in hiring for these target occupations, while 17% said they have "great" difficulty. On the other hand, only 15% of respondents reported "little to no" difficulty in hiring (Figure 10). Reasons for this reported hiring difficulty are explored later in the report in Figure 18.[46]

Figure 10. Surveyed Firms' Level of Difficulty with Hiring Qualified Workers



When considering employers' hiring experiences across the various occupations, those who employ Construction Managers and Electrical Engineers most frequently experienced "great" difficulty hiring for these occupations. Filling Automotive Service Technician and Weatherization Technician positions also pose challenges to surveyed firms, with 83% and 79% of firms reporting "some" or "great" difficulty hiring qualified workers for these occupations, respectively (Figure 11).

Electricians and Construction and Building Inspectors are the least challenging occupations to hire, based on survey responses. Approximately one-in-two (50%) firms who employ Electricians reported "little to no" difficulty hiring for this occupation. For Carpenters, however, employers reported mixed levels of hiring difficulty. Among the seven employers who employ this occupation

[45] The full survey response data, including the characteristics of responding employers, can be found in "

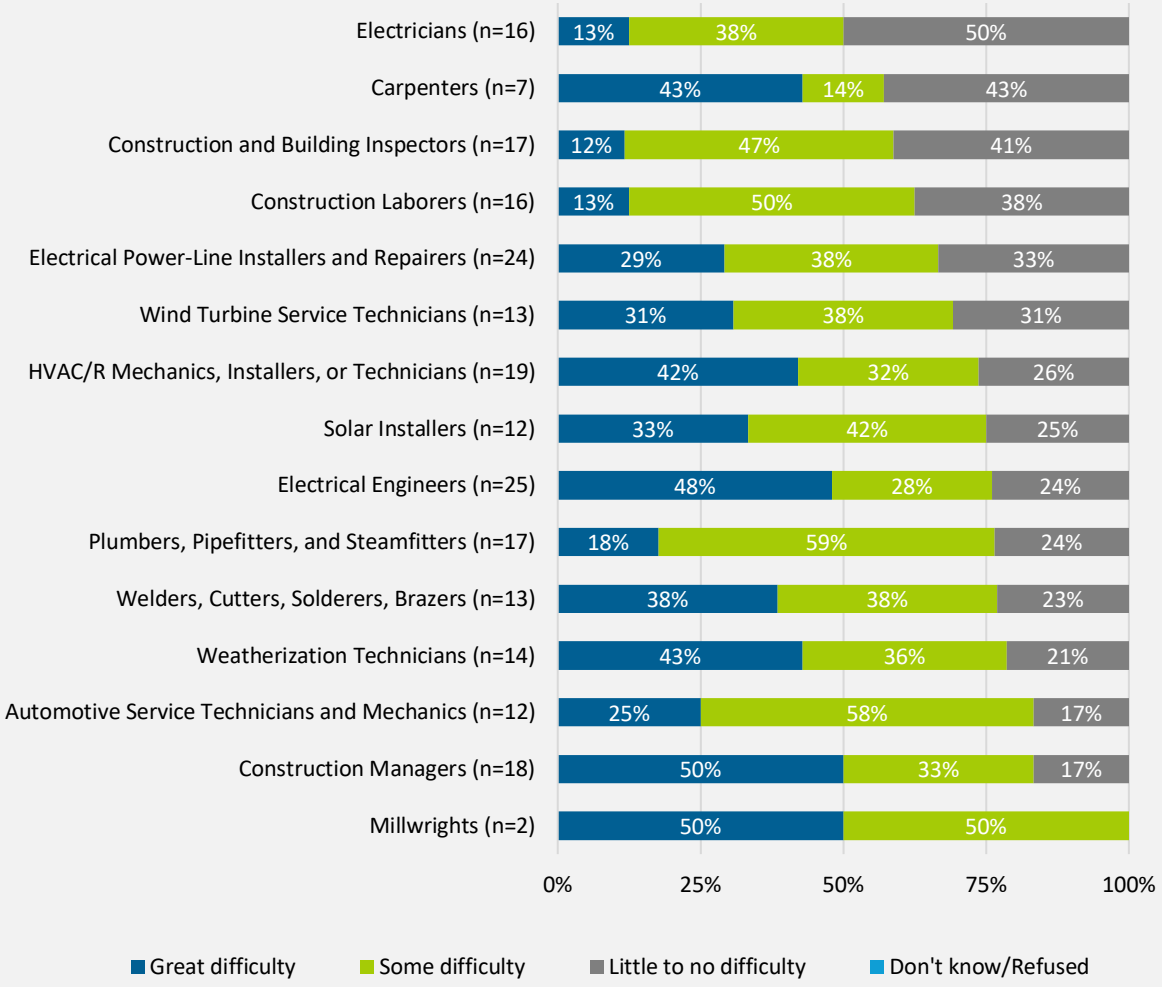
Appendix E: Survey Toplines"

[46] The full survey response data, including the characteristics of responding employers, can be found in "

Appendix E: Survey Toplines"

and responded to the survey, three reported “great” difficulty, three reported “little to no" hiring challenges, and one reported “some” difficulty (Figure 11).

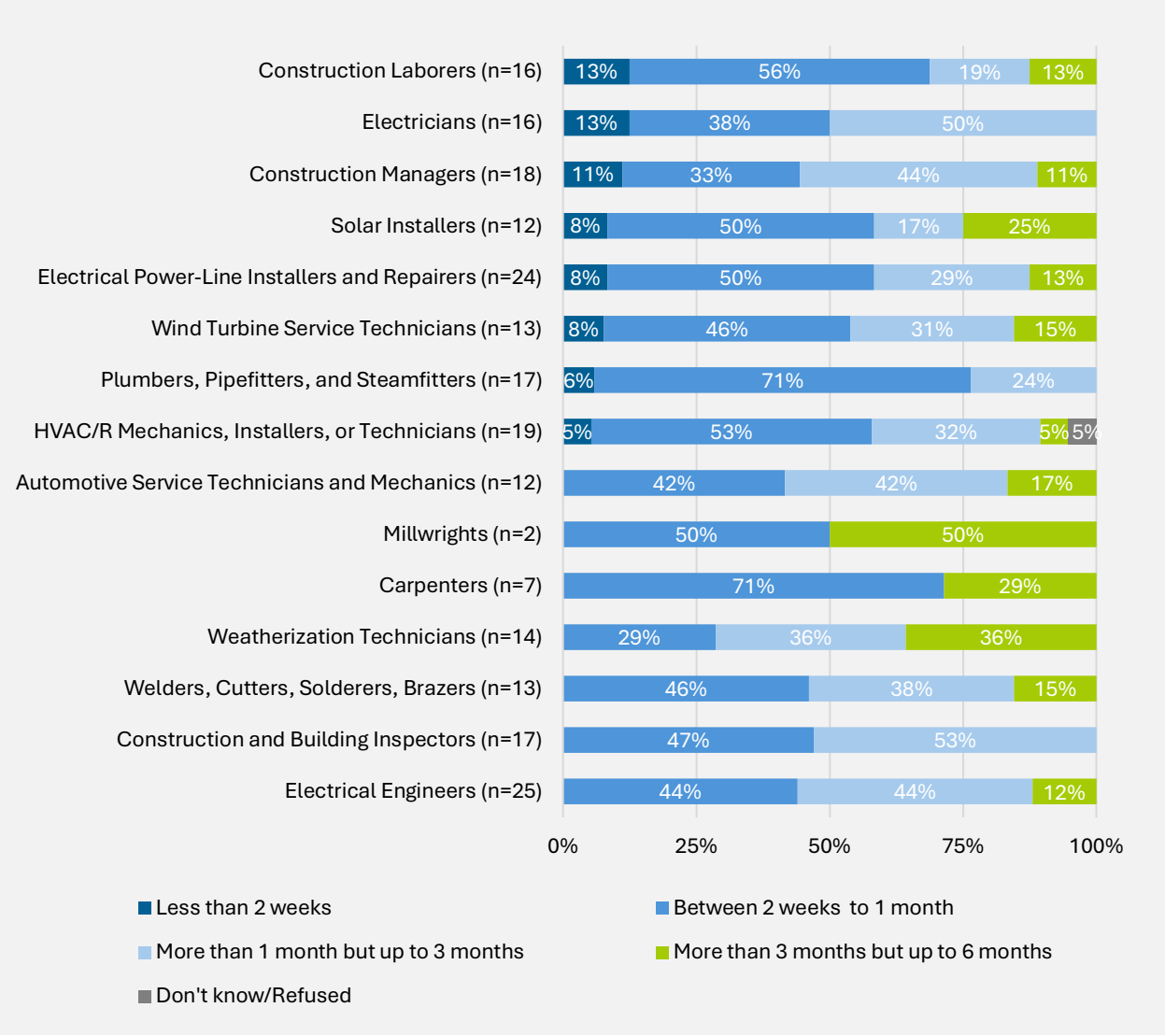
Figure 11. Surveyed Employers’ Level of Difficulty with Hiring Qualified Workers, by Occupation[47]



The approximate time to find and hire qualified workers varied by occupation. Overall, a very low share of employers claimed to hire workers in these occupations in less than two weeks. Hiring between two and four weeks and between one and three months were the most frequently reported hiring times among employers across all occupations. Over one-third (36%) of employers of Weatherization Technicians said it takes them more than three months but less than six months to find and hire qualified workers (Figure 12). [48]

[47] Additional occupations beyond key occupations are included in presented survey data.
[48] Millwrights were studied in the employer survey due to feedback received in stakeholder engagement claiming a need for workers in this occupation. While Figure 12 shows that 50% of Millwright employers reported taking between three and six months to hire, caution interpreting results must be applied due to the low response rate (n=2).

Figure 12. Surveyed Employers' Reported Approximate Time to Find and Hire Qualified Workers, by Occupation[49]



Education and Requirements

Education and training requirements may present barriers to workforce development as higher education credentials may be difficult for job seekers to attain given financial or other limitations, while certain levels of training may be inaccessible to job seekers or have limited offerings.

In Delaware, Construction Manager, Wind Turbine Service Technician, and Carpentry jobs often require higher levels of education and indicate a greater strain on job seekers to enter these occupations than Construction Laborer positions (Figure 22 on page 100 in Appendix B).[50]

[49] Additional occupations beyond key occupations are included in presented survey data.
[50] Millwrights were studied in the employer survey due to feedback received in stakeholder engagement claiming a need for workers in this occupation. While Figure 13 shows that 50% of Millwright employers

Approximately nine-in-ten surveyed firms required at least some form of prior work experience for entry-level applicants. Employers of Construction Managers and Carpenters in Delaware more frequently reported seeking job applicants with more intensive prior work experience than employers of the other target occupations. Thus, it may take Delaware more time to expand these occupations as job applicants may need to gain more than three years of experience in a comparable position. On the other hand, for entry-level positions, a larger share of employers of Electricians, Carpenters, and Weatherization Technicians cited only a pre-apprenticeship or other short-term job training requirement (Figure 23 on page 101 in Appendix B).[51]

Across the key occupations in the state's overall workforce, a high school diploma or equivalent is the highest educational attainment most frequently held by workers. Construction Laborers, who also tend to earn the lowest wages, have the highest percentage (26.5%) of workers with less than a high school diploma as the most common educational attainment. The largest shares of current workers with four-year degrees are employed in Landscape Architect (59%), Electrical Engineering (48%), and Construction Manager (33%) positions (Figure 21 on page 99 in Appendix B). Notably, these are the same three occupations that also have the largest proportion of female workers (Table 13).

indicated they require Master's degrees or higher from qualified applicants, caution interpreting results must be applied due to the low response rate (n=2).

[51] While Figure 12 shows that 50% of Millwright employers seek job applicants with more than three years of experience in a comparable position, caution interpreting results must be applied due to the low response rate (n=2).

Strengths Within Delaware's Existing Workforce Ecosystem

Delaware has several important strengths it can leverage in order to grow its clean energy workforce and support climate change action made possible by federal and state investments. These strengths are highlighted through the primary and secondary data collection efforts as well as conversations BW Research had with local workforce stakeholders, including educators, training providers, employers, industry groups, and government agencies or departments, both virtually and in-person.

1. **A strong foundation of workforce programs and assets**
2. **Existing partnerships within the workforce and education system**
3. **Existing apprenticeship and career technical education (CTE) system**
4. **Many Delaware stakeholders are already actively planning or engaging in education or workforce programs to support the clean energy workforce**
5. **Business interest in new workforce initiatives**
6. **Coverage of workers by union agreements**

Delaware's strong foundation of workforce programs and assets will play a key role in supporting workforce development in the state's clean energy industry.

BW Research developed a comprehensive inventory of 105 publicly available training and credentialing programs in Delaware that serve the 13 target occupations.[52] These trainings were

[52] Appendix A contains details on the training inventory methodology.

identified by looking at programs offered at the state's community college system, career technical education school districts, labor unions, and other local entities. 85 training programs in Delaware were identified as supporting the eight key occupations with the highest employment. Programs for Automotive Service Technicians and Mechanics make up the largest concentration (17%) of identified training programs, followed by programs for Electricians (14%) (Table 5). In total, across all key occupations, 105 programs were inventoried, 54 of which are in New Castle County, aligning with the state's total population and clean energy employment distribution.

Table 5. Training Programs Identified and Occupational Demand By 2030 of Eight Largest Key Occupations[53] [54]

PRIMARY OCCUPATIONAL FOCUS	NUMBER OF PROGRAMS	TOTAL DEMAND THROUGH 2030
Automotive Service Technicians and Mechanics	18	109
Electricians	15	224
HVAC Technicians and Mechanics	11	151
Welders, Cutters, Solderers, and Brazers	11	55
Carpenters	9	175
Construction Laborers	7	379
Construction Managers	7	112
Plumbers, Pipefitters, and Steamfitters	7	114

While engaging with stakeholders within the state's workforce ecosystem,[55] BW Research discovered that workforce supports are offered at the state level, but these programs have low utilization rates. An interesting program at the Delaware Department of Small Business, for example, supports employers who wish to provide training opportunities to staff and provides funding that matches what employers are willing to pay. This often covers the training costs while the employers' funds cover the employees' wages during attendance. It is largely underutilized, however, with only 20% of available funds used each year. The state's Workforce Development Board (WDB) also has funds available to support or develop trainings and help secondary or post-secondary students access job training programs.

[53] After extensive research, the team found that most training programs didn't provide information on program enrollment, capacity, graduation rates, or job placement data.
"Appendix G: Training Inventory" contains details on data that was identified for the inventory.

[54] The forecasted occupational demand detailed here represents occupational growth, or new workers added to the economy, and does not account for occupational separations, or workers transferring to different occupations in the workforce and workers exiting the workforce. Therefore, the occupational demand reported here should not be expressed in a proportion relative to number of training programs which include training programs for re-skilling or advancement.

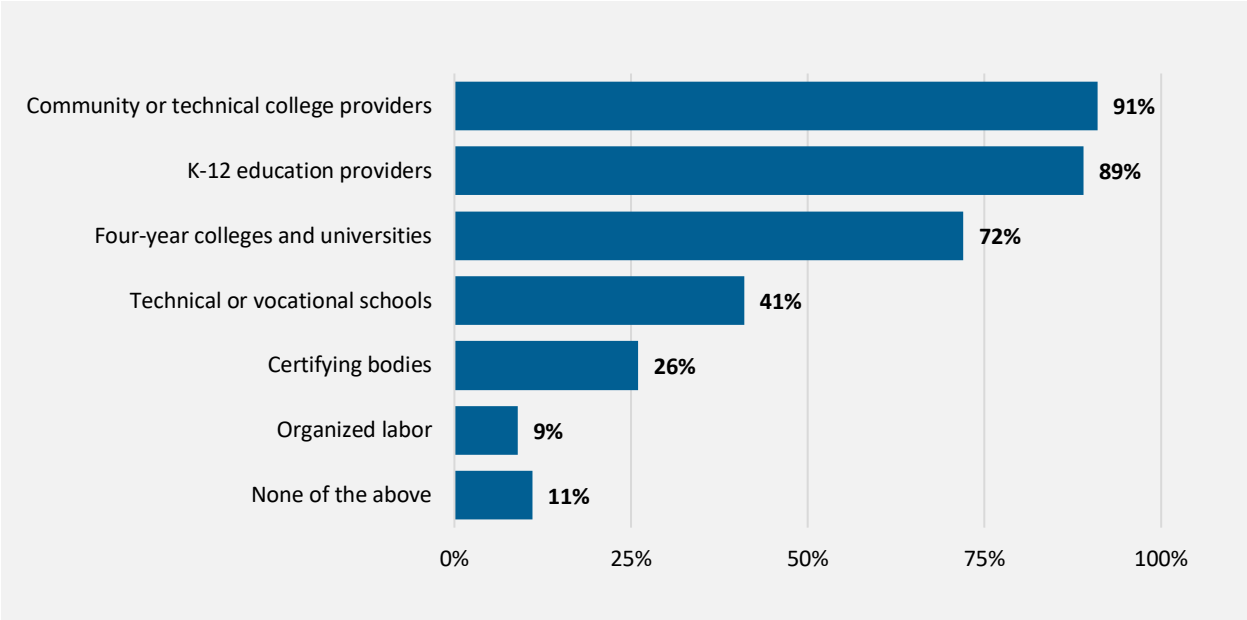
[55] Appendix A contains details on the stakeholder engagement processes used by BW Research.

When asked about strengths that Delaware can build upon to develop this clean energy and climate-related workforce, stakeholders who attended the in-person workshop hosted by DNREC[56] highlighted the number of training programs and Delaware's existing training facilities and education programs.

The existing partnerships within the state's workforce and education system provide a strong foundation of collaboration and alignment on future action for developing the state's clean energy and climate-related workforce.

Firms who responded to BW Research's survey of clean energy and climate-related employers in Delaware most frequently reported partnering with community or technical colleges (91%) and K-12 education providers (89%). Partnerships with four-year colleges and universities (72%) and technical or vocational schools (41%) were also commonly cited by these employers (Figure 13).

Figure 13. Organizations with which Surveyed Firms Reported Partnering



As a part of the stakeholder engagement process, BW Research conducted 15 executive interviews, in which Delaware's size and intimacy were frequently addressed, which provided additional context to these frequently reported partnerships. **Historically, action in Delaware has been driven by connections between various stakeholders due to the small size of the state and the close relationships of its residents, which has led to strong relationships within the workforce ecosystem.** This was emulated at the in-person DNREC stakeholder workshop, noting how Delaware's size can help foster collaboration, build relationships, and address the state's clean energy needs at a reasonable scale. Delaware has a smaller degree of separation between its residents than other states, which can help develop and organize workforce programs and

[56] Appendix A contains details on the stakeholder engagement processes used by BW Research.

processes. For example, Career and Technical Education (CTE) program administrators have strong relationships with employers and workers, which facilitates the recruitment of instructors and helps with securing sponsorships and job opportunities for students. These relationships provide Delaware with a valuable asset to drive change.

Partnerships with employers are a large component of this and will be especially important for supporting the workforce support system to meet their workforce demands. Among the surveyed employers, 89% indicated they partner with workforce organizations (Figure 13). At the in-person stakeholder workshop and during executive interviews, stakeholders discussed these types of partnerships as a key strength in Delaware's workforce ecosystem. Stakeholders emphasized the willingness of the private sector, including contractors and other industry representatives, to collaborate with, learn from, teach, and support educators and trainers in order to pursue common goals.

Stakeholder Insights

"Everybody knows everybody in this state... it's not six degrees of separation; it's one or one and a half"

"We're in this general northeast area, but it's very relational... I think a lot of things happen because somebody knows somebody."

"I think we're state of neighbors, that's the governor's favorite thing to say. So, it is all very small and we're one or two degrees of separation away from everything. So, there's natural overlap..."

Delaware's Career and Technical Education (CTE) System and vocational schools are an essential pipeline for the climate and clean energy workforce and are well-regarded by employers, educators, and students.

Delaware's CTE ecosystem, especially in the trades, is an essential pipeline for the climate and clean energy workforce and is highly valued by employers for training and hiring, especially for apprenticeships. Career and technical education, historically referred to as vocational education, provides useful and practical skills and hands-on experience for entering the workforce in a shorter time compared to 4-year and graduate degree paths. There are many fields for which there are CTE programs, including automotive technology, construction, culinary, healthcare, information technology, and more.

Vocational technical high schools or adult training centers (votechs) host half (51%) of the 105 identified training programs in Delaware focused on supporting the 13 key occupations (Table 6). These votechs offer an abundance of CTE apprenticeship programs and other short-term training

programs that support the key occupations and have experienced high growth over the past several years, according to interview participants from the Delaware votechs.

Delaware's sole community college has four campuses across the state and offers workforce and certification tracks in heating, ventilation, and air conditioning (HVAC), welding, construction technology, and more. It is another important component of the state's overall CTE ecosystem and hosts over one-tenth of the total identified programs (Table 6).

Table 6. Training Programs Identified for All Key Occupations by Institution Type

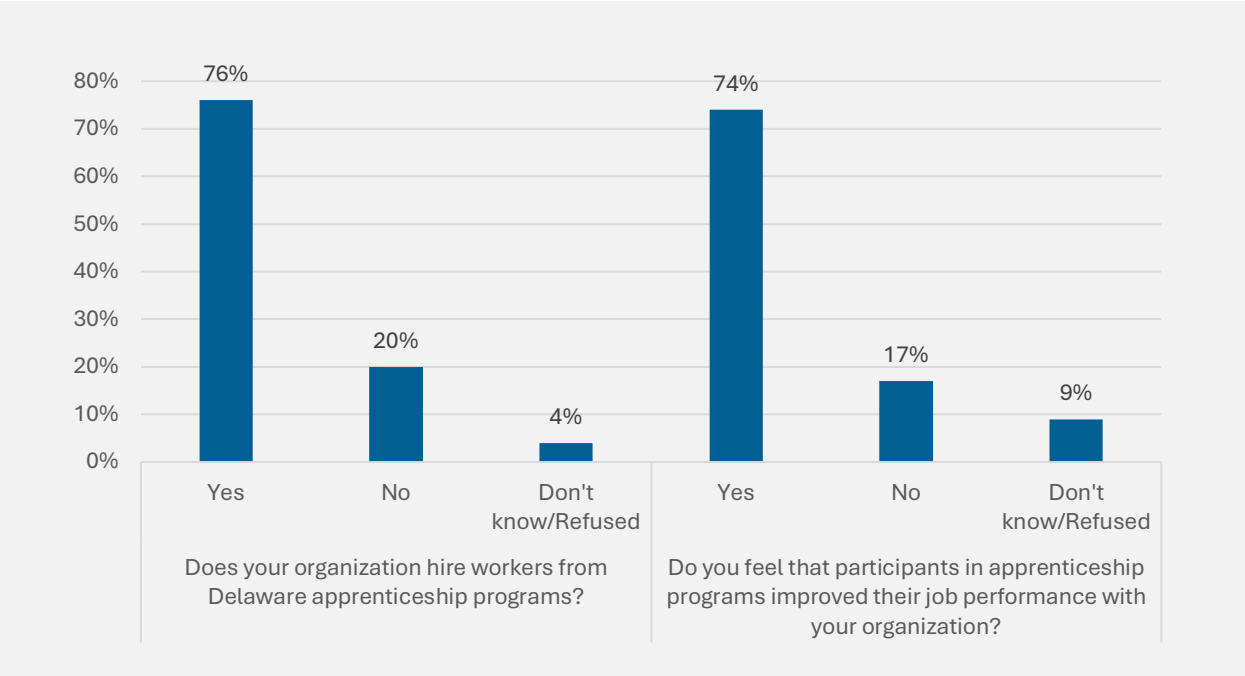
INSTITUTION TYPE	NUMBER OF PROGRAMS
Vocational Technical School or Training Center	54
Community College	15
College/University (incl. Technology Institute)	12
Industry Association	8
Labor Union	5
Private Training Company	5
Government Agency	2
Public High School	2
Utility Company	2

Votech interviewees shared with BW Research that they often work directly with employers, responding to their feedback on training offerings and practices. The votech high school districts see a high employment rate among CTE apprenticeship program participants in their third and fourth academic years. As clean energy technology and infrastructure expand across Delaware and the U.S., these CTE pathways will continue to be increasingly prominent and in high demand. For example, a recent initiative includes adding electric vehicle-related curriculum to the CTE program modules at the Newcastle and Sussex County Vocational Technical School Districts. In 2023, Delcastle Technical High School installed three electric vehicle charging station , or charging stations specifically made for learning and training purposes.[57]

When employers were asked about hiring patterns from Delaware-based apprenticeship programs, three-quarters (76%) of surveyed employers said they hire from these programs and similarly, three-quarters (74%) indicated that participation in these programs improved job performance (Figure 14).

[57] Rutz, Jarek. "DNREC funds Delcastle program to build EV charging stations." *Delaware Live*. 14 September 2023. Accessed October 2024. https://delawarelive.com/dnrec-funds-delcastle-program-to-build-ev-charging-stations/
The executive interview participant used the term "trainers" for these charging stations.

Figure 14. Delaware Apprenticeship Program Hiring Patterns and Perceptions Among Employers[58]



Overall, during stakeholder engagement sessions with BW Research, employers, industry representatives, and government officials expressed the importance of registered CTE apprenticeship programs at votechs and community colleges. One employer mentioned how workers hired through these CTE apprenticeship programs are generally more committed and more familiar with the job activities than hires who did not participate in these programs. However, stakeholders expressed concern about a lack of awareness and appreciation of the importance of CTE.

Stakeholder Insights

"Trade school apprentices are easier to bring in since they have better understanding of the jobs and are most committed."

"Delaware has got a very strong CTE model."

"I think we are sort of one-off and we have a really robust vocational technical school district in Delaware."

[58] The second question was asked to all responding employers, even those who responded "no" to hiring workers from Delaware apprenticeship programs.

Stakeholder Insights

"At meetings and workshops... [there has always been talk about] plumbing and electric and really the trades from the [vocational technical schools], and how there's jobs available now."

"We're half of what it takes to become a journey person."

"Our hope is that [our Career and Technical Education initiative] helps actually connect students to 'green careers' more globally or thinking about it more intentionally as a career option because it connects with their identity."

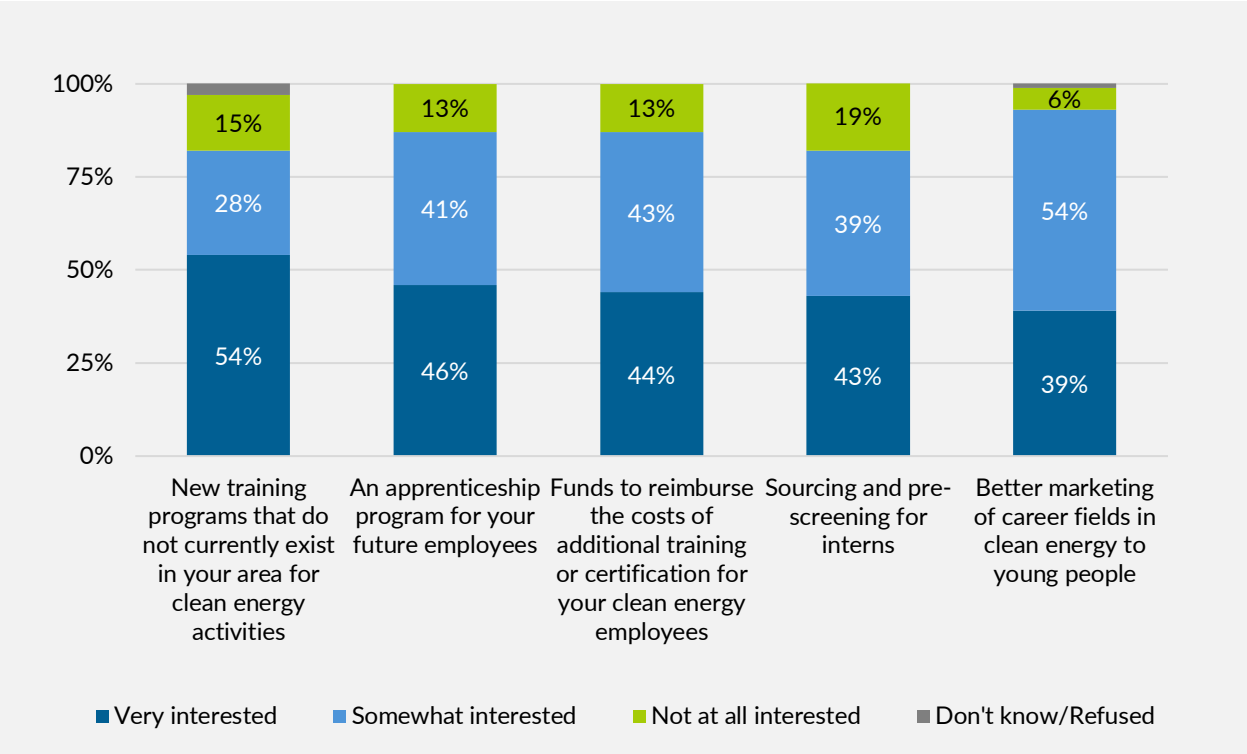
Many Delaware stakeholders – educators, employers, training providers, researchers, and government officials – are actively planning or engaging in education or workforce programs to support the clean energy workforce.

Multiple interviewees expressed knowledge of, or participation in, initiatives to support climate and clean energy training and expansion. On the education and training provider side, stakeholders expressed excitement about these initiatives and new opportunities while seeing increased interest from students and job seekers in being involved in the clean energy and climate-related economy. Government and industry stakeholders want to support the green economy as well and are either already implementing programs in collaboration with educators and employers or are ready to develop new programs. However, these stakeholders need direction and a better understanding of the state's priorities and future strategies for greater harmonization across the numerous activities and actors.

Delaware businesses have expressed interest and support in creating new workforce initiatives and developing employment pipelines.

More than three-quarters of surveyed firms reported being either "very interested" or "somewhat interested" in several types of workforce programs, services, and resources that could support their workforce needs. One-in-two (54%) firms indicated they are "very interested" in developing new clean energy training programs to support their workforce needs, while almost half (46%) of firms said they are "very interested" in developing an apprenticeship program pipeline. In terms of overall interest, 93% of respondents expressed being *at least* "somewhat interested" in better marketing of the clean energy and climate-related career fields to younger age groups (Figure 15).

Figure 15. Surveyed Firms' Interest in Workforce Programs, Services, and Resources



In addition to this, as mentioned previously, at the workshop hosted by DNREC and during one-on-one executive interviews, stakeholders talked about how private businesses, contractors, and industry representatives are eager and willing to partner with education and training providers to help Delaware reach its clean energy and climate-related goals. As the survey results highlighted, many employers, in fact, already partner with training and education organizations (Figure 13).

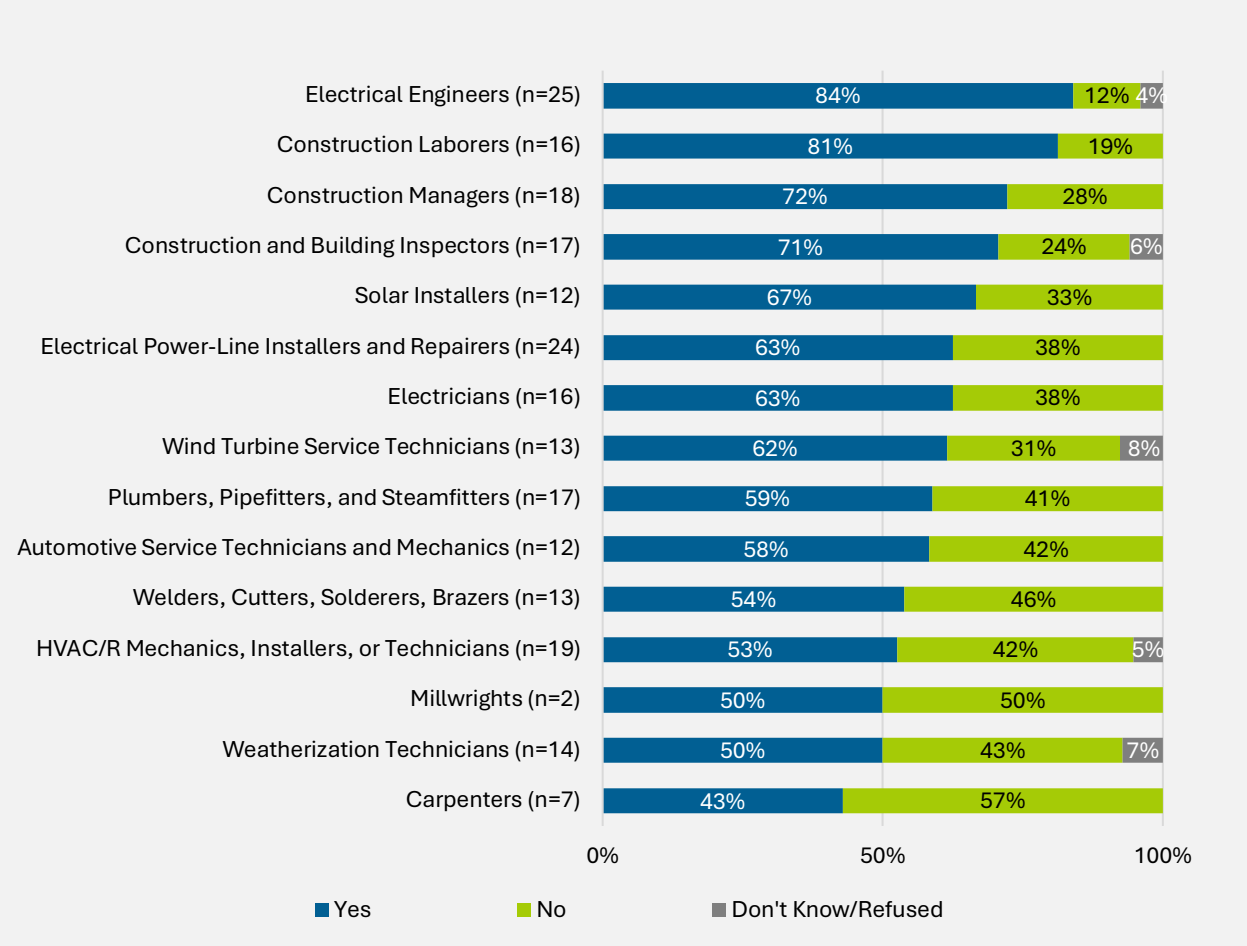
In Senator Stephanie Hansen's stakeholder meetings between April and June of 2024, it was revealed that energy stakeholders desire pre-apprenticeship program options as well as additional in-state programs closer to home. This arrangement would promote better information retention, as opposed to distant options with shorter courses of study. The desire for evening or weekend programs was expressed during these meetings so that full-time workers have the option to attend outside of their regular business hours. Leveraging the inventory of available training programs in Delaware and existing funding options can help increase awareness of the offerings, highlight areas of need, and respond to these needs more quickly.

A significant portion of workers in the target occupations are covered by some type of contract or membership that protects their rights and benefits as employees.

Labor-driven collective bargaining agreements, such as Project Labor Agreements, often lead to preferred benefits for workers compared to their non-covered counterparts. A high rate of coverage may indicate a strong workforce with high-quality jobs and family-sustaining wages and benefits. These offerings attract job seekers and can result in greater job satisfaction in an industry.

The surveyed employers of the key occupations reported a high frequency of labor union, Community Benefit Agreement, or Project Labor Agreement coverage among workers. This type of coverage was most frequent among Electrical Engineers and Construction Laborers. Overall, for all occupations aside from Carpenters, at least 50% of the employers reported that most of their workers in those occupations are covered by a labor union, Community Benefit Agreement, or Project Labor Agreement (Figure 16).

Figure 16. Are a Majority of Workers Covered by a Collective Bargaining Agreement or Project Labor Agreement, or Otherwise Covered by a Labor Union?[59]



Wages for these occupations are competitive, with many positions offering salaries above the state average. Eight of the key occupations provide median wages higher than the estimated living wage for families of two working adults and two children in Delaware. The highest median wages are earned by Electrical Engineers, followed by Construction Managers and Electrical Power-Line Installers and Repairers (Table 7). This makes the sector attractive to job seekers and essential for economic growth.

[59] Additional occupations beyond key occupations are included in presented survey data.

Table 7. Occupational Wages in Delaware's Overall Economy, 2023Q4[60]

6-DIGIT SOC CODE	OCCUPATION	MEDIAN HOURLY WAGES	MEDIAN ANNUAL WAGES
	Delaware Overall Workforce	$23.36	$48,600
47-2111	Electricians	$31.17	$64,800
17-2071	Electrical Engineers	$52.45	$109,100
49-9021	HVAC Technicians and Mechanics	$28.49	$59,300
51-4121	Welders, Cutters, Solderers, and Brazers	$24.60	$51,200
47-2031	Carpenters	$27.34	$56,900
49-9081	Wind Turbine Service Technicians	$29.73	$61,800
49-9051	Electrical Power-Line Installers & Repairers	$49.96	$103,900
11-9021	Construction Managers	$55.21	$114,800
47-2231	Solar Photovoltaic Installers	$22.24	$46,200
47-4011	Construction and Building Inspectors	$32.52	$67,600
47-2061	Construction Laborers	$21.91	$45,600
47-2152	Plumbers, Pipefitters, and Steamfitters	$29.56	$61,500
49-3023	Automotive Service Mechanics	$25.13	$52,300
Living Wage Category		**Hourly Wage**	**Annual Wage**
DE LIVING WAGE PER WORKING ADULT (2 WORKING ADULTS AND 2 CHILDREN)		$27.52	$57,242
DE LIVING WAGE PER WORKING ADULT (1 WORKING ADULT AND 2 CHILDREN)		$50.54	$105,123

Not only are the wages of most of these occupations higher than the state average, but union jobs in construction and extraction occupations and production occupations are greater, on average, than their non-union counterparts as well (Table 8).

Table 8. Average Hourly Union and Non-Union Wages in Delaware by Occupational Group, 2022[61]

2-DIGIT SOC CODE	OCCUPATIONAL GROUP	AVERAGE HOURLY UNION WAGES	AVERAGE HOURLY NON-UNION WAGES
47	Construction and Extraction	$32.69	$26.54
49	Installation, Maintenance, and Repair	$37.70	Not available
51	Production	$24.94	$21.23

[60] Sources: JobsEQ®. 2023Q4. Based on Place of Work estimates.
& *Living Wage Calculator*. Massachusetts Institute of Technology. Accessed May 2024. https://livingwage.mit.edu/metros/20100.

[61] U.S. Bureau of Labor Statistics. Modeled Wage Estimates 2022. https://www.bls.gov/mwe/tables.htm

Barriers to Workforce Development for Clean Energy and Climate Jobs

The State of Delaware will need to address a number of barriers and challenges within its workforce ecosystem that may hamper the necessary employment expansion in key occupations across the state for meaningful climate action.

1. Lack of coordination among Delaware stakeholders to maintain momentum on initial programs and support emerging efforts for a clean energy and climate-related workforce
2. Uncertainty among employers, mostly small businesses, around the funding and market dynamics of the clean energy industry and around the trainees remaining in-state
3. Geographic variance within training programs and a limited number of training programs for some key occupations
4. Difficulty finding qualified applicants due to lack of training, education, and experience
5. Low demographic representation among the existing clean energy and climate-related workforce with very limited hiring initiatives targeting female, minority, or LGBTQ+ hires
6. Need for more information about clean energy occupations
7. Lack of additional resources for vocational and technical schools
8. Existing gap in wraparound support services for those entering the workforce

A lack of coordination among Delaware stakeholders to maintain momentum on initial programs and support emerging efforts for a clean energy and climate-related workforce is hindering the state from efficient action due to uncertainty regarding necessary steps and overlapping efforts.

While Delaware's size and low separation among its residents offer a strong foundation for the state, these close existing relationships can crowd out the development of other relationships that broaden networks, create innovation, and lead to new opportunities. Stakeholders should be more aware of broader economic trends and ensure that action driven by these relationships is synergistic with the state's broader workforce ecosystem. Workforce programs must find a balance between responding to current employer demands and being more aware of future needs outside their network.

In nearly all executive interviews, respondents conveyed a sense of concurrent, siloed, and potentially duplicative efforts and assemblies in Delaware in support of clean energy and climate-related actions. At the same time, there is also a risk of excluding stakeholders from these conversations due to a reliance on close relationships. Multiple stakeholders communicated that better guidance from a single entity is desired for greater leadership and alignment in the climate-related field. This single entity would identify and bring all relevant stakeholders to the table, dictate the priority of measures that should be taken across all actors, identify the areas of greatest need to streamline the use of available resources, and coordinate between stakeholders' initiatives and programs for greater efficiency. It could also serve as a hub for grant applicants and other federal opportunities, being the one entity informed of all related activity to ensure that the relevant stakeholders are engaged, and the information is disseminated, as well as the single place for stakeholders to access the information.

Stakeholder Insights

"Workforce initiatives are not all connected through any entity... sometime stuff is overlapping, sometimes it's missing"

"The business community gets pulled into conversations about [climate and clean energy] every so often, but I think it's a little disjointed at the moment."

"My bottom line is that it can be duplicative and siloed. It's hard to not be duplicative [but] we don't really have the luxury of being duplicative..."

"I feel like we all agree conceptually on what needs to be done, but I'm still not seeing how that first step is taken to actually doing it."

Stakeholder Insights

"The ecosystem I think is there... I just don't know that everybody is always on the same page."

"Having leadership from the top... to point out what our priorities are, is helpful in thinking about standing up unique programs that don't overlap."

There is uncertainty among employers, mostly small businesses, around the funding and market dynamics of the clean energy industry and trainees remaining in-state once training is completed.

There is concern or weariness among small businesses and contractors in expanding too quickly, having experienced financial difficulties with unsustainable federal funding opportunities in the past. Stakeholders from industry, government, and education institutions explained the hesitancy or caution among employers, especially small businesses, with utilizing the announced federal funding and expanding quickly to meet the clean energy demands. Previous experience with the American Recovery and Reinvestment Act (ARRA) funds was mentioned multiple times. Businesses expanded, and hiring increased, because of the federal stimulus bill from 2009, but the growth was unsustainable and led to many layoffs once the funds were used up. Many businesses, especially small businesses and contractors, remember that negative experience and are weary of these new federal funds stimulating clean energy expansion.

In addition, given the evolving nature of the technologies, feelings of uncertainty also arose in discussions regarding effective preparation strategies and the longer-term sustainability of educational and credentialing resources. Addressing these concerns or identifying strategies for more sustainable growth may help to bolster the climate and clean energy economy in Delaware.

Stakeholder Insights

"Contractors wanted to know about the federal funding, and they said, we need to have certainty, and the market needs to have certainty and familiarity, or we aren't going to expand our businesses because during the ARRA days, they expanded their businesses in anticipation of the funding that never came and then ended up laying off a bunch of people."

Stakeholder Insights

"If [employers] are using federal money to do these jobs and the federal money dries... those employees lose their job"

"We saw this before, during the ARRA [American Recovery and Reinvestment Act] days over a decade ago when resources flooded the state, our workforce was not prepared for that... Some folks that remember ARRA, whether that is the education institutions or the small businesses, [they] remember getting burned once and they're a little reluctant right now to dive in headfirst hearing the same storyline 10, 12 years later... The education institutions created infrastructure as they prepared for ARRA. They did well for a few years with their graduates and their job placements. But then the money went away, the jobs went away, and their ability to place students out of those programs diminished.

Based on BW Research's inventory of currently available and publicly listed training programs for the targeted occupations, there are geographic gaps visible in Delaware's training ecosystem.

Among the 105 total Delaware-based and publicly listed training programs, eight are offered online with the remaining 97 hosted in person. New Castle County hosts the greatest number of in-person trainings. The map in Figure 17 also shows that New Castle County has a larger variety of programs than Kent or Sussex Counties do, though New Castle County has a higher population density.[62] The U.S. Environmental Protection Agency's (EPA) defined Disadvantaged Communities (DACs)[63] in Delaware are generally spread across the state. **While Kent or Sussex Counties have smaller population densities, it appears that residents of these Counties, especially those in DACs, may still need to travel further distances to access training programs for the key occupations** than residents in New Castle County (Figure 17).

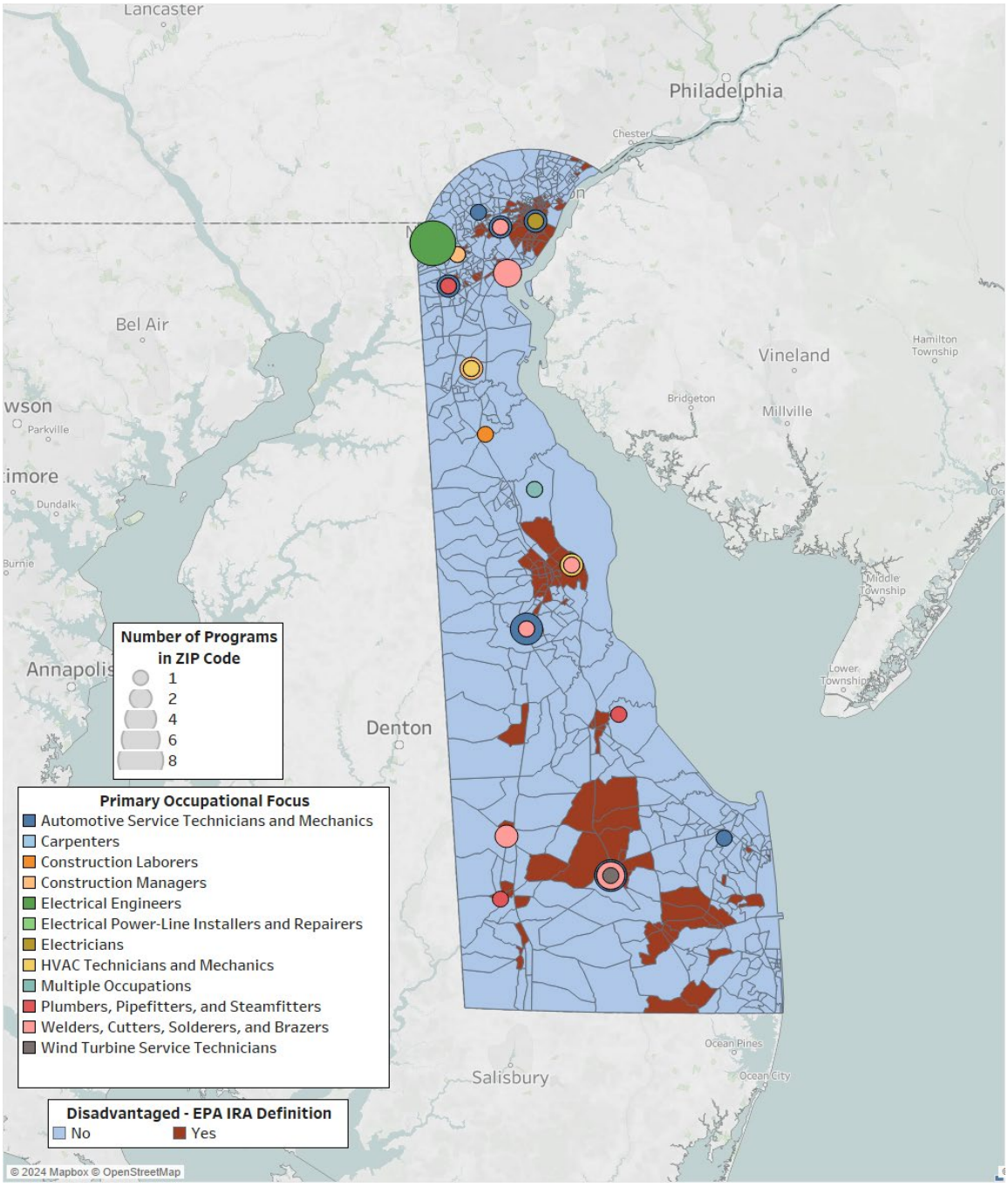
The Delaware Department of Natural Resources and Environmental Control has a digital mapping tool, the **EJ Area Viewer**, with a variety of environmental justice indicators across Delaware at detailed census tract levels. It integrates data from the EPA's DAC definition; the White House Council on Environmental Quality's Climate and Economic Justice Screening Tool; the Environmental Justice Index of the U.S. Department of Health & Human Services' Agency for Toxic

[62] https://www.arcgis.com/home/item.html?id=b66e5a3949b64c4dab8c47594987f792

[63] EPA DACs incorporate Environmental and Climate Justice Program Communities, as defined in the EPA's Inflation Reduction Act Environmental and Climate Justice Program, and DACs designated in the Climate and Economic Justice Screening Tool (CEJST) of the U.S. Council on Environmental Quality. Source: "Inflation Reduction Act Disadvantaged Communities Map." U.S. Environmental Protection Agency. Accessed 5 July 2024. https://www.epa.gov/environmentaljustice/inflation-reduction-act-disadvantaged-communities-map

Substances and Disease Registry; and the U.S. Centers for Disease Control and Prevention's Social Vulnerability Index. This is an interactive tool for policymakers and Delaware residents to utilize for decision-making processes and advocacy efforts for greater equity in the state.

Figure 17. Map of Identified Training Programs and EPA Disadvantaged Communities (DACs) in Delaware[64]



[64] EPA Disadvantaged Communities in Delaware are mapped based on The Environmental Justice Screening and Mapping Tool (U.S. Environmental Protection Agency https://www.epa.gov/ejscreen) and The Climate

For some key occupations, a limited number of training programs were identified for Delaware residents to attend.

There are limited training programs offered for Wind Technicians, Solar Installers, Electrical Power-Line workers, and Construction and Building Inspectors. For each of these occupations, the research team identified less than five Delaware-based training programs offered for each of these occupations.[65] Further, the only training programs identified for Solar Installers and Construction and Building Inspectors are online programs. **There are no publicly listed and in-person training opportunities for Solar Installers or Energy Auditors in Delaware** (Figure 17).

Programs for Automotive Service Technicians and Mechanics make up the largest concentration (17%) of identified training programs, followed by programs for Electricians (14%) (Table 9). Based on occupational modeling, additional programs could be important for HVAC Technicians and Mechanics, Carpenters, and Plumbers.

A few programs are not targeted to a specific occupation but are designed for multiple pathways. For example, a construction technology program at the community college system was developed to expose participants to various types of trades and give them a wide range of foundational knowledge and skills, allowing them to specialize later, once employed.

Table 9. Number of Identified Training Programs by Primary Occupational Focus

PRIMARY OCCUPATIONAL FOCUS	NUMBER OF PROGRAMS
Automotive Service Technicians and Mechanics	18
Electricians	15
Electrical Engineers	11
HVAC Technicians and Mechanics	11
Welders, Cutters, Solderers, and Brazers	11
Carpenters	9
Construction Laborers	7
Construction Managers	7
Plumbers, Pipefitters, and Steamfitters	7
Multiple Occupations[66]	3
Construction and Building Inspectors	3
Electrical Power-Line Installers and Repairers	1

and Economic Justice Screening Tool (U.S. Council on Environmental Quality https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5).
Note that publicly listed Solar Installer and Construction and Building Inspector trainings are online and do not appear on the map.

[65] This does not include any training program serving Delaware residents but hosted outside of Delaware.

[66] Designed for multiple pathways, typically to provide foundational skills for participants who may choose whether and how to specialize at a later time.

Solar Installers	1
Wind Turbine Service Technicians	1

As previously mentioned in Figure 15, the business survey highlighted an interest among employers in new clean energy training programs to support their workforce needs. Specifically, 54% of surveyed firms reported being "very interested" in new programs that do not currently exist in their local areas to support their clean energy work activities, and only 15% said they were "not at all interested" in these types of programs.

Stakeholder Insights

> *"We recognize there's a huge need around training to ensure we have young people ready to step into the new economy around green jobs and that we are creating the kind of systems and pathways for people who need upskilling and reskilling to move into those jobs."*

Clean energy employers reported difficulty in finding qualified applicants for open positions for the targeted occupations.

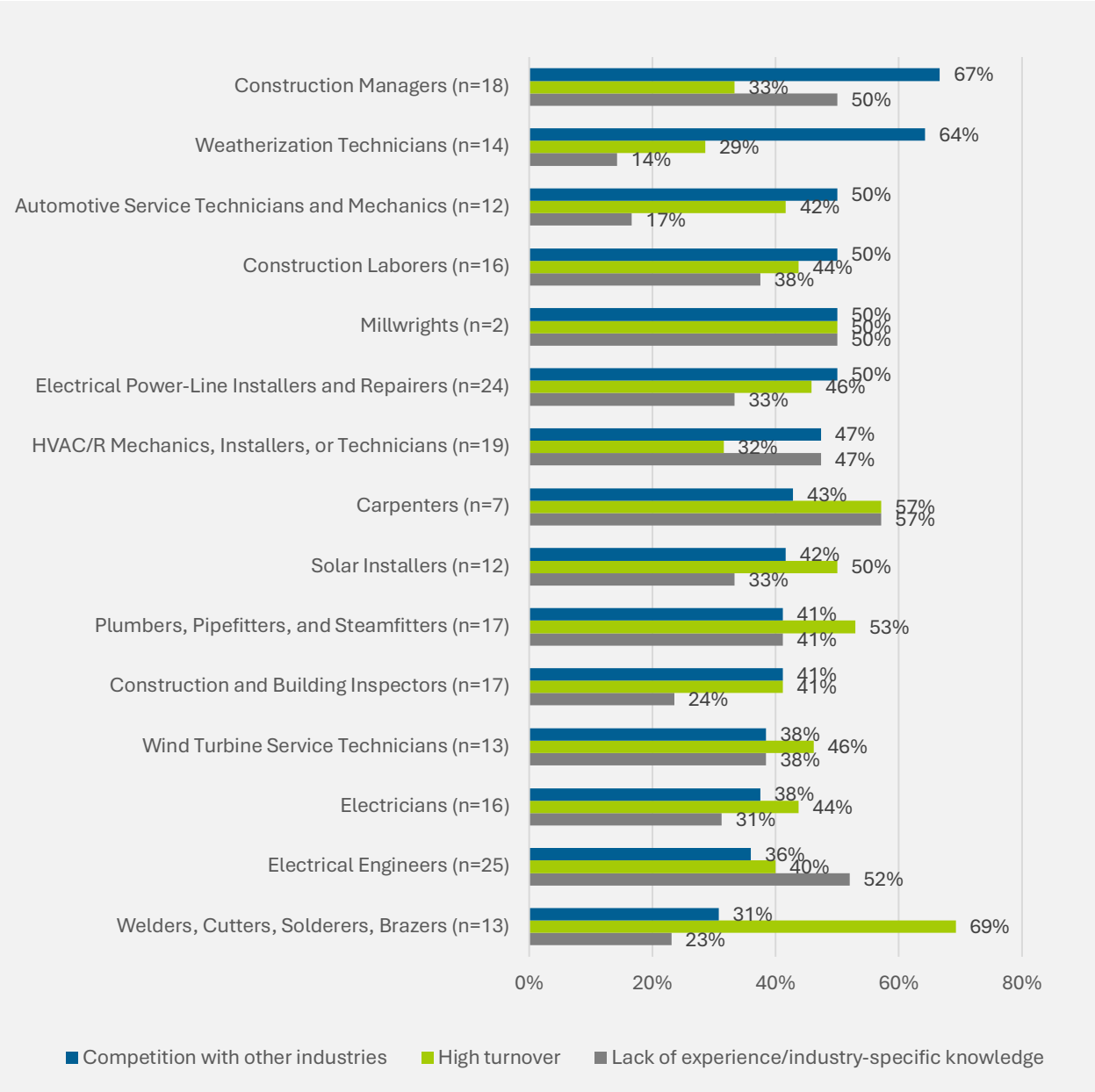
As previously mentioned, over four-in-five surveyed clean energy firms reported at least some level of hiring difficulty (Figure 10) with a greater share of Construction Manager and Electrical Engineer employers who indicated "great difficulty" compared to employers of the other targeted occupations (Figure 11).

When selecting the top three reasons for the reported hiring difficulties, seven-in-ten firms who employ Welders reported a high turnover rate while around two-thirds of Construction Manager and Weatherization Technician employers indicated that their challenges were driven by competition with other industries. Firms with Carpenters and Electrical Engineers often attributed these experiences with a lack of experience among applicants (Figure 18).[67]

[67] More details on hiring difficulties can be found in "

Appendix E: Survey Toplines"

Figure 18. Top Three Reasons for Reported Hiring Difficulty, by Occupation[68][69]



There is a low rate of gender and ethnic diversity within the key occupations, across all economic industries in Delaware, and employers reported a low frequency of implementing initiatives to increase female, minority, or LGBTQ+ hires.

Workers in the key occupations, across all industries, are predominantly comprised of workers who are male and of White race. There is a higher percentage of White workers in all 13 target

[68] Multiple responses permitted; Percentages may sum to more than 100%.
[69] Additional occupations beyond key occupations are included in presented survey data.

occupations than there is in the overall Delaware workforce. Additionally, in each occupation, over 89% of workers are male, in contrast to Delaware's overall workforce, which is 51% male (Table 10). Efforts to increase diversity and inclusion are necessary to create a more equitable and representative industry.

Black or African American workers comprise the largest share of non-White workers in the key occupations, reaching one-quarter of total Welders (25.1%) and total Wind Technicians (23.9%) in Delaware. Among Electrical Engineers, Asian workers (14.9%) make up the largest proportion of the minorities in the occupation, even larger than the share in Delaware's overall labor force (Table 10).

Table 10. Gender, Racial, and Ethnic Composition of Key Occupations in Delaware's Overall Economy, 2023Q4[70]

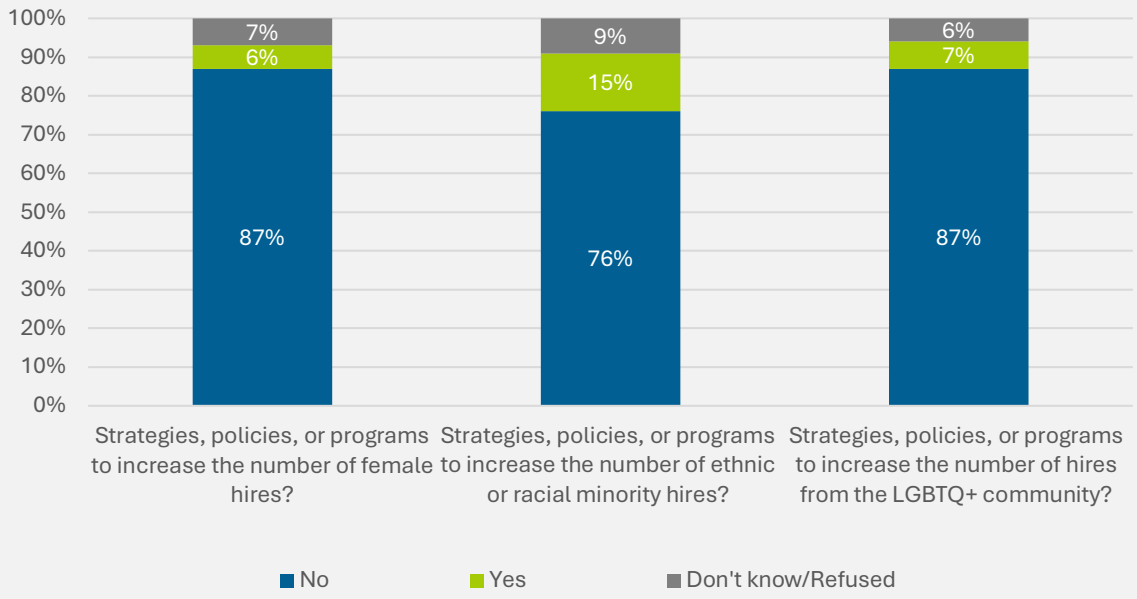
6-digit SOC Code	Occupation	Female	Black or African American	American Indian or Alaska Native	Asian	Native Hawaiian or Other Pacific Islander	Two or More Races	Hispanic or Latino (of any race)[71]
Delaware Overall Workforce		49.2%	23.6%	0.3%	4.6%	0.0%	6.0%	9.9%
47-2111	Electricians	3.0%	15.7%	0.6%	1.1%	0.1%	5.4%	12.5%
17-2071	Electrical Engineers	10.1%	10.3%	0.0%	14.9%	0.0%	1.7%	3.8%
49-9021	HVAC Technicians and Mechanics	2.5%	20.8%	0.4%	0.4%	0.0%	5.1%	11.8%
51-4121	Welders, Cutters, Solderers, and Brazers	6.3%	25.1%	0.4%	1.3%	0.0%	5.7%	14.0%
47-2031	Carpenters	3.3%	11.9%	0.5%	0.8%	0.1%	6.3%	24.8%
49-9081	Wind Turbine Service Technicians	4.7%	23.9%	0.4%	1.5%	0.1%	5.5%	11.4%
49-9051	Electrical Power-Line Installers and Repairers	2.5%	11.8%	0.1%	0.0%	0.0%	2.0%	6.8%
11-9021	Construction Managers	10.5%	9.2%	0.2%	1.4%	0.0%	6.7%	7.2%
47-2231	Solar Photovoltaic Installers	4.6%	15.9%	0.5%	0.9%	0.0%	7.0%	24.3%
47-4011	Construction and Building Inspectors	9.8%	17.9%	0.4%	4.9%	0.0%	5.8%	9.4%
47-2061	Construction Laborers	4.7%	18.3%	0.6%	0.8%	0.1%	8.0%	30.6%
47-2152	Plumbers, Pipefitters, and Steamfitters	2.4%	22.4%	0.3%	1.4%	0.0%	4.1%	14.7%
49-3023	Automotive Service Mechanics	2.6%	18.1%	0.5%	2.2%	0.1%	8.3%	15.1%

[70] Source: JobsEQ®. 2023Q4. Based on Place of Residence estimates.

[71] The U.S Census Bureau considers race and Hispanic origin to be two distinct concepts. Hispanic or Latino is considered to be an ethnicity and may be of any race. Therefore, the percentage of Hispanic or Latinos should not be added to percentages for racial categories.

Yet, even with low proportions of female and racial minority workers in the occupations, the majority of surveyed firms who employ these occupations have no special hiring initiatives to target female, minority, or LGBTQ+ hires (Figure 19). Without these initiatives, Delaware may struggle to increase gender, racial, and sexual orientation diversity within the clean energy industry and exclude certain populations from accessing the new, high-quality jobs.

Figure 19. Strategies, Policies, or Programs to Increase the Diversity of Hires at Clean Energy Firms



A wide range of stakeholders have expressed the need for more information about which clean energy occupations are in greatest demand, the necessary requirements to access the jobs, and the career pathways of the occupations.

Based on the employer survey, there was expressed interest in better marketing of the clean energy career fields to young people. More specifically, 39% of employers reported being "very interested" in this type of initiative while 54% said they were "somewhat interested" (Figure 15).

In addition, in one-on-one meetings, BW Research heard from several stakeholders, from government, industry, education, and philanthropy fields, that there is not a clear definition of climate and clean energy work. This makes it difficult for people to discern what types of workers will be needed and thus, what types of workforce support is most crucial. Industry representatives expressed interest in better marketing for construction and trades jobs and their corresponding career ladders or pathways. They shared that often, people do not realize how involved the trades are in climate and clean energy work or that a certain occupation, such as an Electrician, is a "green" job.

These sentiments were also expressed at the in-person stakeholder workshop where individuals shared that awareness of the industry must be raised and that skills and training needs must be made clearer in order to expand the industry's workforce.

Stakeholder Insights

"How do you define clean?... How do you define green? ... I don't think we have clear definitions."

"It'd be nice if there was a career ladder to say... here's all the jobs that are available in the solar industry and here's all the jobs available in the energy efficiency industry."

"I think there's probably some work to be done to broaden our view of what it means to have a job in clean and green energy... [and] helping to identify... what we would maybe think of as the adjacent green jobs... A big one that was an 'aha' for me several months ago to a year ago now as electricians."

The votech high schools often compete with other entities in the educational system for support and do not have enough funds to continue growing to serve all interested students or participants and expand the employment pipeline.

Although votech schools and CTE programs are an important partner to employers and recent legislation in Delaware declared that contractors bidding on state projects must have registered apprenticeships (alongside new federal requirements in some cases), state funding for votech schools has not increased for 10-20 years. Meanwhile, the number of annual students enrolled and the costs for materials and equipment have increased, making it challenging for the schools to operate with enough capacity to serve the industry. Employers are important contributors who donate supplies and labor to try to support the students and training practices needed for their workers. At the same time, some perceive that the community college system, while also having a strong CTE apprenticeship program, tends to receive greater support and funding from the state and other stakeholders.

Strains on votech institutions are already hindering the pipeline of trades workers who can support the state's clean energy and climate-related economy. Without the necessary support, teachers, equipment, and administrative staff cannot meet the growing demands.

Stakeholder Insights

“My phone rings and … next thing you know, there’s a truck from the supply house showing up at X program to bolster them and keep them going. I don’t ever want to stop doing that… these [CTE] programs are working because industry is supporting them.”

"I think there needs to be a lot of marketing going towards [supporting CTE programs]"

“I'm not speaking on behalf of any politician, but I don't think they see the value in CTE.”

“I don't think you have enough businesspeople in the in the general assembly, as they understand the need for workforce development in our industry and the value of [CTE].”

***“**As we continue to expand, to meet the needs of industry, we’ve found ourselves at a bottleneck…the funding is not there… We don't charge registered apprentices tuition for our [CTE] programs. But meanwhile… we have to pay instructors more, our material costs have gone up exponentially, and we're still funded at levels that were prior to 2010.”*

“In the past, if you were a sponsored registered apprentice, Delaware would not charge for your training. Right now, we're having to ask the question if we can afford to continue to do that because our [expenses], like everybody else's, continues to grow…but our budget does not….”

“Our funding has not increased in about 20 years. And in fact, back in 2018, we lost 5% of our funding and it was never restored.”

A lack of qualified teachers is causing capacity limitations in the vocational technical school districts.

With growing waitlists for CTE apprenticeship programs and a growing clean energy economy, vocational technical schools are expanding, trying to meet the demand of students and the needs of the industry. However, without a sufficient number of teachers who are willing to work in the votech schools for the current wages offered, the Delaware schools cannot significantly increase the class capacities to accept the additional students as they struggle to incentivize workers to work in education. The votechs typically hire instructors from industry who have practical knowledge and experience, and currently, many of the instructors teach in the evenings while working full time in the industry during the day. In the skilled trades, the gap between the industry wages and the votech instructor wage may be more than $15 an hour. To support the growing clean energy and climate-related economies, Delaware must address this critical bottleneck in the workforce pipeline. Greater support for the votech schools to offer compelling incentives such as prevailing industry wages, or family sustaining wages and benefits, could help keep the votechs competitive in the industry.

Stakeholder Insights

"The hardest part is the [funding], and the second challenge that we have is finding instructors... We're looking for master electricians to teach our classes... master plumbers and master HVAC technicians, or at least people that have been through the journeyman program and have years of experience and meet the criteria for a CTE instructor as DOE regulates... These folks that we're looking for get paid $45 an hour, and if they're working on a prevailing wage job, they're getting paid [$70-80] an hour, depending on what trade they're in. And we were barely $29 an hour when I got here, and I had to raise my [registration fee] a little bit to get our staff raises... And it's tough when you have 25 students that want a class, and you just don't have someone to teach it."

"Most [of our instructors] are professionals in the trades full time and work as instructors in the evenings."

"It stifles our growth...we haven't grown above where we are because...we don't have the money to grow above where we are. We had to stop it at 20%. ...[or else] the student-teacher ratio will go up or [we will] lack of materials..."

A gap in wraparound support services offered in Delaware prevents historically marginalized populations and those transitioning from jobs with lower wages from gaining entry, transitioning, or advancing in clean energy.

While training exists in Delaware for climate and clean energy workers, potential participants in these training programs often face barriers that limit their availability, including access to or costs of transportation, childcare, and state identification documents.

Multiple interviewees from the one-on-one stakeholder meetings discussed that it is important to consider these barriers that potential participants may face when trying to attend training programs. One noted that there is not necessarily a shortage of training programs; rather, potential participants may not have a way to travel to the programs. Access to a car or other method of transportation, the ability to drive, and funds to access rideshare options are necessary for Delaware residents without a reliable public transportation system in the state. It is especially important for those who must travel outside of the state for training, to Philadelphia or Baltimore, for example, but still similarly important for accessing in-state training as the training inventory map in Figure 17 displays.

In addition to transportation, stakeholders discussed how childcare presents another challenge for workers in Delaware. In general, childcare is a necessary and costly expense for parents, especially single parents. According to the Living Wage Calculator developed at the Massachusetts Institute

of Technology, the childcare cost for a single parent with two children in Delaware is over $23,500 a year.[72] Workers with children who are transitioning out of their current work to enter the clean energy and climate-related workforce may need support covering childcare expenses while attending training and credentialing programs.

Further, training participants who have been out of the workforce and are training to re-enter it through clean energy and climate-related industries will also need to ensure that their wages will allow them to cover childcare expenses once back at work full-time. A single parent with two children must earn approximately $50.50 an hour in a full-time job to cover basic living expenses for themselves and their children, including childcare. Currently, only two key occupations, Construction Managers and Electrical Engineers, offer a median wage higher than $50.50 (Table 7).

The re-entry and formerly incarcerated workforce face limitations with obtaining a proper government-issued photo identification document as well as transportation and other needs. Funds to cover application fees and access to necessary resources like a computer and internet are easily implementable action items. The Delaware Department of Correction does have an Offender Reentry Planning program, which provides a support team to incarcerated individuals before they are released that is prepared to help the individuals acquire personal identification documents, among many things.[73] Yet, the process for obtaining the documentation still requires time, resources, fees, and other identification documents such as a birth certificate.[74] Stakeholders shared that without proper identification, it is impossible to obtain a driver's license and drive to training programs or job locations, and many employers will not offer jobs to individuals who do not have the necessary documentation either. In fact, just over three-in-four surveyed firms (78%) reported that they conduct criminal background screening on potential applicants, creating an additional barrier for the formerly incarcerated job seekers re-entering the labor force (Figure 20).

Yet, there is a desire among employers to train and hire returning citizens. During the April 2024 Energy Stakeholder meeting hosted by Senator Hansen, one participant shared his positive experience with hiring individuals coming out of prison at a construction company. These hires had low rates of turnover and saw some advance to superintendent positions. Although resulting in a successful workforce program for both employers and formerly incarcerated individuals, it still requires effort on the employer and workforce development ecosystem to support the returning citizens with multiple barriers they may face, such as obtaining a driver's license, housing, and more.

Efforts to reach and recruit individuals from communities with high concentrations of minority populations and non-English speakers into the clean energy workforce generate the need for language services alongside other support services.

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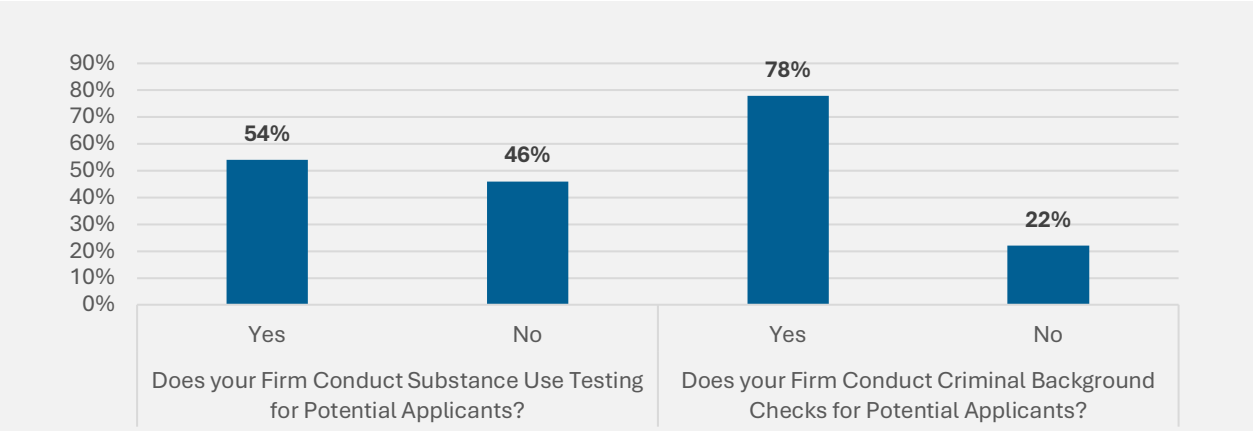
[72] Living Wage Calculator, Massachusetts Institute of Technology. https://livingwage.mit.edu/states/10

[73] "Providing Identification for Those Released from Incarceration." National Conference of State Legislatures. 04 January 2024. Accessed October 2024. https://www.ncsl.org/civil-and-criminal-justice/providing-identification-for-those-released-from-incarceration#:~:text=Twenty%2Done%20states%20have%20laws,both%20provide%20temporary%20ID%20cards.

[74] Wise, Cat. "Leaving prison without a government ID can block access to housing, jobs and help." PBS News. 31 December 2020. Accessed October 2024. https://www.pbs.org/newshour/nation/leaving-prison-without-a-government-id-can-block-access-to-housing-jobs-and-help

Overall, connecting wraparound services with job training programs can help Delaware residents overcome barriers that may prevent them from upskilling, reskilling, or entering the workforce.

Figure 20. Substance Use Testing and Criminal Background Checks for Potential Applicants



Stakeholder Insights

"They often don't have the resources available. It might be as simple as a vehicle to get to a training location."

"We've actually done... some surveys and polling that show that the lack of access to affordable, quality childcare is holding a number of people back from like going back to school, getting further education, getting jobs that they want and need."

"Transportation is another one...especially on the K-12 side of the house, [in the sense that] we want kids to have access to work-based learning experiences and those sorts of things, but we also know that transportation is a barrier in some cases."

"My [colleague]...is trying to do a pilot program [to] bring the Delaware [Department of] Motor Vehicles to a high school to help students get their driver's license or a state ID, because that is a barrier to employment at some point...We haven't done it yet, but the idea behind that is like, can we identify students that need it and then eliminate another barrier?"

"I think...the single largest issue with getting those that have been rehabilitated into the workforce is that we are so focused on providing the trainings or certifications that we lose sight of the fact that they may not have transportation. 'It's not that I don't have a desire, I actually can't get there.' And we tend to lose sight over those things."

Strategies for Action in Delaware

These strategies for actions are drawn from, and integrate, the wide range of key findings developed during this research process. This includes insights captured from analysis of current and future employment projections; availability of education, training, and wraparound support options; reviews of existing literature; the business survey; executive interviews, and workshop. Where possible, specific actors or stakeholders have been highlighted for the role they can play. The Strategies for Action are organized into the following categories:

1. **Maximize and enhance Delaware's workforce ecosystem and training assets** to meet the needs of workers, educators, training entities, unions, and employers.

2. **Leverage and expand on existing partnerships** more directly for clean energy and climate-related occupational needs, while integrating clean energy employers into the workforce system.

3. **Ensure more equitable access to employment opportunities** for all Delaware workers to encourage greater diversity of future workers by gender and race.

4. **Build workforce pipelines** by engaging students and young workers about opportunities in clean energy.

5. **Improve leadership and coordination across state government in ways that better align** workforce partners, organized labor, educators, and employers throughout the state, and build confidence in Delaware's long-term commitment to meeting its clean energy workforce needs.

1 Maximize and enhance Delaware's workforce ecosystem and training assets to meet the needs of workers, educators, training entities, unions, and employers.

1.1. Focus near-term workforce development strategies on specific occupations found in current clean energy and climate technologies. BW Research's projections, based on anticipated clean energy and climate investments, highlight a set of specific occupations that will see considerable growth in the coming decade (Figure 8). Many are traditional construction, operations, maintenance, and production roles with no additional training requirements[75] for entering the clean energy field, or, at most, the completion of a short training module beyond existing occupational training.[76]

These occupations are already in high demand,[77] and there is limited risk in expanding the pipeline of future workers for these roles. This report documents programs already in place to develop workers for these occupations (more information on this training inventory can be found in the Workforce Ecosystem Strengths and Barriers to Workforce Development sections above, or Appendix G). Delaware possesses well-established approaches that train for these occupations and build the pipeline of future workers; these existing workforce programs should be prioritized with additional resources and support.

1.2. Continue to monitor clean energy and climate-related employment trends to prepare for future workforce gaps and develop new training and education initiatives. To meet its greenhouse gas emissions reduction targets in the coming decades, Delaware will need to expand investment in clean energy and clean transportation industries such as hydrogen, offshore wind, building electrification, and electric transportation, as well as critical grid and transportation infrastructure upgrades. The capital-intensive nature of these industries, coupled with necessary infrastructure development (such as pipelines and transmission systems), presents substantial job growth opportunities.

However, in most cases, not enough is yet known about which types of technologies will be deployed in Delaware. This complicates efforts to develop a comprehensive workforce strategy with training programs and certifications. Instead, for future clean energy investments, Delaware's workforce strategy should be an ongoing, iterative plan that integrates market development cycles and technology pathways, to understand the types of roles and skills and education required. The state, and workforce stakeholders, should focus on regularly assessing clean energy and climate-related market development (discussed in #4 below) so as to develop new programs, sequenced for when workforce development will be needed.

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[75] A person installing pipes or ducts to connect a commercial air-source heat pump into a building's systems needs no additional training

[76] Ensuring a certified Electrician has received a training module on specific requirements in hooking up a solar system or an EV charging station into the grid.

[77] As BW Research's employer survey shows, clean energy employers are currently challenged to meet their workforce needs in specific occupations.

1.3. **Direct resources and capacity building to address geographic and occupational variance and gaps within training programs.** The inventory of available, Delaware-based training programs highlights geographic disparities in the location of training programs relative to the state's disadvantaged communities. It also highlights the potential near-term need for more programs targeting HVAC Technicians and Mechanics, Carpenters, and Plumbers, Pipefitters, and Steamfitters. This training provider analysis can serve as a foundation for future training program development efforts.

1.3 - Key Actions

- Convene training organizations, community partners, educational institutions, and employers, among other stakeholders, to explore and address gaps in training program access in identified DACs. Support organizational partnerships that result in new training capacity in DACs.
- Foster better coordination and efficiency within the training ecosystem through greater involvement by state agencies, including target setting, monitoring and tracking, and performance incentives.
- Increase awareness of Delaware's training ecosystem and specific offerings among the public, especially in DACs. This can include an accessible compendium of training resources in clean energy and climate industries, available to individuals, or to new entrants such as non-profits, advocates, or industry partners.
- Establish and incentivize new partnerships between vocational-technical schools, community colleges, unions, and employers to ensure training pathways will be available for occupations needed in future clean energy technologies.
- Educate workforce advocates, educators, and training providers on near-term clean energy occupational dynamics through regular workshops and ensure clean energy and climate jobs are integrated into official state planning.

1.4. **Commission ongoing research to stay abreast of workforce development needs for clean energy and climate initiatives, including regularly monitoring trends in clean energy deployment, workforce system training capacity, apprenticeship growth, and updating training inventories.** Delaware state agencies should continue to show leadership in tracking development and investment patterns in these technologies, alongside a slew of other employment and workforce data, in order to find the balance between reskilling the current workforce and training new workers for these roles. This information can be used to dictate the priority of measures that should be taken across all actors, to identify the areas of greatest need, and coordinate between stakeholders' initiatives and programs, to streamline the use of the available resources.

1.4 - Key Actions

- Quantify the long-run capacity of Delaware's workforce assets (e.g. schools, votechs, apprenticeships/pre-apprenticeships) to understand how many newly trained workers the Delaware ecosystem can graduate. This can improve planning, efficiency, and coordination among the different stakeholders, and should be regularly updated to ensure training and education programs are continuing to meet evolving employment demand.

- Continue to track clean energy and climate market deployment and investments, especially in new and emerging industries (such as hydrogen and building electrification), to prepare the necessary pipeline of workers to meet these needs. This report can establish an initial baseline for the state to understand its current employment and occupational dynamics in this sector.

- Leverage existing resources, such as the U.S. Department of Energy's U.S. Employment in Energy Report (USEER), to monitor ongoing clean energy and climate employment growth in Delaware.

2 Leverage and expand existing partnerships that focus on clean energy and climate-related occupational needs, while integrating clean energy employers more directly into the workforce system.

2.1 Build on Delaware's strong apprenticeship system, especially its capacity and connection to employers, and provide additional resources for both apprenticeships and pre-apprenticeships within CTE programs. With apprenticeship requirements found in both Delaware and federal legislation, and the growing need for trades workers, demand for apprenticeship programs in the state is expected to grow significantly. As highlighted throughout this report, Delaware's apprenticeship programs are well-regarded by employers, educators, and workers. Most of the targeted occupations highlighted in Table 1 have well-established apprenticeship pathways that can be expanded, either through labor unions or non-union options, such as vocational technical school programs.

Expanding the number of pre-apprenticeships is also foundational in developing healthy apprenticeship pipelines, as pre-apprenticeships provide initial training, education, hands-on experience, and exposure to utilities and trade careers. While these apprenticeship readiness programs exist in the state, they are not as prevalent as traditional apprenticeship programs. Pre-apprenticeships are also a crucial pipeline to increasing access to union apprenticeships from underrepresented populations and DACs.

Enhanced funding could be especially valuable for Delaware's apprenticeship programs in its vocational technical schools. Through interviews, we heard that schools in the New Castle County Vocational-Technical, Polytech, and Sussex Technical School Districts (discussed in Barriers to Workforce Development for Clean Energy and Climate) are at maximum capacity and will need additional funding to add more seats.

2.1 - Key Actions

- Develop a vocational reimbursement program to fund cost reimbursement for employers providing internships, apprenticeships, and on-the-job training models, while supporting trainees and apprentices/pre-apprentices with income as they move through a training program.
- Monitor and enforce apprenticeship requirements found in state and federal funding.
- Educate underrepresented populations about apprenticeships through targeted recruitment programs designed for specific populations (e.g., women, young workers of color) in partnership with trusted community groups.
- Maximize the availability of support services for these programs, through partnerships and initiatives with community groups and others providing wraparound services. Wraparound services are crucial to the success of many individuals from disadvantaged backgrounds entering apprenticeships.
- Expand union acceptance or entrance agreements with pre-apprenticeship programs. This can also include assistance in preparing for apprenticeship tests, mentorship and career exploration, and additional resources and support services.

2.2 Leverage existing employer engagement and interest in Delaware's workforce system while expanding this approach to clean energy companies that are not as involved in workforce issues. As highlighted previously in this report, many employers actively engage in supporting Delaware's workforce ecosystem and work closely with its partners. Through interviews, workforce stakeholders also highlighted the valuable role of Delaware businesses in providing insights on training needs and helping to shape programs, while also offering their future expectations for hiring and new employee requirements. The clean energy business survey highlights close partnerships between employers, workforce and education entities, and employers' strong interest in new workforce training and programs.

However, engagement and collaboration with clean energy employers specifically can be improved. According to stakeholder interviews and workshops, clean energy employers in Delaware are not as available or well-connected as other industries and are not regularly contributing to workforce strategies and conversations. While business leaders, government, and educators are eager to support workforce development in the climate and clean energy economy, the connections between the multiple actors are still evolving and

driven by relationships rather than a system or process. The State of Delaware can help to reduce hesitancy and caution among employers, especially small businesses, by highlighting its ongoing commitment to clean energy and climate investments, deployment, and the development of its workforce. This in turn can encourage businesses to continue utilizing funding and expanding further into clean energy. Moving forward, there are also programs and policies that can promote business engagement and support clean energy and climate-related workforce development (see 2.2 – Key Actions).

2.2 - Key Actions

- Establish regular convening opportunities between workforce stakeholders and clean energy employers to learn more about training needs (especially specific hard and soft skill requirements), concerns and future expectations for hiring, and new hiring requirements. These needs are anticipated to transition significantly over time as clean energy and climate-related technologies evolve.

- Sponsor mentorship programs for clean energy and climate careers in Delaware by funding partnerships between training providers and employers that focus on career coaching and on-the-job training and include wage subsidies, marketing support, and access to pipelines of future workers.

- Connect middle schools and high schools in the state to clean energy and climate-related companies to host career days, job fairs, and site visits.

2.3 Work closely with organized labor, an important and valuable partner in expanding Delaware's clean energy and climate-related workforce. The state, and other workforce stakeholders, should seek and support new opportunities to partner with organized labor. Organized labor can provide highly trained workers for clean energy needs and graduate apprentices for many key occupations. One challenge for local unions is having to predict demand for workers in coming years to ensure they are able to meet that demand without generating an oversupply that could limit employment opportunities for their members. Maintaining regular communication and sharing data on employment trends can help to address this challenge.

2.3 - Key Actions

- Share and educate unions about the analysis conducted in Recommendation 1.4, to increase understanding of anticipated occupational demand from clean energy and climate-related investments.

- Integrate relevant labor unions into convenings, partnerships, and initiatives targeting clean energy and climate-workforce development.

3 Ensure more equitable access to employment opportunities for all Delaware workers to encourage greater diversity of future workers by gender and race.

3.1 Support hiring initiatives that expand gender and racial diversity of those hired in clean energy and climate-related fields. Very few Delaware companies report having dedicated initiatives to support diversity in the BW Research business survey. The state of Delaware can pursue a variety of actions that promote and highlight the value of a diverse workforce and create a more diverse pipeline of workers interested in working in clean energy and climate-related industries (See 3.1 – Key Actions).

3.1 - Key Actions

- Understand inequities in the geographic placement of training programs that reach underserved communities to better target funding, equipment, and curriculum support for training entities and educational institutions that support these communities.
- Develop focused outreach and awareness campaigns for clean energy and climate-related jobs that target more diverse and lower-wealth communities.
- Fund programs that create dedicated "career navigators" to provide workforce support in specific communities, including connecting individuals to resources and opportunities.
- Explore online and virtual learning opportunities in partnership with existing training providers, community colleges, universities, and employers. Most of Delaware's training is in-person but can be difficult to access for those in disadvantaged communities. Online (full or hybrid) options can be a cheap and easy way for low-income students to participate in training.
- Increase the availability of wraparound services (see Recommendation 3.2) to support under-resourced workers in entering training, apprenticeship, and workforce opportunities.

3.2 Address the need for greater wraparound support that assists those from disadvantaged communities in overcoming barriers to joining the workforce. A strong, state-wide consensus exists on the need for more comprehensive wraparound services and other resources to support hard-to-reach and entry-level workers from underserved communities in entering new jobs in the clean energy and climate economy. Delaware

participants in training programs, especially from disadvantaged communities, can often face barriers that limit their ability to participate. This includes access to a car, high costs of transportation, or lack of a state driving license. Underserved and low-income households, especially those re-entering the workforce or transitioning between jobs, may find it difficult to afford childcare, which limits parents from earning certifications or other credentials and finding high-quality jobs. The re-entry and formerly incarcerated workforce face limitations in having proper state identification documents as well as transportation and other needs. Language barriers can also limit efforts to reach individuals in communities with high concentrations of non-English speakers. All of these challenges should be addressed to increase access to opportunities in new and emerging industries (See 3.2 – Key Actions).

3.2 - Key Actions

- Highlight, promote, and encourage holistic job training programs that integrate wraparound services for workers directly into training offerings, and provide dedicated support in accessing those services.
- Promote and fund stipends and other compensated training opportunities to ensure job seekers of limited financial means can continue training programs.
- Conduct a transit analysis to identify transportation deserts that limit accessibility to work or training sites, especially for those who must travel outside of the state for training.
- Engage local and regional transportation agencies and other transportation partners to offer programs and services, such as a central pick-up point, contractor carpooling, low-cost licensing, public transport vouchers, or funds to access rideshare options.
- Support partnerships and initiatives between employers to assist returning citizens in addressing the multiple barriers they may face, such as obtaining a driver's license, housing, and more.
- Address childcare needs through partnerships with childcare providers that allow them to maintain earlier or later hours, offer satellite options closer to work-sites, or other stipends.

4 Build workforce pipelines by engaging students and young workers about opportunities in clean energy.

4.1 Increase exposure to clean energy and climate-related topics across all school grades (K-12). A common concern highlighted during stakeholder interviews involves the lack of climate, energy, and environmental education available in Delaware's K-12 system. While the state is exploring opportunities to integrate more sustainability-related topics into the curriculum, exposure to clean energy technologies, and its specific career paths, can increase the likelihood of students selecting relevant fields of study in post-secondary institutions and in career decisions. The state, and other stakeholders, should consider how they are best able to provide resources and programming to K-12 education for these programs.

4.1 - Key Actions

- Increase funding for clean energy and climate-related career programs in high schools and votech schools that can be used to fund instructors, internship stipends, and equipment needs.
- Educate teachers, guidance counselors, and students about clean energy career opportunities through information campaigns and hands-on field trips starting in middle school.
- Support job-readiness "bootcamps" and more hands-on training in high schools to give young job seekers an opportunity to experiment with different career pathways and roles available in clean energy.
- Encourage more engagement and outreach efforts in schools by employers, unions, and utilities, including donating training equipment, advising on more informed curriculums, and helping workers serve as part-time instructors.

4.2 Improve recruitment and retention of new workers by addressing misconceptions about the trades and highlighting the high-quality jobs and long-term careers that the trades can offer. Most building and construction trades offer higher-than-average wages and benefits and a long-term career pathway. However, in interviews, many stakeholders expressed the need to overcome bias and pre-conceptions about these careers in Delaware. Better marketing and communication efforts can highlight to students, parents, teachers, and guidance counselors that the trades are highly viable, non-college pathways.

4.2 - Key Actions

- Facilitate listening sessions and other research among young people to involve them in the process and discussion, and capture challenges and opportunities they see.

- Create a comprehensive campaign that highlights different trajectories in the trades. Key messages can include earnings potential; the extensive opportunity for career growth, especially once a worker has moved through lower paid roles, and access to information about specific career ladders or pathways across a wide range of different occupations.

- Develop messaging for reaching future workers interested in issues of sustainability by highlighting how involved the trades can be in climate and clean energy work or that a certain occupation, such as an electrician, can also be a "green" job. Foster excitement about the importance and scale of clean energy industries in the state.

4.3 Expand opportunities for in-person experiences and on-the-job training and development. Two-thirds of employers surveyed said applicants lack the experience they are looking for in new hires. Construction firms, in particular, are eager to hire workers with past experience, especially small contractors who have less room to take risks on new employees.

4.3 - Key Actions

- Increase entry-level employment options found at clean energy and climate-related employers through policies and programs that offer additional incentives or reduce the risk of hiring (such as covering portions of internship pay or addressing insurance requirements).

- Connect new workers and employers through specialized early technical education in career fields, practical training outside of school hours, and creation of a matchmaker service with a database of candidates.

- Establish partnerships with Delaware utilities to support the creation of additional internships and interview opportunities for recent graduates, especially from disadvantaged communities. Utilities can be an important source of opportunities for on-the-job experience. Utilities can also support the creation of an information clearinghouse for internship and other earn-and-learn opportunities. Educators, especially at community colleges and vocational-technical schools, can be helpful contacts and sources of recruits for utilities looking to expand their pipeline.

4.4 Prioritize and increase resources and support programs for Delaware Career and Technical Education involving clean energy and climate-related occupations, especially targeting well-regarded, heavily oversubscribed vocational-technical schools. There is a growing waitlist for several programs in votechs that serve as entry points for the occupations featured in this research. To support the clean energy industry and its workforce demands, votechs should receive more support to supply training supplies, hire more teachers and pay them prevailing wages, and continue increasing annual enrollment. There are initiatives in Delaware to increase interest in and applications for CTE programs by informing students, parents, and teachers about career options outside degree programs. Multiple interviewees shared information about the Advance CTE pilot and middle school outreach. Both programs are intended to increase awareness among middle and high school students about their future career options.

4.4 - Key Actions

- Provide funds to fill the gaps in availability of training supplies and pay more competitive wages to teachers and administrative workers. Federal funds may be available for stipends to recruit teachers for priority CTE fields.

- Engage contractors and retirees to become trainers. Individuals who have been in the industry with years of background and experience could be excellent trainers. Such models have been used by training institutions in other states.

- Invest in match-maker programs to connect votechs and community colleges with employers and unions.

- Facilitate information sharing and broker relationships between industry, students, and teachers. Stakeholders in education, as well as at workforce boards and non-profit trainers, described the difficulty in gaining information and honest feedback about clean energy industry needs and opportunities for students to support hiring, curriculum development, and training programs. Similarly, industry members discussed a need for better relationships that could be leveraged to quickly fill roles and find recruits.

5 Improve leadership and coordination across state-government in ways that better align workforce partners, organized labor, educators, and employers throughout the state, and build confidence in Delaware's long-term commitment to meeting its clean energy workforce needs.

5.1 Provide clarity on decision-making and leadership in setting workforce targets, and timelines, and establish coordination and decision-making structures that provide engagement platforms on clean energy and climate-related workforce issues. Many stakeholders are planning education or workforce strategies to support the growth of Delaware's clean energy workforce, but most efforts are still at an early stage. Stakeholders uniformly offer that the state needs to provide more guidance, coordination, and resources and that Delaware's workforce entities will benefit from increased statewide dialogue and coordination, especially between state and local agencies

5.1 - Key Actions

- Set workforce goals and training requirements with clear directives that align government agencies on specific clean energy and climate-related workforce goals.
- Establish a statewide task force comprised of stakeholders in education, unions, employers, community groups, and state officials to advise on key issues and serve in a coordinating, connective role.
- Explore regional partnerships for workforce and education with states like Maryland, New Jersey, Virginia, or Pennsylvania. Regional collaboration could center on emerging industries such as hydrogen, or clean transportation. One example is the recent U.S. Climate Alliance workforce initiative, of which Delaware is a part.[78]
- Establish statewide metrics, goals, and mechanisms for tracking. To achieve more clarity and alignment among stakeholders, government, and the private sector, the state should develop a list of metrics that can be tracked over time

5.2 **Explore establishing a dedicated entity to drive progress.** There is no entity coordinating workforce development activities in the clean energy industry in Delaware, which has been seen as a best practice in states such as Connecticut and Illinois. Stakeholders believe that guidance from a single, centralized entity could avoid duplication of efforts, provide clarity on decision-making, and serve as a convener to regularly assemble critical stakeholders. Representatives from industry, government, and philanthropy pointed to the state's Workforce Development Board (WDB) as a potential coordinating entity for this work. The WDB possesses specific, unique expertise on workforce topics and data, and has systems in place to facilitate streamlined workforce development. However, it has not yet been regularly engaged in climate and clean energy discussions.

[78] https://usclimatealliance.org/press-releases/building-a-climate-ready-workforce-sep-2024/

Appendix A: Methodology

Industry and Occupational Employment

Industry level clean energy employment data for Delaware is sourced from the 2023 U.S. Energy and Employment Report (USEER) published by the U.S. Department of Energy reporting on 2022 data.

To obtain occupational employment estimates in Delaware's clean energy industry, BW Research applied proprietary energy-specific national staffing patterns to the USEER industry data to sum the employment within each sub-technology included in the clean energy definition for each key occupation.[79] These proprietary energy-specific staffing patterns were created using national- and state-level primary and secondary data to estimate employment at the detailed occupation level within 76 detailed energy technologies and the nine value chains within them.

Employment Modeling Projections

The following methodology section details the policies and assumptions included in the Delaware Climate Workforce Needs Assessment jobs modeling and maps the policies and programs included in this analysis to the greenhouse gas (GHG) emission reduction activities that they will support. These policies were derived from the Inflation Reduction Act (IRA) legislation, the Energize Delaware programs, and the Regional Greenhouse Gas Initiative (RGGI) programs. This methodology also details existing modeling BW Research leveraged in the research process and the new modeling BW Research undertook.

Our modeling strategy is our best estimate of the investments and resources available to ensure the state of Delaware meets the emissions targets associated with the Climate Action Plan and Climate Solutions Act over the next 10 years. Our modeling strategy does not incorporate the economic impact of energy savings due to energy efficiency upgrades, or economic losses to fossil fuels and fossil electricity generation. Our modeling strategy does not incorporate the economic modeling conducted by ICF for DNREC in the 2020 Delaware Climate Action Plan Supporting Technical Greenhouse Gas Mitigation Analysis Report for two reasons:

1. The ICF economic analysis does not measure investments into climate activities, but rather estimates net costs (e.g. DG-1 measures installation and maintenance costs over the lifetime of renewable electric generation systems, while EE-1 measures energy savings from efficiency upgrades).
2. Including the ICF estimates would result in double counting on GHG emission reduction activities that leverage funding from the IRA, Energize DE, and RGGI programs.

The federal investment detailed for the IRA policies are derived from Congressional Budget Office and US Joint Committee on Taxation estimates from 2022, and the Private Match amounts are percentages detailed in the legislation. The projected investments for the Energize DE and RGGI programs are derived from currently committed investments along with previous years' investments.

[79] See "Appendix C: Clean Energy Definition and Technology List" for this definition.

The research team built custom IMPLAN input-output models to estimate the specific employment impacts associated with investments in each of the six sectors detailed below. While these models calculate direct, indirect, and induced employment outputs from these investments, the occupational outputs presented in this report only include direct and indirect outputs.

Annual investments in Delaware for each model sector are detailed in the table below.

SECTOR	ANNUAL INVESTMENT IN DELAWARE ($MILLIONS)
Power	$12.25
Buildings	$75.88
Industrial	$3.27
Transportation	$23.62
EJ & LC	$40.95
Hydrogen	$100.00
Total Investment	**$255.96**

New Modeling: Energize Delaware and RGGI Programs

BW Research built new employment models to capture the benefits generated by investments from the Energize Delaware and RGGI programs in Delaware. Future investment amounts were estimated using currently committed investments along with previous years' investments. Program lifetime was also used to forecast the investments through the 10-year study period used in this analysis. The programs included in this new modeling effort are detailed below with historical investment and budget amounts.

ENERGIZE DELAWARE PROGRAM NAME	PROGRAM TYPE	FY2023 PROGRAM BUDGET
Online Marketplace	Efficiency	$300,000
Home Performance with ENERGY STAR	Efficiency	$8,000,000
ZeMod (Zero-Energy Modular Home)	Efficiency & Clean Energy	$375,000
Pre-Weatherization Program	Efficiency	$1,750,000
Affordable Multifamily Housing	Efficiency & Clean Energy	$2,900,000
Energy Assessments for Nonprofits and Government	Efficiency	$150,000
Low-Interest Revolving Loan	Efficiency & Clean Energy	$6,000,000
Energy Savings Performance Contracting*	Efficiency & Clean Energy	~$115,000,000
Pathways to Green Schools	Efficiency	$195,000
Faith Efficiencies	Efficiency & Clean Energy	$300,000
Farm Program	Efficiency & Clean Energy	$1,320,000
Lights-On Delaware Strong	Efficiency	$825,000

Residential Solar Loan	Clean Energy	$2,500,000
Home Energy Counseling & Checkup (HEC2)	Efficiency	$700,000
Empowerment Grant	Efficiency	$3,215,000
Energy Equity Fund*	Clean Energy	~$5,000,000
D-PACE Commercial Financing	Efficiency & Clean Energy	$145,000
Total Energize Delaware Budget		**~$148,675,000**

*Budget listed is total fund budget, not annual budget

RGGI INVESTMENTS BY CATEGORY[80]	2017 INVESTMENT	2018 INVESTMENT	2019 INVESTMENT	2020 INVESTMENT	2021 INVESTMENT
Energy Efficiency Programs	$20,846,154	$18,000,000	$14,117,083	$9,341,500	$13,842,315
Clean & Renewable Energy Programs	$2,405,325	$2,028,169	$1,342,657	$1,664,200	$1,327,345
Administration of Programs	$1,603,550	$1,774,648	$767,233	$1,538,600	$948,104
Beneficial Electrification Programs	$0	$0	$0	$1,381,600	$2,465,070
GHG Abatement & Climate Change Adaptation (CCA) Programs	$1,603,550	$2,788,732	$2,531,868	$894,900	$379,242
RGGI, Inc.	$106,903	$101,408	$95,904	$78,500	$37,924
Direct Bill Assistance	$534,517	$507,042	$345,255	$800,700	$0
Total RGGI Investments	**$27,100,000**	**$25,200,000**	**$19,200,000**	**$15,700,000**	**$19,000,000**

Hydrogen

BW Research built a new employment model to estimate the economic impact of the MACH2 hydrogen hub. Investments into Hydrogen are derived from conversations with industry experts and include both federal and private match spending. This model assumes a total investment of $1 billion spread over 10 years, or $100 million invested annually on average.

Inflation Reduction Act Policies and Investments

This section details the federal and total investment for each investment vehicle, each policy group, and overall, as well as the specific legislation from which each investment vehicle is derived. This section is broken up into two chapters: the first chapter maps the GHG emission reduction actions from the Delaware Climate Action Plan to policies included in the modeling, then the next chapter details the policies that will be included in the Delaware Climate WNA modeling (Power, Buildings, Transportation, Industrial, and EJ & LC).

[80] Investments listed here are derived using total annual investments and the percentage share of annual investments for each category from the RGGI Proceeds reports.

The IRA policies are split into five groups: Power, Buildings, Industrial, Transportation, and Environmental Justice & Local Communities (EJ & LC). Five major sectors included in this memo cover the target sectors in this workforce needs assessment: renewable energy and energy transmission, distribution, and storage (Power, Industrial, and EJ & LC), energy efficiency and weatherization (Buildings, Industrial, and EJ & LC), and clean transportation (Industrial, Transportation).

The total IRA investment, equal to federal investment plus any private match funds, generated nationally by these five climate sectors amounts to $315 billion, or 98% of the $322 billion in total investment across five sectors. These funds are assumed to be spent over 10 years.

Total Inputs by Policy Group

Federal and total investments for each policy group are detailed in the table below.

Policy Group	Federal Investment ($billions)	Total Investment ($billions)
Power	$134.23	$137.81
Buildings	$58.33	$58.92
Industrial	$27.07	$27.07
Transportation	$59.55	$61.97
EJ & LC	$36.06	$36.06
Total Investment – 5 Sectors	**$315.24**	**$321.83**

Delaware Climate Plan GHG Emission Reduction Action Mapping

These mapping tables aim to show the federal policies from the IRA that act as closest-fit mechanisms for aiding with Delaware climate GHG emission reduction activities. The policies identified are the resources available to support Delaware in meeting its climate goals but do not claim to complete the GHG emission reduction activities.

GHG Emission Reduction Code	GHG Emission Reduction Name	GHG Emission Reduction Description	Policy or Program (Sector, Investment Vehicle, Legislation Section)
DG-1	Expanded Renewable Energy On-site (Residential and Commercial)	Installation of renewable energy on-site at residential and commercial buildings. This includes energy storage and grid integration (peak demand reduction) and expansion of the low-income housing solar energy program.	Power, S.45 - PTC Ext, SEC. 13101 Power, S.48 - ITC Ext, SEC. 13102 Power, ITC Increase, SEC. 13103 Power, Clean Energy Loan Guarantees, SEC. 50144 Buildings, Residential Energy Efficient Property, SEC. 13302 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 EJ & LC, Low-Income Solar Credit, SEC. 13103 RGGI, Clean & Renewable Energy Programs Energize Delaware, Clean Energy Programs

DG-2	Expanded Renewable Energy On-site (Industrial)	Installation of renewable energy on-site at industrial facilities, including energy storage and grid integration to facilitate peak demand reduction.	Power, S.45 - PTC Ext, SEC. 13101 Power, S.48 - ITC Ext, SEC. 13102 Power, ITC Increase, SEC. 13103 Power, Clean Energy Loan Guarantees, SEC. 50144 Industrial, Zero Emission Facility, SEC. 13104 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 EJ & LC, Low-Income Solar Credit, SEC. 13103 RGGI, Clean & Renewable Energy Programs Energize Delaware, Clean Energy Programs
GRID-1	Expanded Renewable Portfolio Standard (RPS)	Expansion of the RPS in Delaware, with the targets of 25% renewable electricity from the grid by 2025, 40% by 2035, and 100% by 2050.	Power, S.45 - PTC Ext, SEC. 13101 Power, S.48 - ITC Ext, SEC. 13102 Power, ITC Increase, SEC. 13103 Power, Clean Energy Loan Guarantees, SEC. 50144 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 EJ & LC, Low-Income Solar Credit, SEC. 13103 Energize Delaware, Clean Energy Programs

GHG Emission Reduction Code	GHG Emission Reduction Name	GHG Emission Reduction Description	Policy or Program (Sector, Investment Vehicle, Legislation Section)
EE-1	Expanded Building Energy Codes	Expansion of the current building energy codes in Delaware to increase energy efficiency.	Buildings, Assistance for Latest and Zero Building Energy Code Adoption, SEC. 50131 RGGI, Energy Efficiency Programs Energize Delaware, Efficiency Programs
EE-2	Expanded Residential Energy Efficiency Programs	Expansion of existing residential energy efficiency programs in Delaware.	Buildings, Residential Energy Efficient Property, SEC. 13302 Buildings, New Energy Efficient Home Credit, SEC. 13304 Buildings, Home Energy Performance-Based, Whole-House Rebates, SEC. 50121 Buildings, High-Efficiency Electric Home Rebate Program, SEC. 50122 Buildings, Nonbusiness Energy Property Credit, SEC. 13301 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs RGGI, Beneficial Electrification Programs Energize Delaware, Efficiency Programs
EE-3	Building Electrification	Retrofits of existing buildings to replace fossil fuel systems and appliances with electric and requirements for building electrification for new constructions.	Buildings, Energy Efficient Commercial Buildings Deduction, SEC. 13303 Buildings, Residential Energy Efficient Property, SEC. 13302 Buildings, Nonbusiness Energy Property Credit, SEC. 13301 Buildings, New Energy Efficient Home Credit, SEC. 13304

			Buildings, Home Energy Performance-Based, Whole-House Rebates, SEC. 50121 Buildings, High-Efficiency Electric Home Rebate Program, SEC. 50122 Buildings, Assistance to Federal Buildings, SEC. 60502 Buildings, Improving Affordable Housing,SEC. 30002 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs RGGI, Beneficial Electrification Programs Energize Delaware, Efficiency Programs
EE-4	Expanded Commercial Energy Efficiency Programs	Development and/or expansion of commercial building energy efficiency programs in Delaware.	Buildings, Energy Efficient Commercial Buildings Deduction, SEC. 13303 Buildings, Assistance for Latest and Zero Building Energy Code Adoption, SEC. 50131 Buildings, Assistance to Federal Buildings, SEC. 60502 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs RGGI, Beneficial Electrification Programs Energize Delaware, Efficiency Programs
EE-5	Industrial Energy Efficiency Improvements	Improvements to industrial lighting systems, motor systems, air compressors, materials handling equipment, process improvements, and operational reviews and improvements.	Industrial, Zero Emission Facility, SEC. 13104 Industrial, Advanced Industrial Facilities Deployment Program, SEC. 50161 Buildings, Energy Efficient Commercial Buildings Deduction, SEC. 13303 Buildings, Assistance for Latest and Zero Building Energy Code Adoption, SEC. 50131 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs RGGI, Beneficial Electrification Programs Energize Delaware, Efficiency Programs

GHG Emission Reduction Code	GHG Emission Reduction Name	GHG Emission Reduction Description	Policy or Program (Sector, Investment Vehicle, Legislation Section)
HIGH-GWP-1	Reduce Commercial Building High-Global Warming Potential Emissions	Expansions and use of Delaware's Cool Switch program and implementation of Regulation 1151.	Buildings, Energy Efficient Commercial Buildings Deduction, SEC. 13303 Buildings, Assistance for Latest and Zero Building Energy Code Adoption, SEC. 50131 Buildings, Assistance to Federal Buildings, SEC. 60502 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs Energize Delaware, Efficiency Programs
HIGH-GWP-2	Reduce Industrial High-GWP Emissions	Expansion of the use of low GWP refrigerants and reduce high-GWP refrigerant emissions in the industrial sector by implementing Cool Switch and Regulation 1151, and implementation of programs to manage HFCs and other high-GWP materials throughout the product lifecycle.	Industrial, Zero Emission Facility, SEC. 13104 Industrial, Advanced Industrial Facilities Deployment Program, SEC. 50161 Buildings, Assistance for Latest and Zero Building Energy Code Adoption, SEC. 50131 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Climate Pollution Reduction Grants, SEC. 60114 RGGI, Energy Efficiency Programs

GHG Emission Reduction Code	GHG Emission Reduction Name	GHG Emission Reduction Description	Policy or Program (Sector, Investment Vehicle, Legislation Section)
TPORT-1	Low Carbon Fuel Standard	Implementation of a Low Carbon Fuel Standard (LCFS) to incentivize and increase the implementation of low carbon fuels, based on the California Air Resources Board (CARB) program.	Transportation, 2nd Gen Biofuel Incentive Ext, SEC. 13202 Transportation, Biodiesel, Renewable Diesel, Alt Fuel Credit, SEC. 13201 Transportation, Biofuel Infrastructure, SEC. 22003 Transportation, EV Charging / Alt Fuel Tax Credit, SEC. 13404 Transportation, Sustainable Aviation Fuel Credit, SEC. 13203 & 13704 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201

TPORT-2	Light-Duty Vehicle Travel Demand Management and Land Use Strategies	Reduction of vehicle miles traveled of private passenger vehicles by implementing travel demand strategies such as shifting travel time, mode choice, and route and increasing frequency of telecommuting. These efforts would be paired with land use and development policies	N/A
TPORT-3	Vehicle Manufacturer Regulations	Implementation of regulations requiring vehicle manufacturers to make available specific quantities of light-duty zero emission vehicles (ZEVs), including electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen fuel cell vehicles.	Industrial, Advanced Technology Vehicle Manufacturing, SEC. 50142
TPORT-4	Consumer Electric Vehicle Adoption Incentives	Creation of a program to advance EV adoption through increased infrastructure, incentive programs, charging rate plans, and legislation.	Transportation, Clean Vehicle Tax Credit, SEC. 13401 Transportation, Used Clean Vehicles Credit, SEC. 13402 Transportation, EV Charging / Alt Fuel Tax Credit, SEC. 13404 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Neighborhood Access & Equity Grants, SEC. 60501 RGGI, Beneficial Electrification Programs
TPORT-5	State Fleet Electrification	Electrification of the state's vehicle fleet. State agencies are projected to increase the number of ZEVs in light-duty fleets to at least 20% of the fleet by 2025, and to 100% by 2050.	Transportation, Clean Vehicle Tax Credit, SEC. 13401 Transportation, Used Clean Vehicles Credit, SEC. 13402 Transportation, Commercial Clean Tax Credit, SEC. 13403 Transportation, USPS Clean Vehicle Fleet, SEC. 70002 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Neighborhood Access & Equity Grants, SEC. 60501 RGGI, Beneficial Electrification Programs
TPORT-6	Fuel-Efficient Vehicles	Implementation of incentive programs and consumer outreach to expand adoption of more fuel-efficient gasoline-powered private passenger vehicles.	Transportation, Clean Vehicle Tax Credit, SEC. 13401 EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Neighborhood Access & Equity Grants, SEC. 60501 RGGI, Beneficial Electrification Programs
TPORT-7	Expand Freight Best Practices and Regulatory Actions	Expansion of freight best practices for fuel efficiency and emission reductions including mode switching, route optimization,	Transportation, Diesel Emissions, SEC. 60104 Transportation, Clean Heavy-Duty Vehicles, SEC. 60101

		emissions regulations, and efficiency standards.	EJ & LC, Greenhouse Gas Reduction Fund, SEC. 60103 EJ & LC, Environmental and Climate Justice, SEC. 60201 EJ & LC, Neighborhood Access & Equity Grants, SEC. 60501

GHG Emission Reduction Code	GHG Emission Reduction Name	GHG Emission Reduction Description	IRA Policy (Sector, Investment Vehicle, Legislation Section)
NG-1	Methane Emission Reductions from Utility Gas Lines	Implementation of a Leak Detection and Repair (LDAR) program for utility gas lines; includes a requirement for all utility gas lines to undergo LDAR inspections.	EJ & LC, Methane Emissions Reduction Program, SEC. 60113
WASTE-1	Expanded Methane Capture	Reduction of methane emissions through improved controls and monitoring and expanded methane capture for Renewable Natural Gas (RNG) supply or flaring.	EJ & LC, Methane Emissions Reduction Program, SEC. 60113
WASTE-2	Waste Diversion and Reduction	Diversion of waste from landfills through increased recycling and organic waste diversion (composting, land application, animal feed, etc.).	N/A

Specific IRA policies and policy investment amounts are detailed by policy group below.

IRA Climate Policies Included in the Delaware Climate WNA Modeling

Power Policy Group Inputs

Investment vehicles used in the Power policy group modeling. Section numbers refer to the Inflation Reduction Act, as signed into law.

Investment Vehicle	Inflation Reduction Act Legislation
S.45 - PTC Ext	SEC. 13101 - Extension and Modification of Credit for Electricity Produced from Certain Renewable Resources
S.48 - ITC Ext	SEC. 13102 - Extension and Modification of Energy Credit
ITC Increase	SEC. 13103 - Increase in energy credit for solar and wind facilities placed in service in connection with low-income communities
Nuclear Tax Credit	SEC. 13105 – Zero-Emission Nuclear Power Production Credit
Transmission Investments	SEC. 50151– Transmission Facility Financing
	SEC. 50152 – Grants to Facilitate the Siting of Inter-state Electricity Transmission Lines
	SEC. 50153 – Interregional and Offshore Wind Electricity Transmission Planning, Modeling, and Analysis

Rural Electrification Act	SEC. 22001 – Additional Funding for Electric Loans for Renewable Energy
Rural Electrification USDA	SEC. 22004 – USDA Assistance for Rural Electric Cooperatives
Uranium Investments	SEC. 50173 – Availability of High-Assay Low-Enriched Uranium
National Lab Infrastructure	SEC. 50172 – National Laboratory Infrastructure
Clean Energy Loan Guarantees	SEC. 50144 – Energy Infrastructure Reinvestment Financing

Federal and total investments for each investment vehicle for the Power policy group are detailed in the table below.

TITLE	TYPE	FEDERAL INVESTMENT ($billions)	PRIVATE MATCH	TOTAL INVESTMENT ($billions)
S.45 - PTC Ext	Tax Credit	$56.51	N/A	$56.51
S.48 - ITC Ext & Increase	Tax Credit	$53.61	N/A	$53.61
Nuclear Tax Credit	Tax Credit	$0.98	N/A	$0.98
Transmission Investments	Grant	$2.86	100%	$5.72
Rural Electrification Act	Loans	$2.88	25%	$3.60
Rural Electrification USDA	Loans	$9.70	N/A	$9.70
Uranium Investments	Grant	$0.70	N/A	$0.70
National Lab Infrastructure	Grant	$2.00	N/A	$2.00
Clean Energy Loan Guarantees	Loans	$5.00	N/A	$5.00
Total Power Investment		**$134.23**		**$137.81**

Buildings Policy Group Inputs

Investment vehicles used in the Buildings policy group modeling. Section numbers refer to the Inflation Reduction Act, as signed into law.

Investment Vehicle	Legislation
Nonbusiness Energy Property Credit	SEC. 13301 – Extension, Increase, and Modifications of Nonbusiness Energy Property Credit
Residential Energy Efficient Property	SEC. 13302 – Residential Clean Energy Credit
Energy Efficient Commercial Buildings Deduction	SEC. 13303 – Energy Efficient Commercial Buildings Deduction
New Energy Efficient Home Credit	SEC. 13304 – Extension, Increase, and Modifications of New Energy Efficient Home Credit

Home Energy Performance-Based, Whole-House Rebates	SEC. 50121 – Home Energy Performance-Based, Whole-House Rebates
High-Efficiency Electric Home Rebate Program	SEC. 50122 – High-Efficiency Electric Home Rebate Program
Assistance for Latest and Zero Building Energy Code Adoption	SEC. 50131 – Assistance for Latest and Zero Building Energy Code Adoption
Federal Procurement	SEC. 60503/60504 – General Services Administration Low Carbon Materials and Emerging Technologies
Assistance to Federal Buildings	SEC. 60502 - Assistance for Federal Buildings
Improving Affordable Housing	SEC. 30002 - Improving Energy Efficiency or Water Efficiency or Climate Resilience of Affordable Housing
Rural Energy for America Program	SEC. 22002 - Rural Energy for America Program

Federal and total investments for each investment vehicle for the Buildings policy group are detailed in the table below.

TITLE	TYPE	FEDERAL INVESTMENT ($BILLIONS)	PRIVATE MATCH	TOTAL INVESTMENT ($BILLIONS)
Nonbusiness Energy Property Credit	Tax Credit	$17.55	N/A	$17.55
Residential Energy Efficient Property	Tax Credit	$24.76	N/A	$24.76
Energy Efficient Commercial Buildings Deduction	Tax Credit	$0.63	N/A	$0.63
New Energy Efficient Home Credit	Tax Credit	$2.72	N/A	$2.72
Home Energy Performance-Based, Whole-House Rebates and Training Grants	Cons Rebate	$2.97	N/A	$2.97
High-Efficiency Electric Home Rebate Program	Cons Rebate	$3.13	N/A	$3.13
Assistance for Latest and Zero Building Energy Code Adoption	Grant	$1.00	N/A	$1.00
Federal Procurement	Grant	$3.15	N/A	$3.15
Assistance to Federal Buildings	Grant	$0.25	N/A	$0.25
Improving Affordable Housing	Grant	$1.00	N/A	$1.00
Rural Energy for America Program	Grant	$1.18	50%	$1.77
Total Buildings Investment		**$58.33**		**$58.92**

Transportation Policy Group Inputs

Investment vehicles used in the Transportation policy group modeling. Section numbers refer to the Inflation Reduction Act, as signed into law.

INVESTMENT VEHICLE	LEGISLATION
Sustainable Aviation Fuel Credit	SEC. 13203, 13704 – Sustainable Aviation Fuel Credit, Clean Fuel Production Credit
Clean Vehicle Tax Credit	SEC. 13401 – Clean Vehicle Credit
Commercial Clean Tax Credit	SEC. 13403 – Qualified Commercial Clean Vehicles
Aviation Tech Program	SEC. 40007 – Alternative Fuel and Low-Emission Aviation Technology Program
Diesel Emissions	SEC. 60104 – Diesel Emissions Reductions
Clean Heavy-Duty Vehicles	SEC. 60101 – Clean Heavy-Duty Vehicles
USPS Clean Vehicle Fleet	SEC. 70002 – United States Postal Service Clean Vehicle Fleets
Biofuel Infrastructure	SEC. 22003 – Biofuel Infrastructure and Agriculture Product Market Expansion
Used Clean Vehicles Credit	SEC. 13402 – Credit for Previously-owned Clean Vehicles
EV Charging / Alt Fuel Tax Credit	SEC. 13404 – Alternative Fuel Refueling Property Credit
Biodiesel, Renewable Diesel, Alt Fuel Credit	SEC. 13201 – Extension of Incentives for Biodiesel, Renewable Diesel and Alternative Fuels
2nd Gen Biofuel Incentive Ext	SEC. 13202 – Extension of Second-Generation Biofuel Incentives

Federal and total investments for each investment vehicle for the Transportation policy group are detailed in the table below.

Title	Type	Federal Investment ($billions)	Private Match	Total Investment ($billions)
Sustainable Aviation Fuel Credit	Tax Credit	$0.15	N/A	$0.15
Clean Vehicle Tax Credit	Tax Credit	$9.65	21%	$11.72
Commercial Clean Tax Credit	Tax Credit	$4.76	21%	$5.78
Aviation Tech Program	Tax Credit	$0.03	N/A	$0.03
Diesel Emissions	Grant	$0.06	N/A	$0.06
Clean Heavy-Duty Vehicles	Grant	$1.00	N/A	$1.00
USPS Clean Vehicle Fleet	Grant	$3.00	N/A	$1.95
Biofuel Infrastructure	Grant	$0.50	75%	$0.88
Used Clean Vehicles Credit	Grant	$2.90	N/A	$2.90
EV Charging / Alt Fuel Tax Credit	Grant	$20.93	N/A	$20.93
Biodiesel, Renewable Diesel, Alt Fuel Credit	Grant	$16.43	N/A	$16.43

2nd Gen Biofuel Incentive Ext	Grant	$0.14	N/A	$0.14
Total Transportation Investment		**$59.55**		**$61.97**

Industrial Policy Group Inputs

Investment vehicles used in the Industrial policy group modeling. Section numbers refer to the Inflation Reduction Act, as signed into law.

INVESTMENT VEHICLE	LEGISLATION
Advanced Energy Project	SEC. 13501 – Extension of the Advanced Energy Project Credit
Advanced Manufacturing Production	SEC. 13502 – Advanced Manufacturing Production Credit
Zero Emission Facility	SEC. 13104 – Extension and Modification of Credit for Carbon Oxide Sequestration
Clean Hydrogen	SEC. 13204 – Clean Hydrogen
Funding for DOE Loan Programs	SEC. 50141 – Funding for DOE Loan Programs
Advanced Technology Vehicle Manufacturing	SEC. 50142 – Advanced Technology Vehicle Manufacturing
Domestic Manufacturing Conversion Grants	SEC. 50143 – Domestic Manufacturing Conversion Grants
Advanced Industrial Facilities Deployment Program	SEC. 50161 – Advanced Industrial Facilities Deployment Program
Low-carbon Transportation Materials Grants	SEC. 60506 – Low-carbon Transportation Materials Grants

Federal and total investments for each investment vehicle for the Industrial policy group are detailed in the table below.

TITLE	TYPE	FEDERAL INVESTMENT ($BILLIONS)	PRIVATE MATCH	TOTAL INVESTMENT ($BILLIONS)
Advanced Energy Project	Tax Credit	$7.65	N/A	$7.65
Advanced Manufacturing Production	Tax Credit	$3.52	N/A	$3.52
Zero Emission Facility	Tax Credit	$2.13	N/A	$2.13
Clean Hydrogen[81]	Tax Credit	$0.00	N/A	$0.00
Funding for DOE Loan Programs	Loan	$3.35	N/A	$3.35
Advanced Technology Vehicle Manufacturing	Grant	$0.92	N/A	$0.92

[81] Investments in hydrogen are removed from the Industrial sector as they are included in the Hydrogen sector.

Domestic Manufacturing Conversion Grants	Grant	$1.99	N/A	$1.99
Advanced Industrial Facilities Deployment Program	Grant	$5.53	N/A	$5.53
Low-carbon Transportation Materials Grants	Grant	$2.00	N/A	$2.00
Total Industrial Investment		**$27.07**		**$27.07**

Environmental Justice & Local Communities Policy Group Inputs

Investment vehicles used in the Environmental Justice & Local Communities policy group modeling. Section numbers refer to the Inflation Reduction Act, as signed into law.

INVESTMENT VEHICLE	LEGISLATION
Healthy Ports	SEC. 60102 – Grants to Reduce Air Pollution at Ports
Environmental and Climate Justice	SEC. 60201 – Environmental and Climate Justice Block Grants
Greenhouse Gas Reduction Fund	SEC. 60103 – Greenhouse Gas Reduction Fund
Low-Income Solar Credit	SEC. 13103 – Increase in energy credit for solar facilities in low-income communities
NOAA Grants	SEC. 40001 – Coastal and Great Lakes Restoration and Technical Assistance
Methane Emissions Reduction Program	SEC. 60113 – Methane Emissions Reduction Program
Neighborhood Access & Equity Grants	SEC. 60501 – Neighborhood Access & Equity Grants
Emergency Drought Relief for Tribes	SEC. 80004 – Emergency Drought Relief for Tribes
Tribal Electrification Program	SEC. 80003 – Tribal Electrification Program
NOAA Facilities & Marine Sanctuaries	SEC. 40002 – Facilities of the National Oceanic and Atmospheric Administration and National Marine Sanctuaries
Tribal Climate Resilience	SEC. 80001 – Tribal Climate Resilience
Climate Pollution Reduction Grants	SEC. 60114 – Climate Pollution Reduction Grants
Funding to Address Air Pollution at Schools	SEC. 60106 – Funding to Address Air Pollution at Schools
Tribal Energy Loan Guarantee Program	SEC. 50145 – Tribal Energy Loan Guarantee Program

Federal and total investments for each investment vehicle for the Environmental Justice & Local Communities policy group are detailed in the table below.

TITLE	TYPE	FEDERAL INVESTMENT ($BILLIONS)	PRIVATE MATCH	TOTAL INVESTMENT ($BILLIONS)

Healthy Ports	Grant	$3.50	N/A	$3.50
Environmental and Climate Justice	Grant	$5.00	N/A	$5.00
Greenhouse Gas Reduction Fund[82]	Loan	$20.00	N/A	$20.00
Low-Income Solar Credit[83]	Tax Credit	$0.00	N/A	$0.00
NOAA Grants	Grant	$9.50	N/A	$9.50
Methane Emissions Reduction Program	Grant	$1.55	N/A	$1.55
Neighborhood Access & Equity Grants	Grant	$0.19	N/A	$0.19
Emergency drought relief for Tribes	Grant	$0.01	N/A	$0.01
Tribal Electrification Program	Grant	$0.15	N/A	$0.15
NOAA Facilities & marine sanctuaries	Grant	$0.15	N/A	$0.15
Tribal climate resilience	Grant	$0.24	N/A	$0.24
Climate pollution reduction grants	Grant	$5.00	N/A	$5.00
Funding to address air pollution at schools	Grant	$0.05	N/A	$0.05
Tribal Energy Loan Guarantee Program	Loan	$0.08	N/A	$0.08
Total Environmental Justice & Local Communities Investment		**$36.06**		**$36.06**

ECONOMIC IMPACT DEFINITIONS

Employment impacts resulting from investment into Delaware's Buildings, Industrial, Power, Hydrogen, Environmental Justice & Local Communities (EJ & LC), and Transportation sectors are divided into direct, indirect, and induced effects across the local economy. This section provides an overview of the types of economic impacts discussed in the findings.

- **Direct effects**, included in the employment projections, show the change in the economy associated with the initial job creation and initial economic activity. For the purposes of this research, direct jobs range from construction workers involved in the direct installation of energy efficiency technologies to sales and administrative employees who work at construction or installation companies.

- **Indirect effects**, included in the employment projections, include all the backward linkages or the supply chain responses resulting from the initial direct economic activity. For example, an indirect job added to the local economy would be a new worker at a heat

[82] Funding amount adjusted, as Delaware does not receive Solar for All Grant
[83] Investment dollar amount for this provision included in the Power sector S.48 - ITC Ext

pump manufacturing facility hired to handle the increased demand for the heat pumps that results from the initial investment.

- **Induced effects**, *not* included in these employment projections, refer to the effects of increased household spending and are the result of direct and indirect workers spending their wages within the local economy. An example of an induced job would be a local restaurant hiring more staff because construction workers and factory workers have new disposable income and eat at this local restaurant.

Employer Survey

BW Research conducted an employer survey of Delaware-based clean energy firms to better understand the existing and future workforce and staffing needs of clean energy businesses and support the development of future training and education programs. The survey sample included a compilation of clean energy firms that had completed the United States Energy and Employment Report (USEER) survey effort in 2022, known clean energy firms identified by DNREC, an online panel of relevant businesses through a third party, and a sample of firms known to employ the relevant industry codes (NAICS) from Crunchbase. The survey instrument was programmed internally by BW Research and each respondent was assigned a unique ID to prevent duplication.

The survey was fielded from May 3, 2024, to June 3, 2024, garnering a total of 54 survey completions by clean energy firms. The average survey duration was 15 minutes.

Stakeholder Engagement

Stakeholder Interviews (15)

BW Research Partnership (BW) conducted 15 executive interviews with stakeholders involved in the state's workforce development ecosystem to uncover existing efforts, challenges, needs, and opportunities in Delaware's climate and clean energy industries.[84] Among the 15 interviewees, six were government officials, five represented education institutions, two were part of industry organizations, one worked with a non-profit organization, and one was an independent contractor with previous experience in education and government work. The interviews took place from the end of April to the beginning of June in 2024 and each took approximately 30 minutes, following a similar discussion guide for each interview.

Stakeholder Sessions (6)

In addition to conducting executive interviews, BW Research was invited to listen into five stakeholder engagement meetings hosted by Senator Stephanie Hansen from April through June 2024. BW's independent takeaways from those sessions are shared as a sidebar within this memorandum, and, where relevant, integrated into similar findings from interviews.

Stakeholder Workshop (1)

On July 25, the Department of Natural Resources and Environmental Control (DNREC) hosted a presentation and workshop for over twenty Delaware stakeholders. The workshop was designed to

[84] BW refers to the "climate and clean energy economy" in this memo, but it is important to note that interview participants also used the term "green economy" in conversations.

serve as a touchpoint for validating and refining research commissioned by DNREC, establish initial engagement with stakeholders, and explore significant opportunities for collaboration.

As shared at the workshop, four goals drove this discussion:

- To share information about the critical need to prepare Delaware's workforce for the climate and clean energy challenge and the opportunity it brings.
- To share and ground-truth preliminary findings by BW Research on Delaware's workforce.
- To facilitate open sharing of feedback and insights among participants.
- To provide a foundation for future collaborative efforts to expand our climate and clean energy workforce.

Training Asset Inventory

The research team developed a comprehensive inventory of 105 publicly available training and credentialing programs based in Delaware that serve the 13 key occupations. These trainings were identified by looking at programs offered at the state's community college system, career technical education school districts, labor unions, and other local entities. All programs included in the inventory were publicly available during the time the research was completed. Training programs that were not offered to the public or were not marketed to the public are therefore excluded from the inventory. The research team collected information related to the program name, host institution name, host institution type, program partners, zip code, primary occupational focus, and degree or outcome. Detailed findings from the inventory are included in Appendix G.

Appendix B: Detailed Employment and Demographic Tables

Table 11. Historical Growth of Key Occupations, Across All Industries, 2017-2023 and 2022-2023[85]

6-DIGIT SOC CODE	OCCUPATION	EMPLOYMENT GROWTH (2017-2023Q4)	EMPLOYMENT GROWTH (2022-2023Q4)
	Delaware Overall Workforce	7.0%	2.4%
47-2111	Electricians	18.7%	4.6%
17-2071	Electrical Engineers	6.7%	3.7%
49-9021	HVAC Technicians and Mechanics	29.4%	2.8%
51-4121	Welders, Cutters, Solderers, and Brazers	2.8%	-0.9%
47-2031	Carpenters	1.5%	-1.1%
49-9081	Wind Turbine Service Technicians	30.8%	7.2%
49-9051	Electrical Power-Line Installers and Repairers	-3.8%	2.5%
11-9021	Construction Managers	10.3%	-0.1%
47-2231	Solar Installers	61.5%	3.7%
17-1012	Landscape Architects	8.3%	1.1%
47-4011	Construction and Building Inspectors	19.3%	4.4%
47-2061	Construction Laborers	11.5%	0.6%
47-2152	Plumbers, Pipefitters, and Steamfitters	11.8%	-0.2%
49-3023	Automotive Service Mechanics	-7.4%	-0.1%

[85] Source: JobsEQ®. 2017-2023Q4. Based on a four-quarter moving average and on Place of Work estimates.

Table 12. Baseline Forecasted Demand Key Occupations, Across All Industries, Exclusive of Targeted Clean Energy Investments from Federal and State Included in Modeling Effort[86]

6-DIGIT SOC CODE	OCCUPATION	7 YEAR GROWTH DEMAND %	7 YEAR GROWTH DEMAND
	Delaware Overall Workforce	4.6%	23,226
47-2111	Electricians	7.4%	170
17-2071	Electrical Engineers	5.0%	26
49-9021	HVAC Technicians and Mechanics	7.2%	111
51-4121	Welders, Cutters, Solderers, and Brazers	4.5%	28
47-2031	Carpenters	4.8%	121
49-9081	Wind Turbine Service Technicians	24.8%	4
49-9051	Electrical Power-Line Installers and Repairers	1.2%	3
11-9021	Construction Managers	7.0%	84
47-2231	Solar Installers	17.5%	15
17-1012	Landscape Architects	4.4%	2
47-4011	Construction and Building Inspectors	0.7%	4
47-2061	Construction Laborers	7.1%	280
47-2152	Plumbers, Pipefitters, and Steamfitters	4.5%	71
49-3023	Automotive Service Mechanics	4.1%	95

Table 13. Gender Composition of Key Occupations in Delaware, 2023Q4[87]

6-DIGIT SOC CODE	OCCUPATION	MALE	FEMALE
	Delaware Overall Workforce	50.8%	49.2%
47-2111	Electricians	97.0%	3.0%
17-2071	Electrical Engineers	89.9%	10.1%
49-9021	HVAC Technicians and Mechanics	97.5%	2.5%
51-4121	Welders, Cutters, Solderers, and Brazers	93.7%	6.3%
47-2031	Carpenters	96.7%	3.3%
49-9081	Wind Turbine Service Technicians	95.3%	4.7%

[86] Source: JobsEQ®. Based on a four-quarter moving average and on Place of Work estimates.
[87] Source: JobsEQ®. 2023Q4. Based on Place of Residence estimates.

49-9051	Electrical Power-Line Installers and Repairers	97.5%	2.5%
11-9021	Construction Managers	89.5%	10.5%
47-2231	Solar Installers	95.4%	4.6%
17-1012	Landscape Architects	85.2%	14.8%
47-4011	Construction and Building Inspectors	90.2%	9.8%
47-2061	Construction Laborers	95.3%	4.7%
47-2152	Plumbers, Pipefitters, and Steamfitters	97.6%	2.4%
49-3023	Automotive Service Mechanics	97.4%	2.6%

Table 14. Racial and Ethnic Composition of Key Occupations in Delaware, 2023Q4[88]

6-DIGIT SOC CODE	OCCUPATION	WHITE	BLACK OR AFRICAN AMERICAN	AMERICAN INDIAN OR ALASKA NATIVE	ASIAN	NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER	TWO OR MORE RACES	HISPANIC OR LATINO (OF ANY RACE)[89]
Delaware Overall Workforce		65.5%	23.6%	0.3%	4.6%	0.0%	6.0%	9.9%
47-2111	Electricians	77.2%	15.7%	0.6%	1.1%	0.1%	5.4%	12.5%
17-2071	Electrical Engineers	73.0%	10.3%	0.0%	14.9%	0.0%	1.7%	3.8%
49-9021	HVAC Technicians and Mechanics	73.2%	20.8%	0.4%	0.4%	0.0%	5.1%	11.8%
51-4121	Welders, Cutters, Solderers, and Brazers	67.5%	25.1%	0.4%	1.3%	0.0%	5.7%	14.0%
47-2031	Carpenters	80.4%	11.9%	0.5%	0.8%	0.1%	6.3%	24.8%
49-9081	Wind Turbine Service Technicians	68.6%	23.9%	0.4%	1.5%	0.1%	5.5%	11.4%
49-9051	Electrical Power-Line Installers and Repairers	86.0%	11.8%	0.1%	0.0%	0.0%	2.0%	6.8%
11-9021	Construction Managers	82.4%	9.2%	0.2%	1.4%	0.0%	6.7%	7.2%
47-2231	Solar Installers	75.7%	15.9%	0.5%	0.9%	0.0%	7.0%	24.3%
17-1012	Landscape Architects	81.5%	5.6%	0.1%	8.6%	0.0%	4.1%	2.8%

[88] Source: JobsEQ®. 2023Q4. Based on Place of Residence estimates.

[89] The U.S Census Bureau considers race and Hispanic origin to be two distinct concepts. Hispanic or Latino is considered to be an ethnicity and may be of any race. Therefore, the percentage of Hispanic or Latinos should not be added to percentages for racial categories.

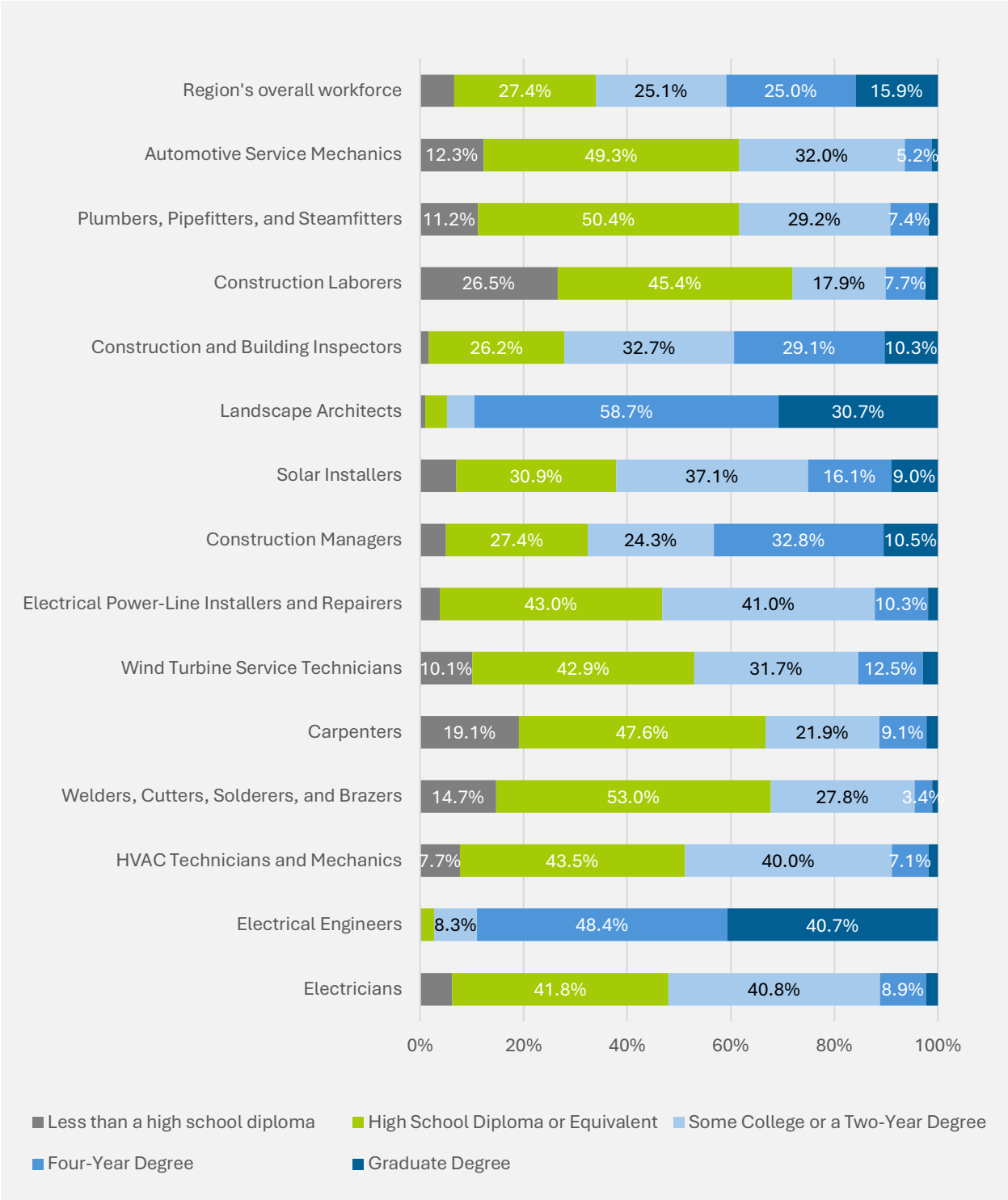
47-4011	Construction and Building Inspectors	70.9%	17.9%	0.4%	4.9%	0.0%	5.8%	9.4%
47-2061	Construction Laborers	72.2%	18.3%	0.6%	0.8%	0.1%	8.0%	30.6%
47-2152	Plumbers, Pipefitters, and Steamfitters	71.9%	22.4%	0.3%	1.4%	0.0%	4.1%	14.7%
49-3023	Automotive Service Mechanics	70.8%	18.1%	0.5%	2.2%	0.1%	8.3%	15.1%

Table 15. Age Composition of Occupations in Delaware, 2023Q4[90]

6-DIGIT SOC CODE	OCCUPATION	16-24 YEARS	25-34 YEARS	35-44 YEARS	45-54 YEARS	55+ YEARS
Delaware Overall Workforce		12.1%	21.6%	20.1%	20.2%	26.0%
47-2111	Electricians	11.5%	24.6%	20.9%	20.7%	22.3%
17-2071	Electrical Engineers	4.1%	22.6%	14.5%	24.3%	34.4%
49-9021	HVAC Technicians and Mechanics	10.8%	24.1%	23.0%	20.6%	21.5%
51-4121	Welders, Cutters, Solderers, and Brazers	12.5%	25.1%	23.1%	18.1%	21.2%
47-2031	Carpenters	7.6%	23.3%	26.3%	23.3%	19.5%
49-9081	Wind Turbine Service Technicians	8.7%	20.6%	22.7%	21.5%	26.6%
49-9051	Electrical Power-Line Installers and Repairers	15.1%	29.6%	24.2%	17.7%	13.3%
11-9021	Construction Managers	3.7%	16.4%	23.4%	24.7%	31.8%
47-2231	Solar Installers	17.7%	33.6%	28.8%	9.7%	10.1%
17-1012	Landscape Architects	2.1%	15.1%	21.3%	20.5%	40.9%
47-4011	Construction and Building Inspectors	3.4%	16.5%	17.5%	18.1%	44.5%
47-2061	Construction Laborers	13.0%	22.9%	23.8%	20.6%	19.7%
47-2152	Plumbers, Pipefitters, and Steamfitters	10.7%	23.9%	21.7%	20.5%	23.2%
49-3023	Automotive Service Mechanics	12.0%	23.8%	23.0%	20.5%	20.7%

[90] Source: JobsEQ®. 2023Q4. Based on Place of Residence estimates.

Figure 21. Educational Attainment of Current Workers in Key Occupations in Delaware's Overall Economy, 2023Q4[91]



[91] Source: JobsEQ®. 2023Q4. Based on Place of Residence estimates.

Figure 22. Highest Education Level Required of Qualified Applicants by Surveyed Employers, by Occupation

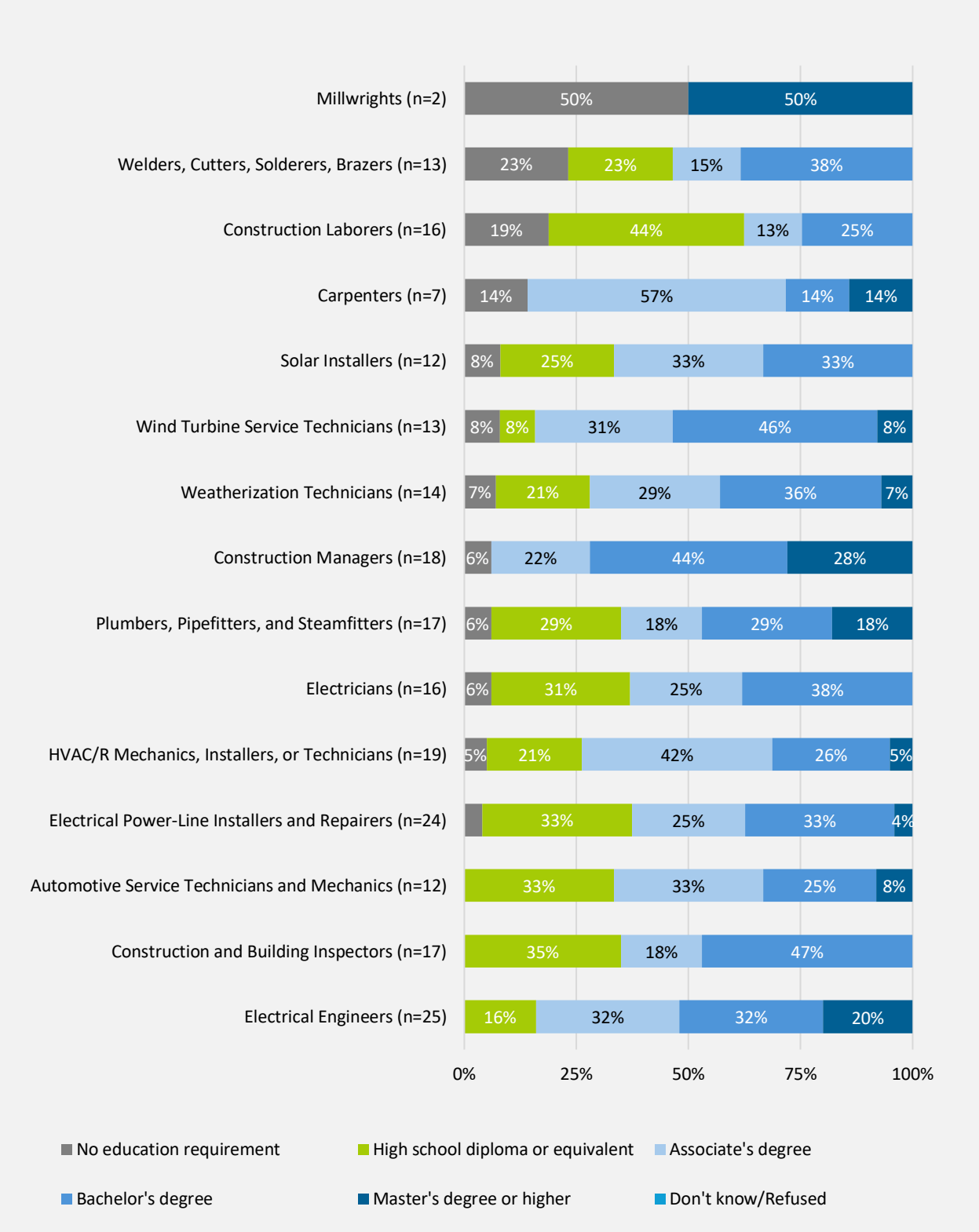
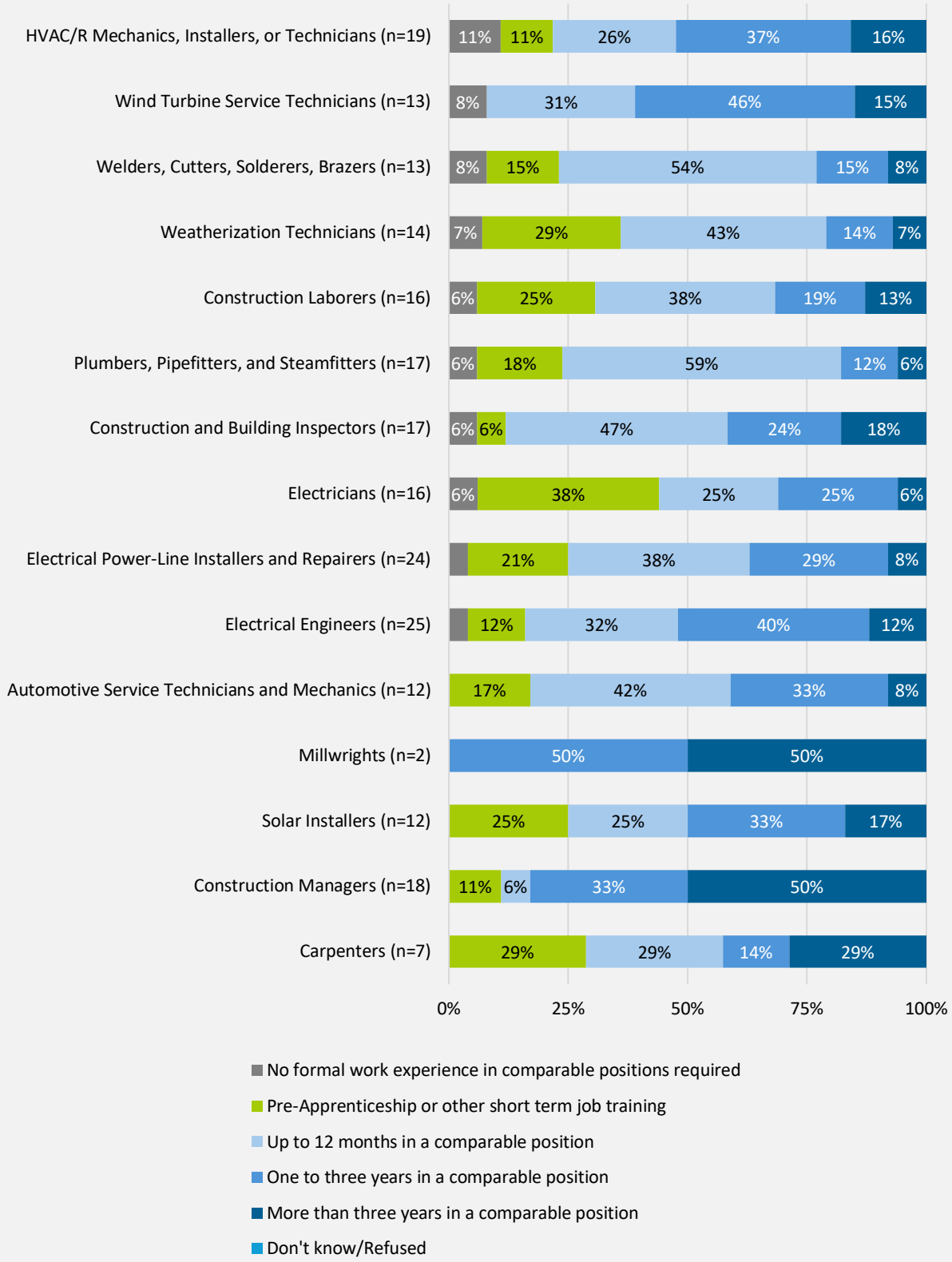


Figure 23. Minimum Level of Prior Experience Required of Qualified Applicants by Surveyed Employers, by Occupation



Appendix C: Clean Energy Definition and Technology List

The definition of clean energy employment has largely been established through the United States Energy and Employment (USEER) report and the United States Climate Alliance Clean Energy Jobs Report released in 2020. In general, a clean energy job is defined as any worker that is directly involved in the research, development, production, manufacturing, distribution, sales, implementation, installation, or repair of components, goods, or services related to the following sectors:

- Clean energy generation
- Grid modernization and storage
- Energy efficiency
- Clean fuels
- Alternative transportation

These jobs also include supporting services such as consulting, finance, tax, and legal services related to clean energy. Included within the above technology sectors are specific sub-technologies; for a full description of these sub-technologies defined as clean energy, please see below. It is important to note that an individual is considered a clean energy worker if they spend any portion of their work week or labor hours dedicated to supporting clean energy goods and services within their firm; in other words, there is no threshold of work or time spent an individual must meet in order to be considered a clean energy employee.

In general, the definition of clean energy is largely similar across other state agency reports or national organizations, particularly for the grid modernization, storage, and energy efficiency sectors. Technology differences are largely related to the inclusion or exclusion of sub-technologies in other sectors such as clean energy generation, clean fuels, and alternative transportation. In particular, state-specific clean energy definitions may vary based on decisions to either include or exclude specific sub-technologies, such as nuclear fuels and generation, traditional hydropower, or corn ethanol. Typically, such decisions are based on adherence to state-level renewable energy standards and other policy mechanisms.

Clean Energy Generation

- Solar
    - Solar photovoltaic
    - Concentrated solar
- Wind
    - Land-based wind
    - Offshore wind
- Geothermal
- Bioenergy/biomass

- Combined heat and power
- Low-impact hydroelectric, including wave/kinetic

Grid Modernization and Storage

- Clean Storage
    - Pumped hydro
    - Battery
    - Mechanical
    - Thermal
    - Biofuel
- Smart grid
- Microgrids
- Other grid modernization

Energy Efficiency

- ENERGY STAR® & Efficient Lighting
    - ENERGY STAR® certified appliances, excluding HVAC
    - ENERGY STAR certified commercial food service equipment
    - ENERGY STAR certified LED lighting
    - Other LED, CFL, and efficient lighting
- Traditional HVAC goods, control systems, and services
- High Efficiency HVAC & 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
    - ENERGY STAR air-source heat pumps
    - ENERGY STAR ground-source or geothermal heat pups
    - Solar thermal water heating and cooling
    - Other high efficiency HVAC that are out of scope for ENERGY STAR certification (e.g. indirect evaporative coolers, air to water heat pumps, energy recovery systems, etc.)
    - ENERGY STAR certified water heaters
    - Other renewable heating and cooling (geothermal, biomass, heat pumps, etc.)
- Advance Materials
    - ENERGY STAR certified windows and doors
    - ENERGY STAR certified roofing
    - ENERGY STAR certified seal and insulation
    - Air sealing
    - Advanced building materials/insulation
- Other energy efficiency
    - ENERGY STAR certified electronics (TVs, Telephones, Audio/Video, etc.)
    - ENERGY STAR certified data center equipment
    - Recycled building materials
    - Reduced water consumption products and appliances

- Energy auditing services

Clean Fuels

- Other ethanol/non-woody biomass, including biodiesel
- Other biofuels
    a. Renewable diesel fuels
    b. Biodiesel fuels
    c. Waste fuels

Alternative Transportation

- Plug-in hybrid vehicles
- Electric vehicles
- Hybrid electric vehicles
- Hydrogen
- Fuel cell vehicles

Appendix D: Clean Energy Sub-Sector Employment

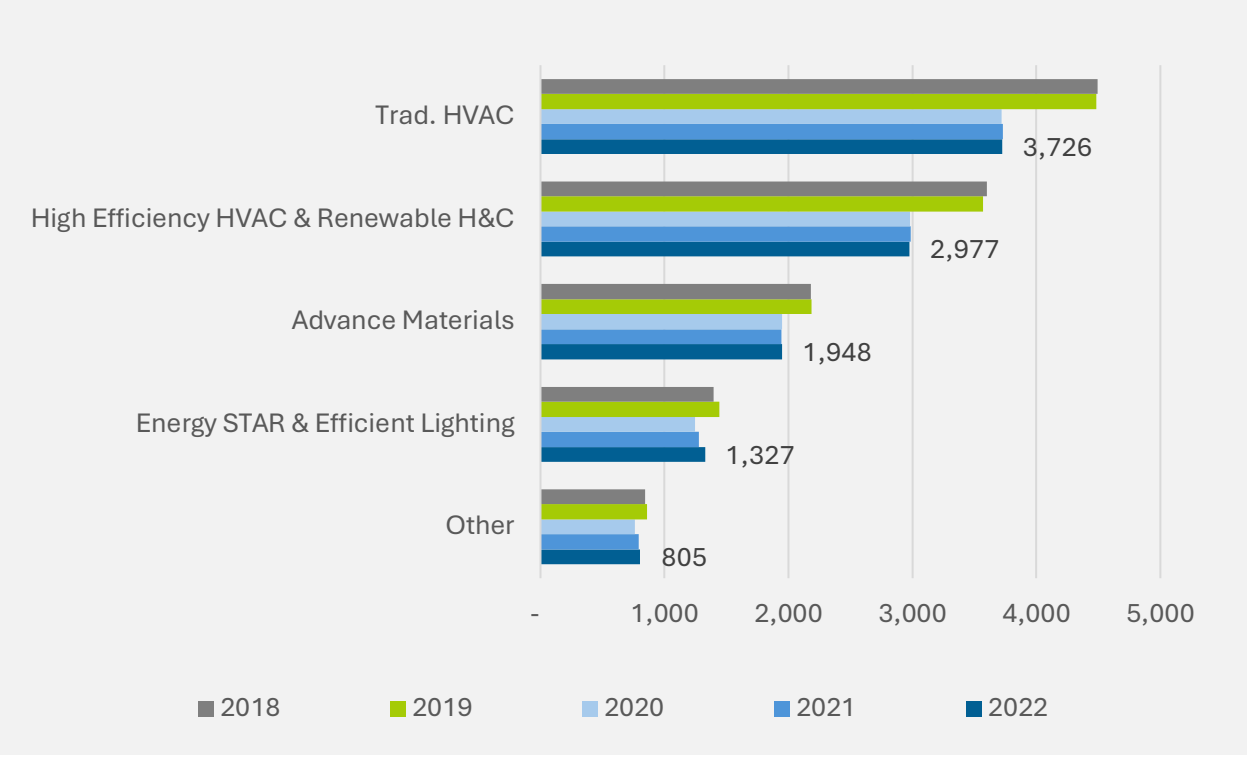
This appendix seeks to clarify some of the terminology used in the workforce needs assessment presentation through brief explanations and definitions. Employment data for each sector is included for additional context.

The employment data for the sectors below, reporting the current and historical state of Delaware's clean energy workforce, are derived from the Department of Energy's U.S. Energy and Employment Report (USEER). Employment figures included in the USEER are derived by surveying tens of thousands of businesses across the nation to determine their involvement in the energy economy and extrapolating publicly available data from the Bureau of Labor Statistics (BLS).

Employment in these sectors spans the entire value chain, and captures clean energy workers in the agriculture, utilities, construction, manufacturing, wholesale trade, professional services, and other services (repair and maintenance) industries.

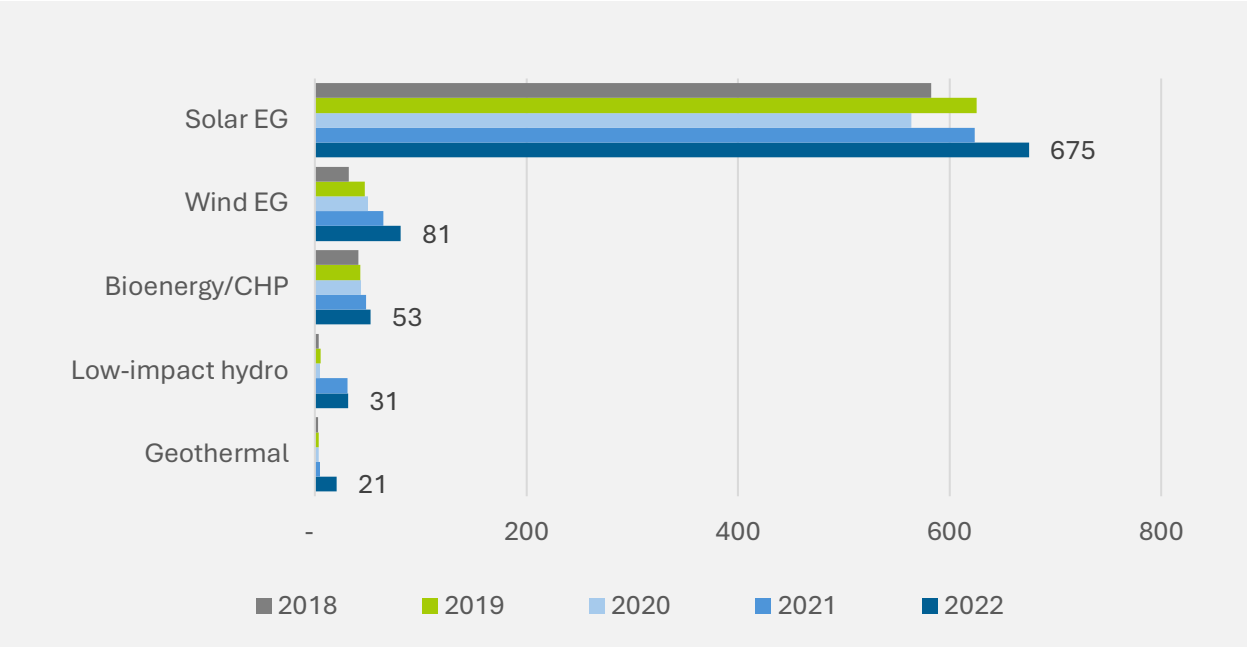
Energy Efficiency

The Energy Efficiency sector includes employment at any firm that works with the following energy efficiency technologies: Energy STAR & Efficient Lighting, Traditional HVAC, High Efficiency HVAC & Renewable Heating & Cooling, Advanced Materials, and Other.



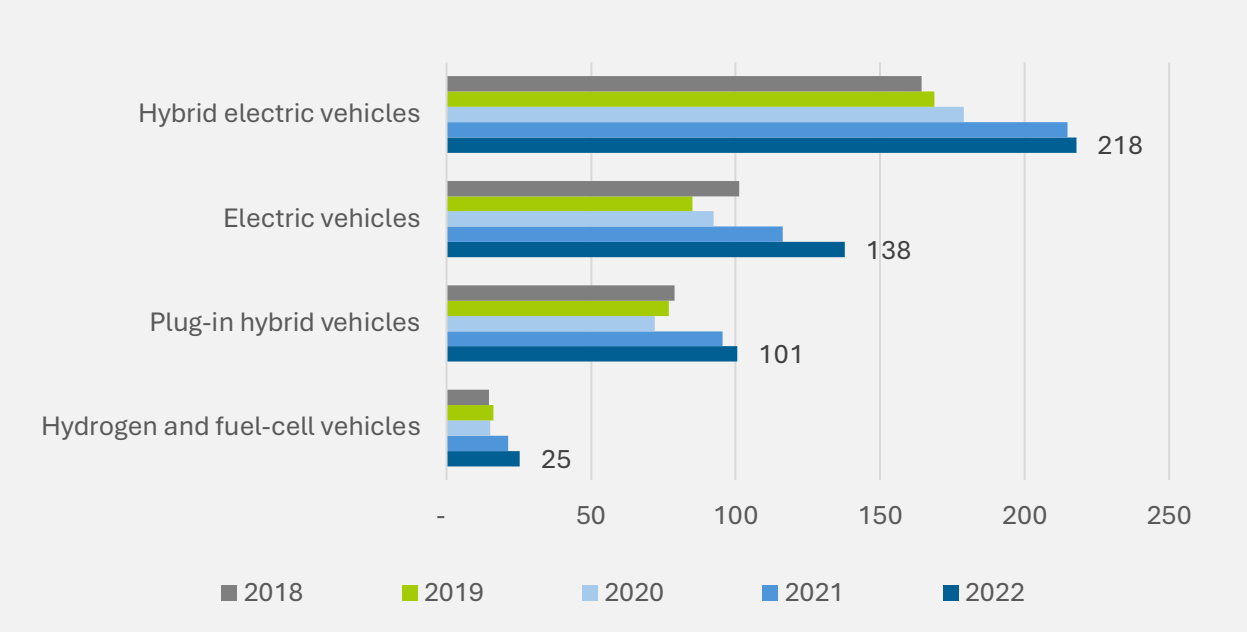
Electric Power Generation

The Electric Power Generation sector includes employment at any firm that works with the following electric power generation technologies: Solar, Wind, Geothermal, Bioenergy, Combined heat and power (CHP), and Low-impact hydro.



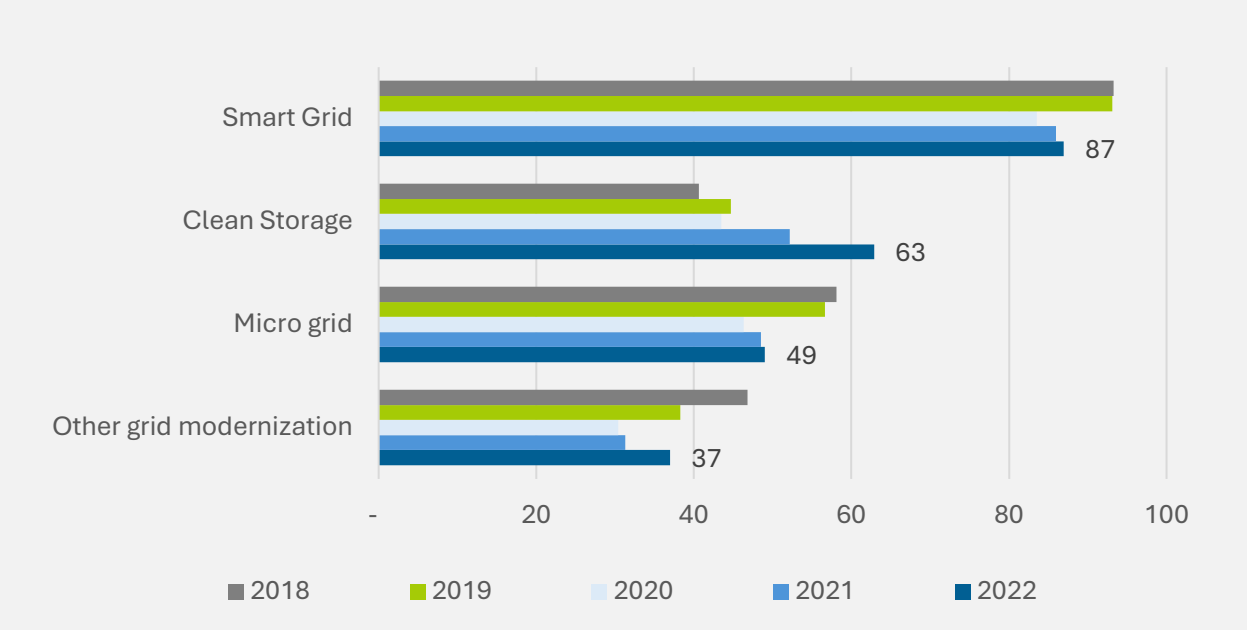
Alternative Transportation

The Alternative Transportation sector includes employment at any firm that works with the following alternative transportation technologies: Hybrid electric vehicles, Plug-in hybrid vehicles, Electric vehicles, and Hydrogen and fuel-cell vehicles.



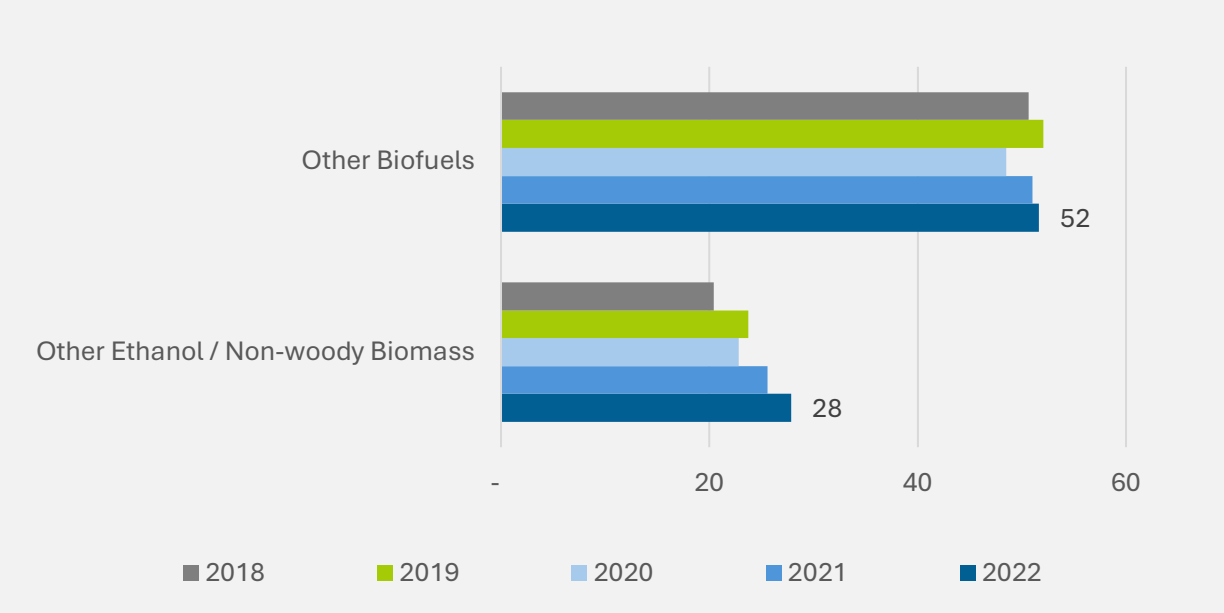
Grid & Storage

The Grid & Storage sector includes employment at any firm that works with the following electric grid and energy storage technologies: Clean storage, Smart grid, Micro grid, and Other grid modernization.



Fuels

The Fuels sector includes employment at any firm that works with the following clean fuel technologies: Other ethanol (non-corn), Non-woody biomass, and Other biofuels.



Appendix E: Survey Toplines

The information contained within this appendix is a collection of primary data obtained from a survey of Delaware clean energy firms (n = 54).[92] This information was gathered by BW Research to support the Delaware Department of Natural Resources Environmental Control (DNREC) and will provide a summary of the information and key findings.

Key Findings

1. **Occupations with the highest expected growth by employers over the next three years include Electrical Engineers; HVAC/R Mechanics, Installers, and Technicians; Wind Turbine Service Technicians; Construction Managers; Plumbers, Pipefitters and Steamfitters, and Electricians.** 60% of firms that employ Electrical Engineers anticipate hiring more of these workers in the next 3 years, while 56% of firms that employ HVAC/R Mechanics, Installers, and Technicians anticipate hiring more of these workers. Half (50%) of firms expect to hire more Construction Managers, Plumbers, Pipefitters, and Steamfitters, and Electricians (Figure 32).

2. **Electricians, Carpenters, and Construction and Building Inspectors are the least challenging occupations to hire, with approximately one in two surveyed firms reporting "little to no" difficulty hiring for these occupations.** Additionally, only 13% of firms reported "great" difficulty in hiring Electricians, indicating little worker supply constraints for this occupation (Figure 34).

3. **Construction Managers, Millwrights,[93] and Electrical Engineers are the most challenging occupations to hire, with approximately one in two firms reporting "great" difficulty hiring for these occupations**. Filling Automotive Service Technician and Mechanics and Weatherization Technician positions also pose challenges to surveyed firms, with 83% and 79% of firms reporting "some" or "great" difficulty hiring qualified workers for these occupations, respectively (Figure 34).

4. **Clean energy firms struggle to find qualified applicants with the prerequisite training or education required and are interested in creating new training programs and employment pipelines in the state to mitigate these hiring challenges.** These deficiencies in training and education are most prevalent for Electrical Engineer, Solar Installer, and Carpenter positions, with a majority of firms (68% to 75%) indicating applicants for these positions are generally lacking in training and education credentials (Figure 36)**.** While 87% of firms reported interest in apprenticeship programs for their future workers, 82% of firms are interested in new clean energy training programs that do not currently exist in the state (Figure 47).

[92] While the results of this survey align with similar surveys fielded in other states, and executive interviews conducted in the state, one consideration is the relatively small number of Delaware businesses that completed the survey (see Methodology for details).
[93] Millwright respondents are a very small sample size (n=2)

5. **Some type of degree or certification is preferred for each key occupation.** A breakdown of firms' most cited occupations is contained in Table 16**.** Additionally, 70% of firms indicated their workers receive certifications from industry training and apprenticeship programs (Figure 43).

6. **Clean energy firms have varied outlooks on hiring over the next three years.** Across all 15 of the identified key occupations, between 17% and 60% of employers expect to have more workers in these occupations three years from now than they currently employ. Between 8% to 33% of firms anticipate having the same number of workers three years from now, while 9% to 20% of firms anticipate having fewer workers (Figure 32).

7. **While most firms report Collective Bargaining Agreement (CBA), Project Labor Agreement (PLA), or Union coverage for their workers across all key occupations, only one in ten firms has formed official partnerships with organized labor.** Between 43% and 84% of employers report CBA, PLA, or Union coverage for their workers across the 15 key occupations (Figure 42), in contrast to the 9% of firms that have formed official partnerships with organized labor or unions (Figure 46).

8. **Nine in ten surveyed firms partner with community or technical colleges (91%) and K-12 education providers (89%) to meet their workforce needs.** Approximately seven in ten (72%) firms partner with four-year colleges and universities, while four in ten firms partner with technical or vocational schools.

9. **Most firms have not implemented specific strategies, policies, or programs to increase special population hires.** Between 76% and 87% of firms reported they have no initiatives targeting female, minority, or LGBTQ+ applicants (Figure 52, Figure 53, Figure 54). Additionally, three in four firms (78%) conduct criminal background screening for potential applicants, though only two in four (54%) conduct substance use screening (Figure 50, Figure 51).

10. **Three in four surveyed firms hire from existing Delaware-based apprenticeship programs (76%) and indicate participation in these programs improved job performance (74%).** One-fifth **(**20%) of firms indicated they do not hire from Delaware-based apprenticeship programs in any capacity, while 17% of firms indicated that participation in these programs did not improve job performance (Figure 48, Figure 49).

Employer Survey Results

The employer survey was conducted from May to June 2024, garnering 54 responses (n = 54) from Delaware-based clean energy firms. The following section outlines general firm characteristics, employment, occupation composition, hiring difficulties, and equity initiatives of responding firms, among other outcomes.

Firm Characteristics

Over two-thirds (69.8%) of surveyed clean energy firms are located in New Castle County, while 22.6% of firms are located in Kent County and the remaining 7.5% in Sussex County

(Figure 24). Additionally, a majority (56%) of firms are less than 10 years old, though only 2% of firms have been founded in the last 1-2 years (Figure 25).

Figure 24. County Distribution of Responding Firms

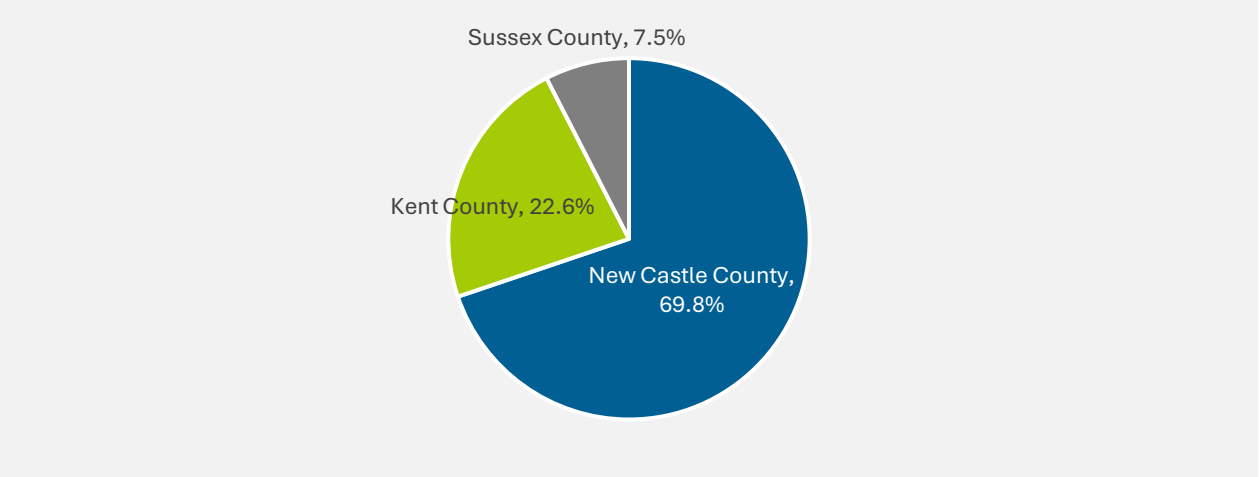
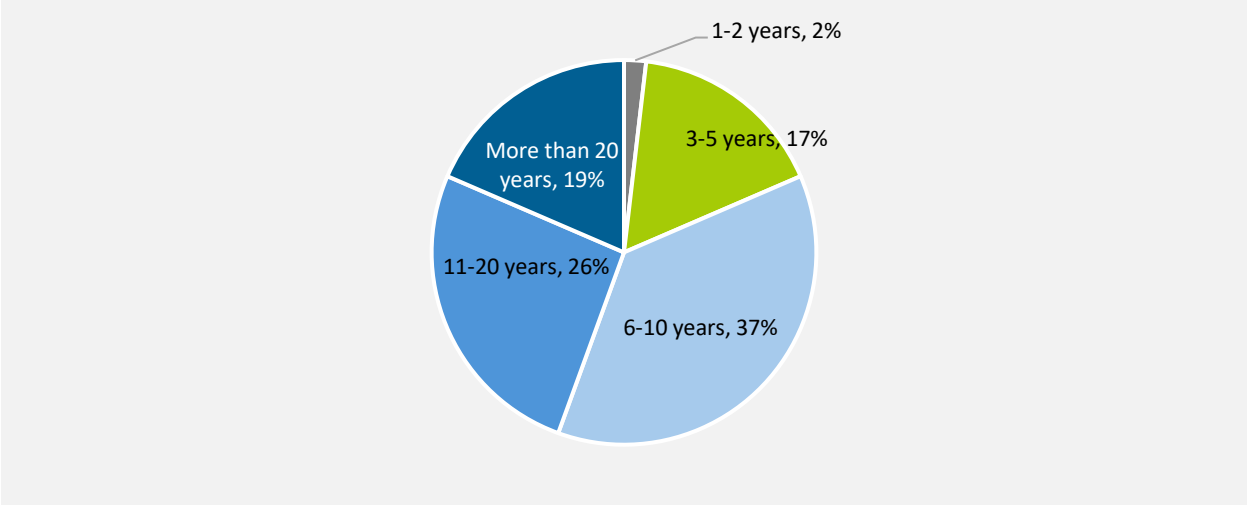
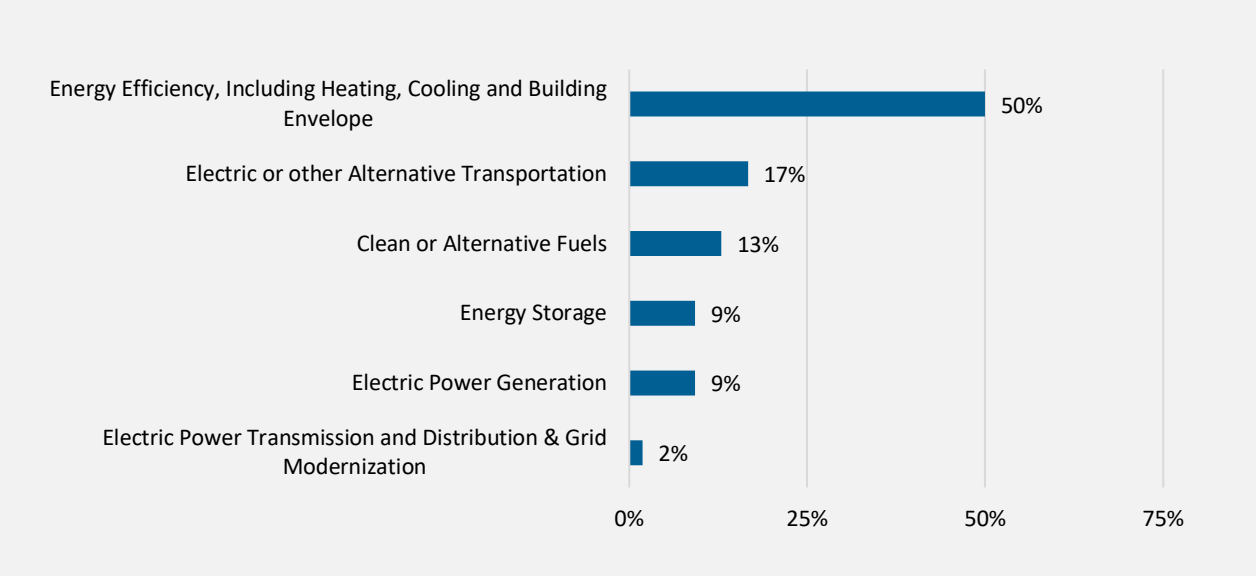


Figure 25. Number of Years in Business



One in two (50%) of surveyed clean energy firms primarily focus on Energy Efficiency-related activities, including Heating, Cooling, and Building Envelope. Firms focused on Electric or other Alternative Transportation represent approximately one in five (17%) of firms, while Clean or Alternative Fuels (13%), Energy Storage (9%), and Electric Power Generation-focused firms (9%) each represent around one in ten firms. Just 2% of firms primarily focus on Electric Power Transmission and Distribution & Grid Modernization activities (Figure 26).

Figure 26. Firm's Primary Clean Energy Technology Focus



Among firms focused on Energy Efficiency-related activities, nearly one in two (48%) focus on High Efficiency HVAC and air-source and ground-source heat pumps (Figure 27). Energy Efficiency firm's building type focus is split evenly between Single Family Residential (37%), Multi-Family Residential (30%), and Commercial Buildings (30%) (

Figure 28).

Figure 27. Primary Clean Energy Sub-Technology Focus Among Energy Efficiency Firms

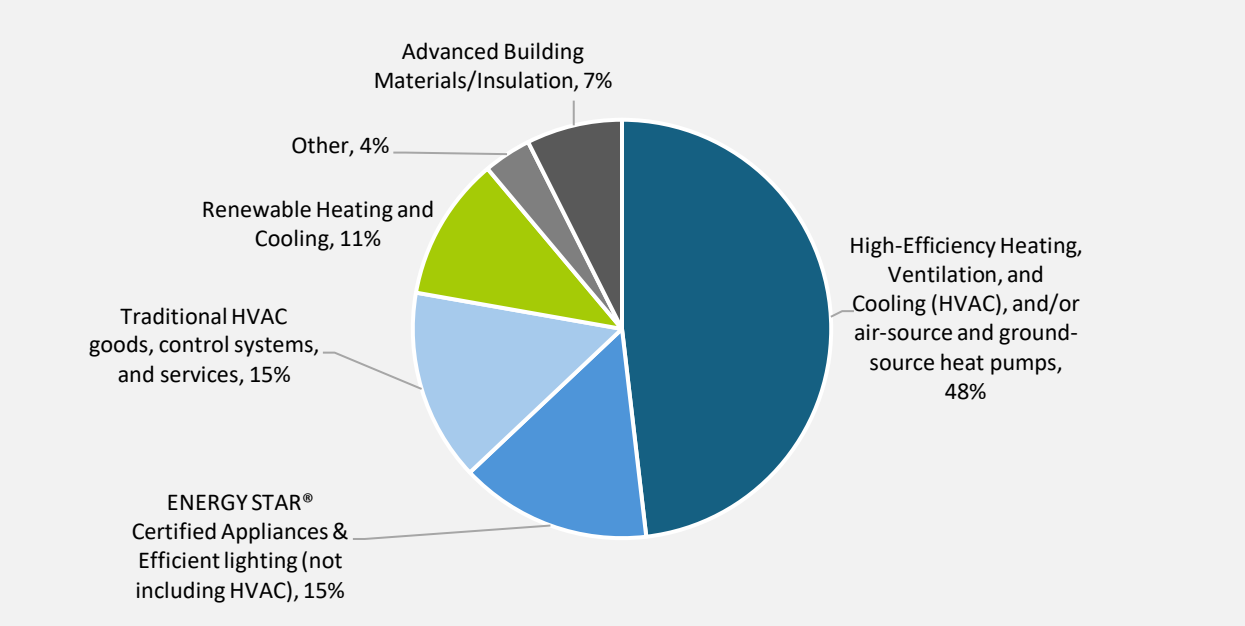
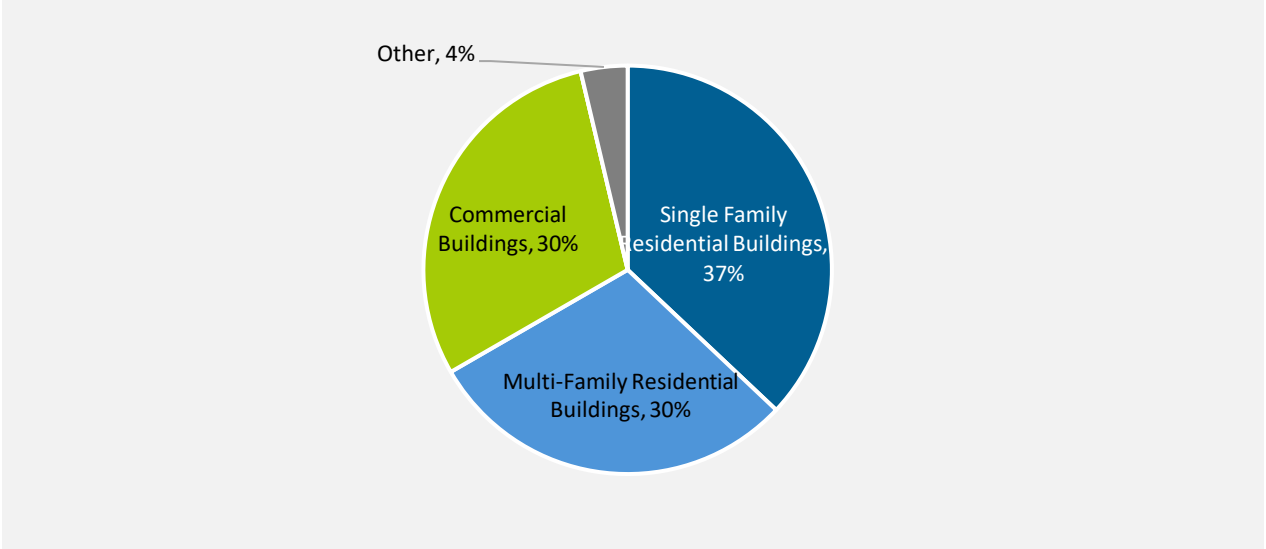
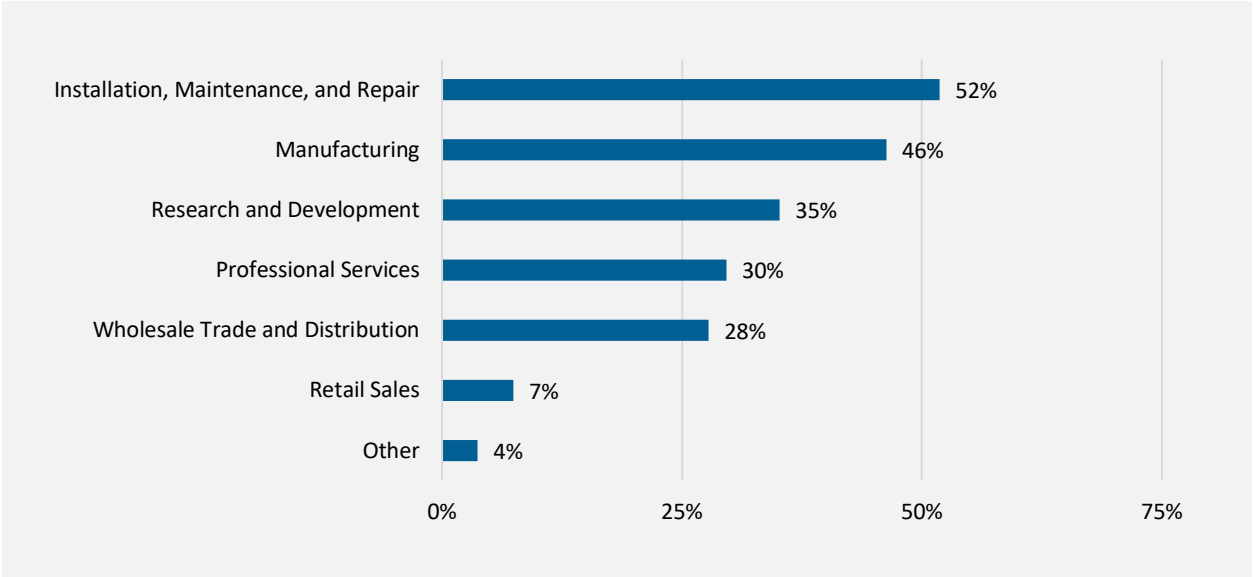


Figure 28. Primary Building Type Focus Among Energy Efficiency Firms



Approximately one in two firms report being in the Installation, Maintenance, and Repair industry (52%) or the Manufacturing industry (46%).[94] Research and Development industry firms represent just over one in three surveyed firms (35%), while Professional Services or Wholesale Trade and Distribution firms represent 30% and 28%, respectively. Only 7% of surveyed firms are involved in the Retail Sales industry (Figure 29).

Figure 29. Firm's Industry Focus - Multiple responses permitted; Percentages may sum to more than 100%

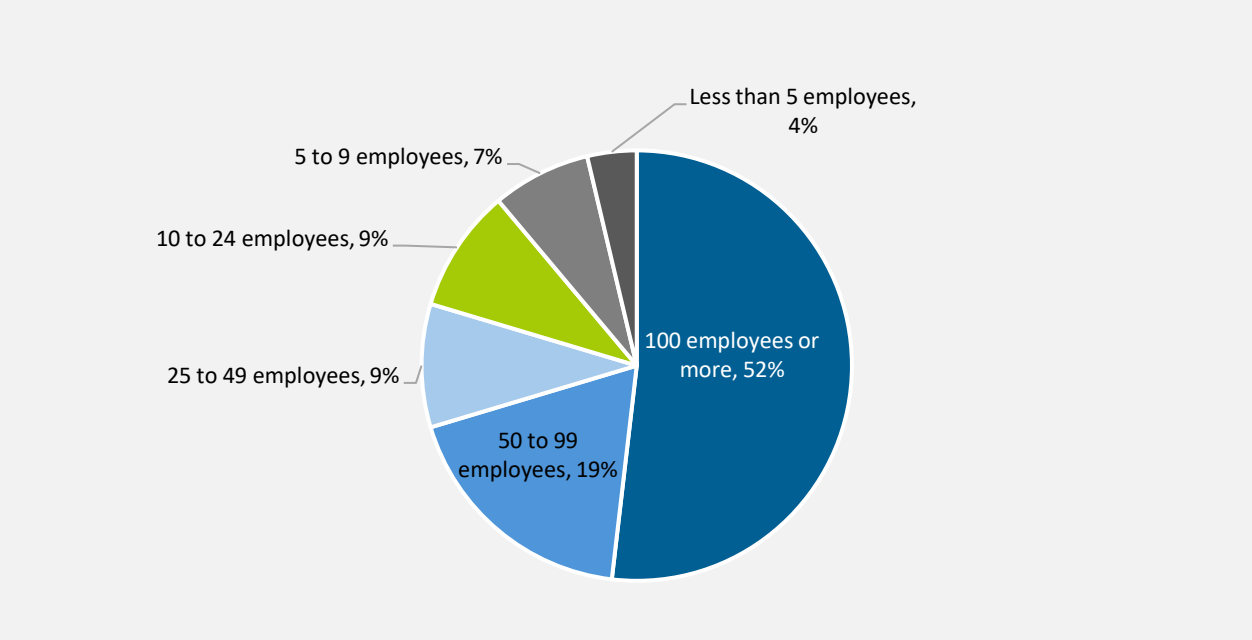


[94] Multiple responses permitted; Percentages may sum to more than 100%.

Employment & Occupation Composition

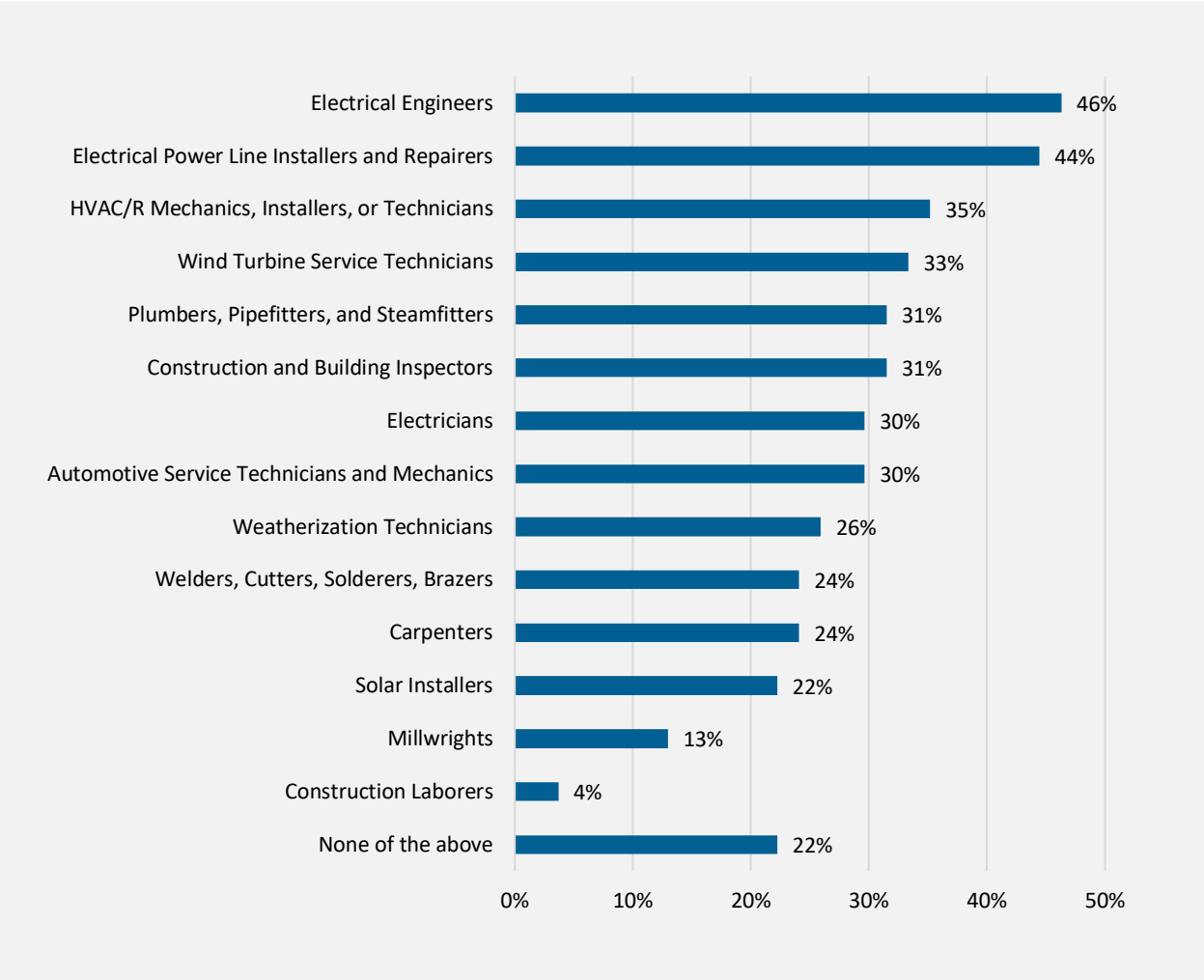
A majority of firms (71%) employ 50 or more workers, while small to mid-sized firms, or those with 5 to 49 employees, represent 25% of surveyed firms. Only 4% of firms employ less than 5 workers (Figure 30).

Figure 30. Number of Employees



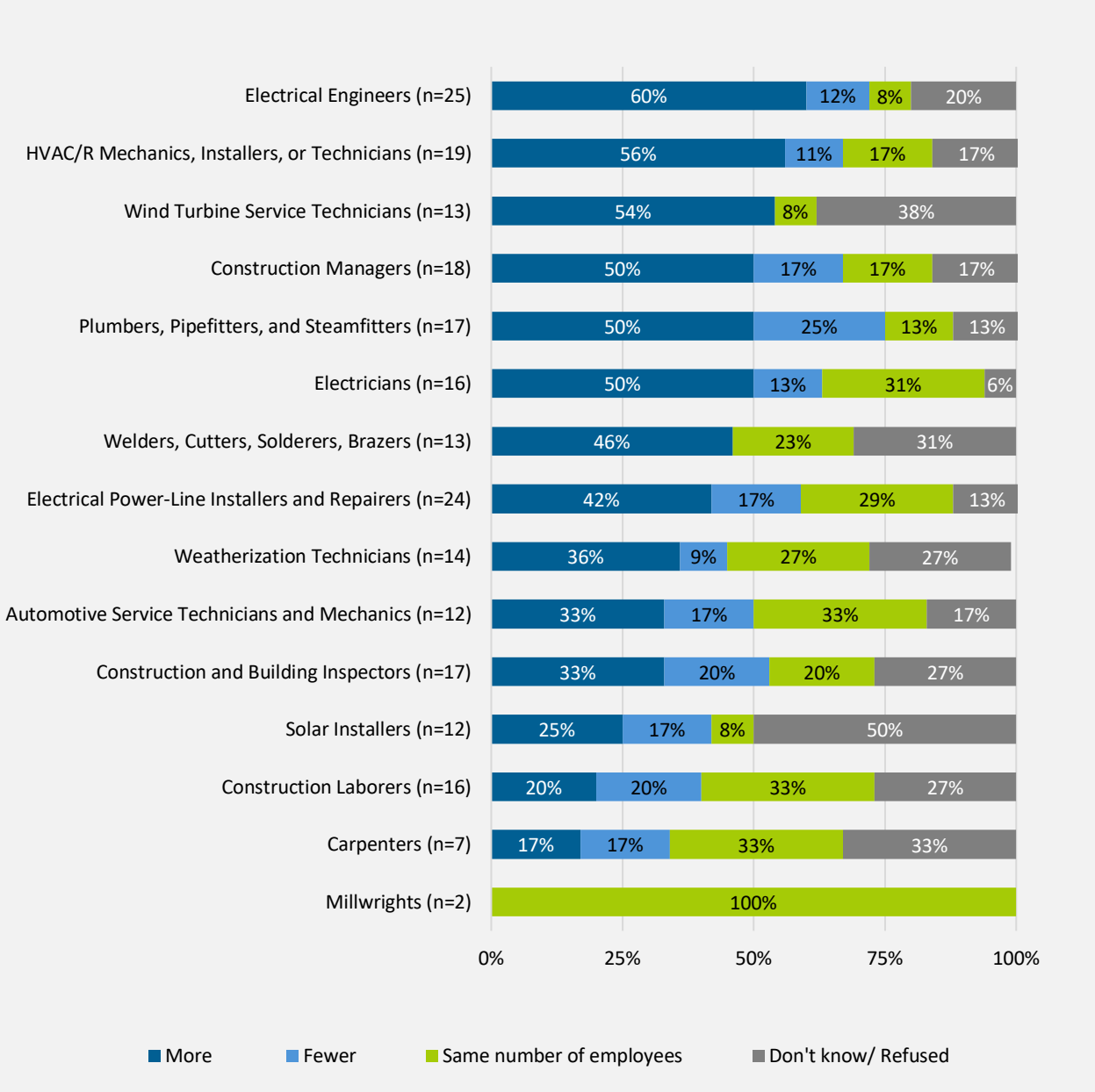
Surveyed firms more frequently reported employing Electrical Engineers (46% of firms), Electrical Power Line Installers and Repairers (44%), and HVAC/R Mechanics, Installers, or Technicians (35%). The least common occupations employed at surveyed firms are Solar Installers (22%), Millwrights (13%), and Construction Laborers (4%). Approximately one in five (22%) surveyed firms employed none of the key occupations identified by the research team (Figure 31).

Figure 31. Occupations Employed - Multiple responses permitted; Percentages may sum to more than 100%



Occupations with the highest expected growth by employers over the next three years include Electrical Engineers; HVAC/R Mechanics, Installers, and Technicians; Wind Turbine Service Technicians; Construction Managers; Plumbers, Pipefitters and Steamfitters, and Electricians. Over one-half (60%) of firms that employ Electrical Engineers anticipate hiring more of these workers in the next 3 years, while 56% of firms that employ HVAC/R Mechanics, Installers, and Technicians anticipate hiring more of these workers. 50% of firms expect to hire more Construction Managers; Plumbers, Pipefitters, and Steamfitters; and Electricians (Figure 32).

Figure 32. Expectation of Employee Growth Over the Next Three Years, by Occupation

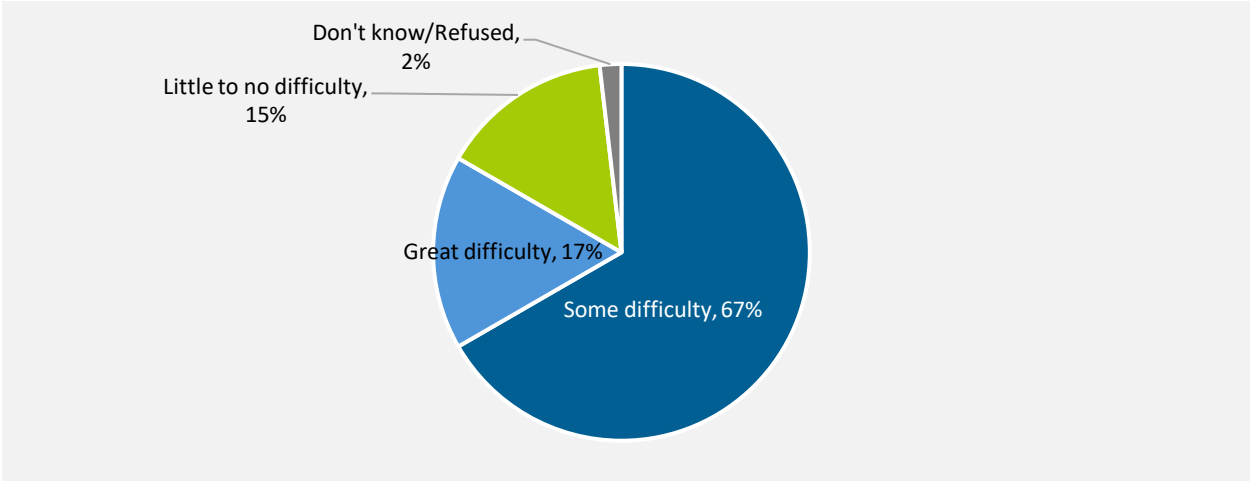


Hiring Profile

Eight in ten (84%) of surveyed firms report "some" or "great" difficulty hiring qualified workers in any occupation. Only 15% of firms reported "little to no" difficulty in hiring qualified workers (

Figure 33).

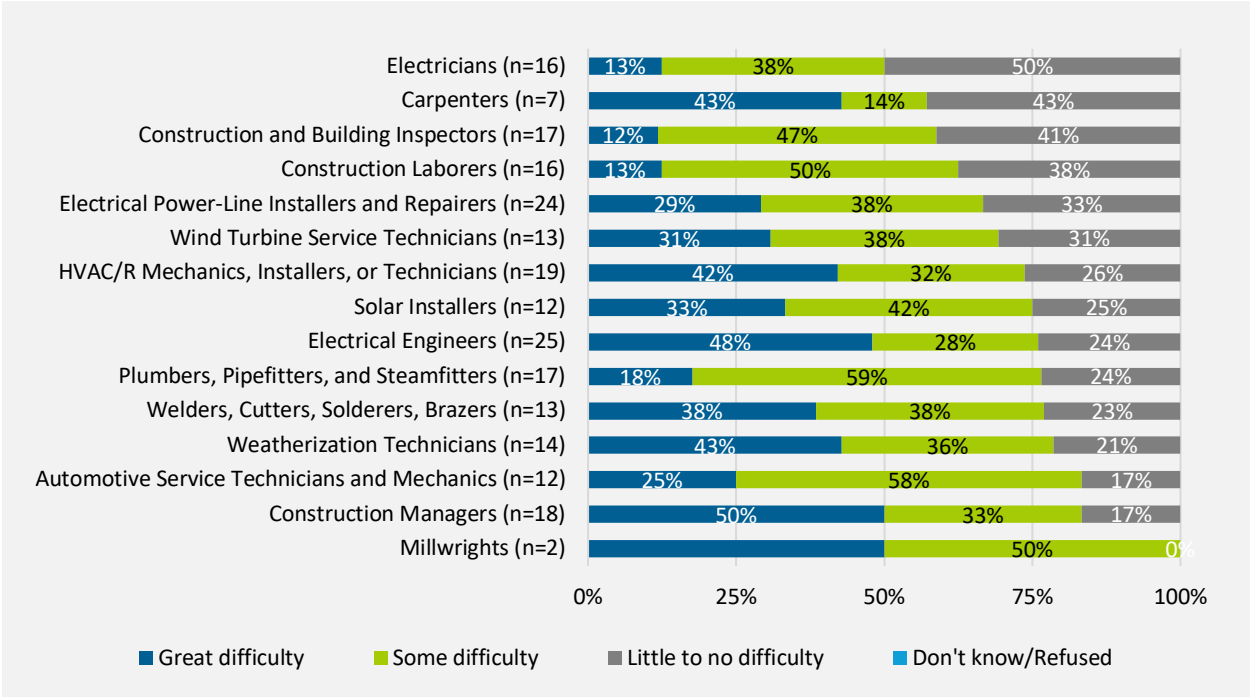
Figure 33. Firms' Level of Difficulty with Hiring Qualified Workers



Construction Managers and Electrical Engineers are the most challenging occupations to hire, with approximately one in two firms reporting "great" difficulty hiring for these occupations. Filling Automotive Service Technician and Mechanics and Weatherization Technician positions also pose challenges to surveyed firms, with 83% and 79% of firms reporting "some" or "great" difficulty hiring qualified workers for these occupations, respectively (Figure 34).

Electricians, and Construction and Building Inspectors are the least challenging occupations to hire, with approximately one in two firms reporting "little to no" difficulty hiring for these occupations. (Figure 34).

Figure 34. Employers' Level of Difficulty with Hiring Qualified Workers, by Occupation



There is a lack of applicants for open Electrical Engineer, Solar Installer, and Weatherization Technician positions among surveyed firms. Approximately two in three firms agree that there are not enough applicants for their firm's open positions in these occupations (Figure 35). Additionally, Solar Installer, Carpenter, and Electrical Engineer applicants are most frequently reported to lack the training or education needed for the job (Figure 36), while Millwright, Carpenter, and HVAC/R Mechanic, Installer, or Technician applicants are most frequently reported to lack the prior work experience needed for the job (Figure 37). Solar Installer, Automotive Service Technician or Mechanic, and Millwright applicants are the most unwilling to work for the wages provided by surveyed firms (Figure 38).

Figure 35. Level of Agreement with "There are not Enough Applicants for my Firm's Open Positions," by Occupation

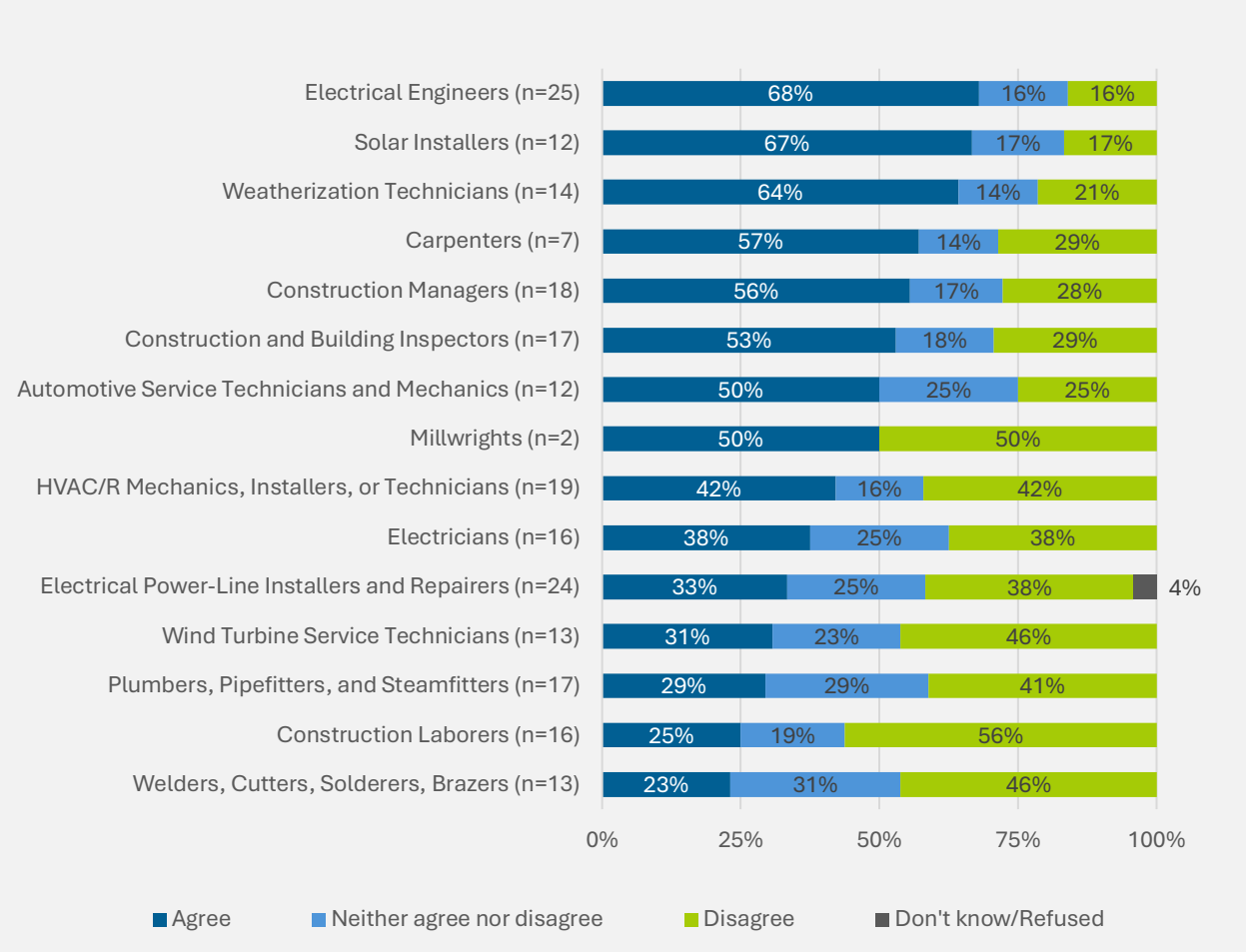


Figure 36. Level of Agreement with "There are Enough Applicants, but they do not have the Training or Education Needed for the Job," by Occupation

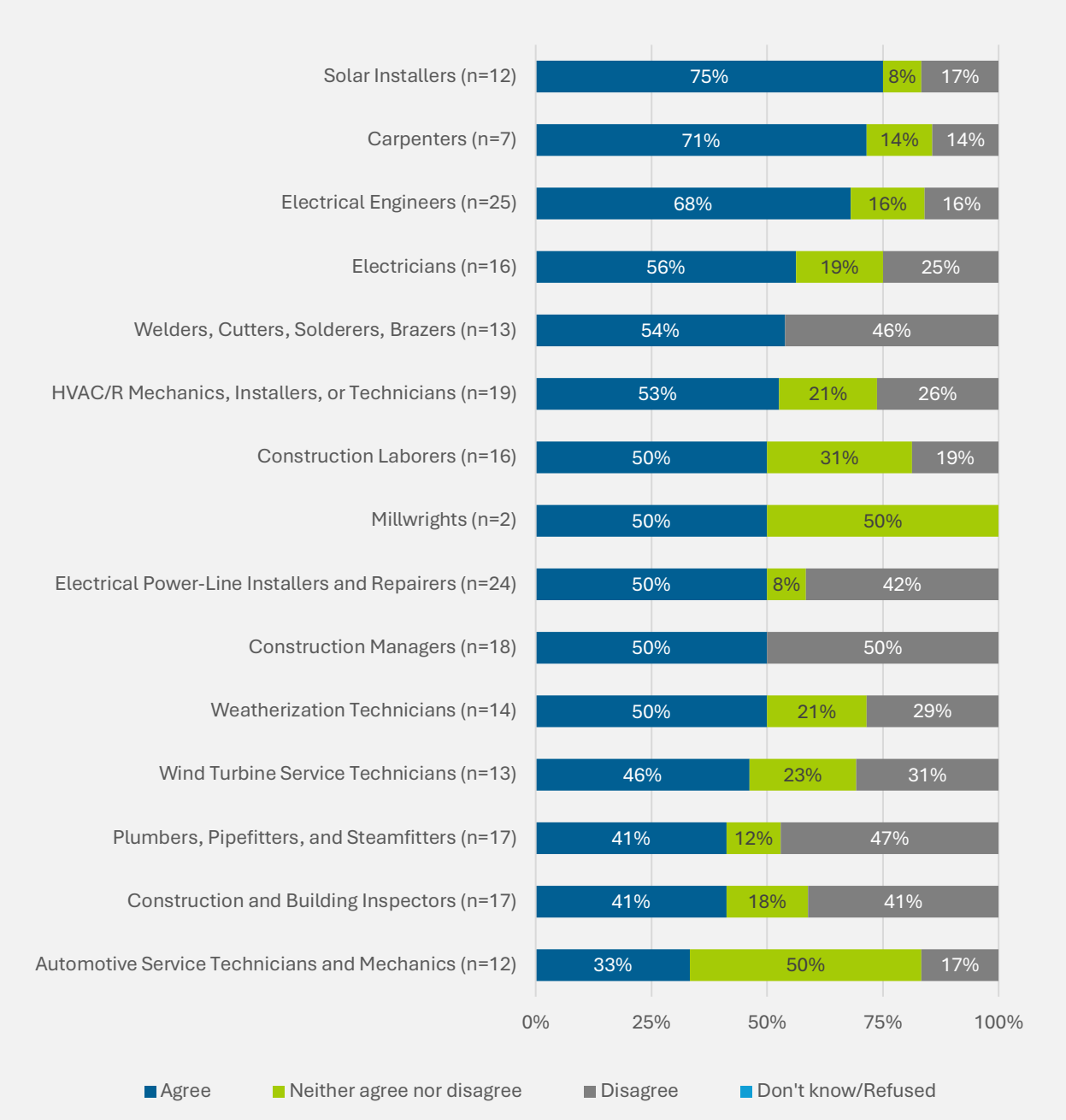


Figure 37. Level of Agreement with "There are Enough Applicants, but they do not have the Prior Work Experience Needed for the Job," by Occupation

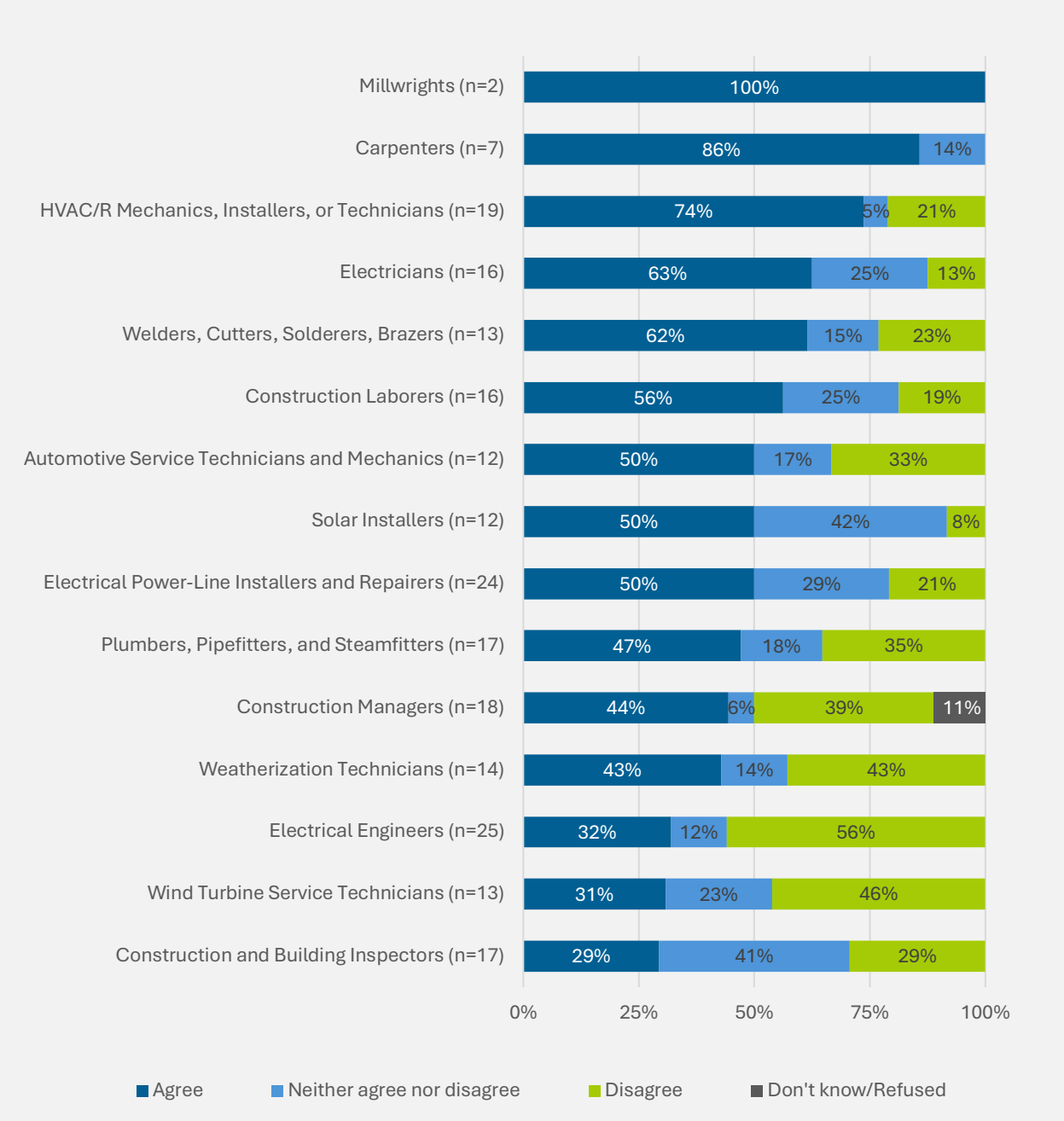
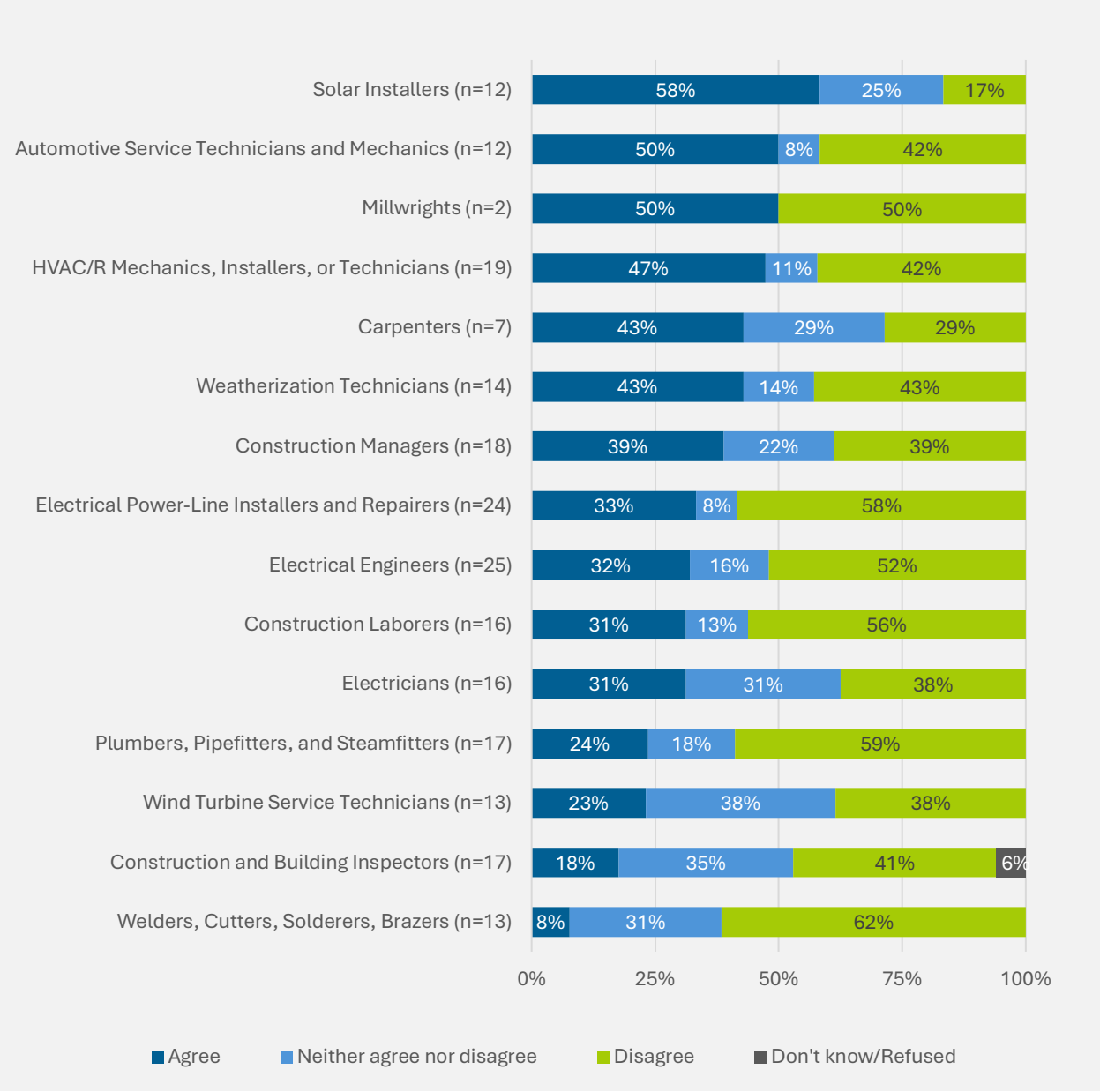
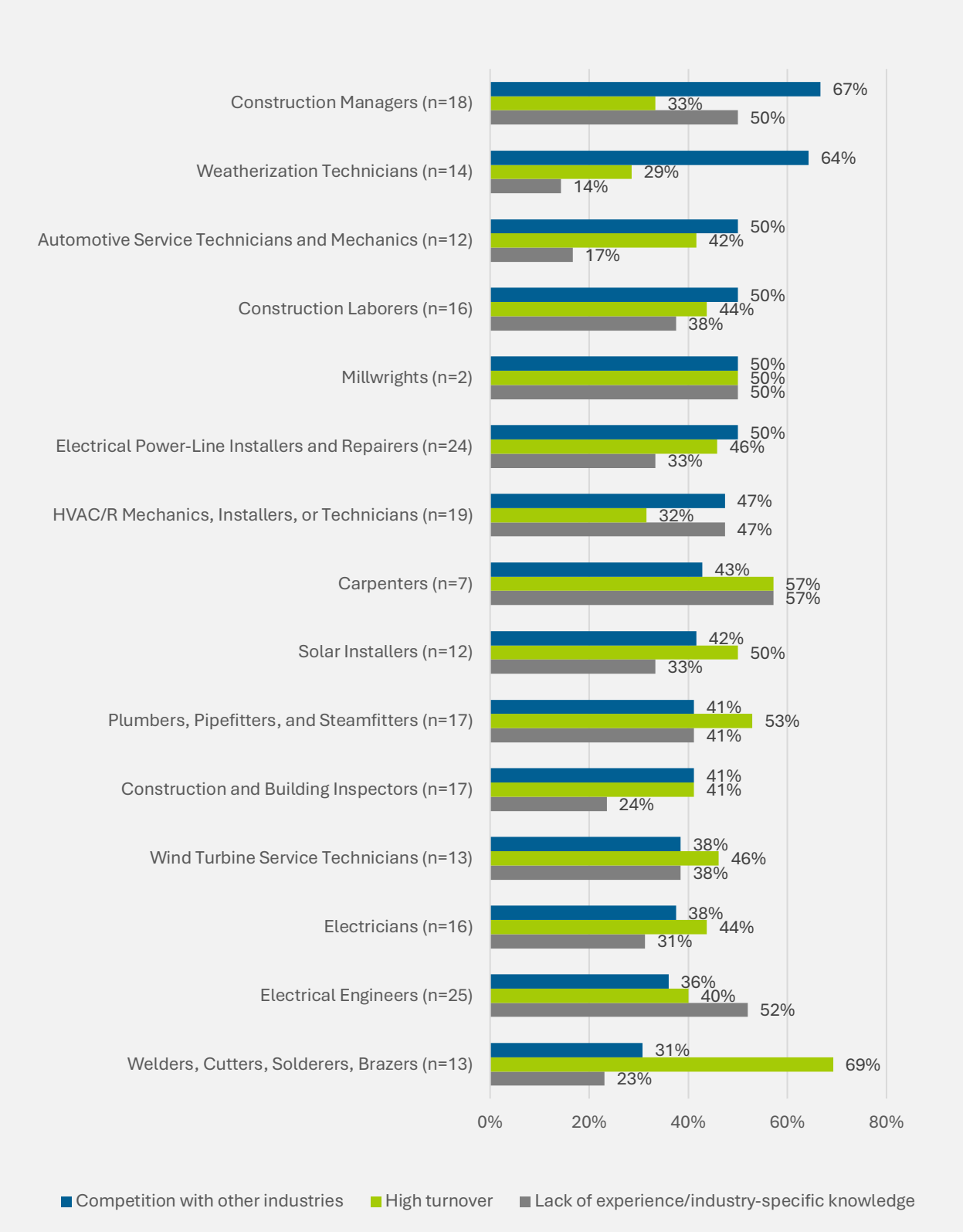


Figure 38. Level of Agreement with "There are Enough Applicants, but they are Unwilling to Work for the Wages we Pay," by Occupation



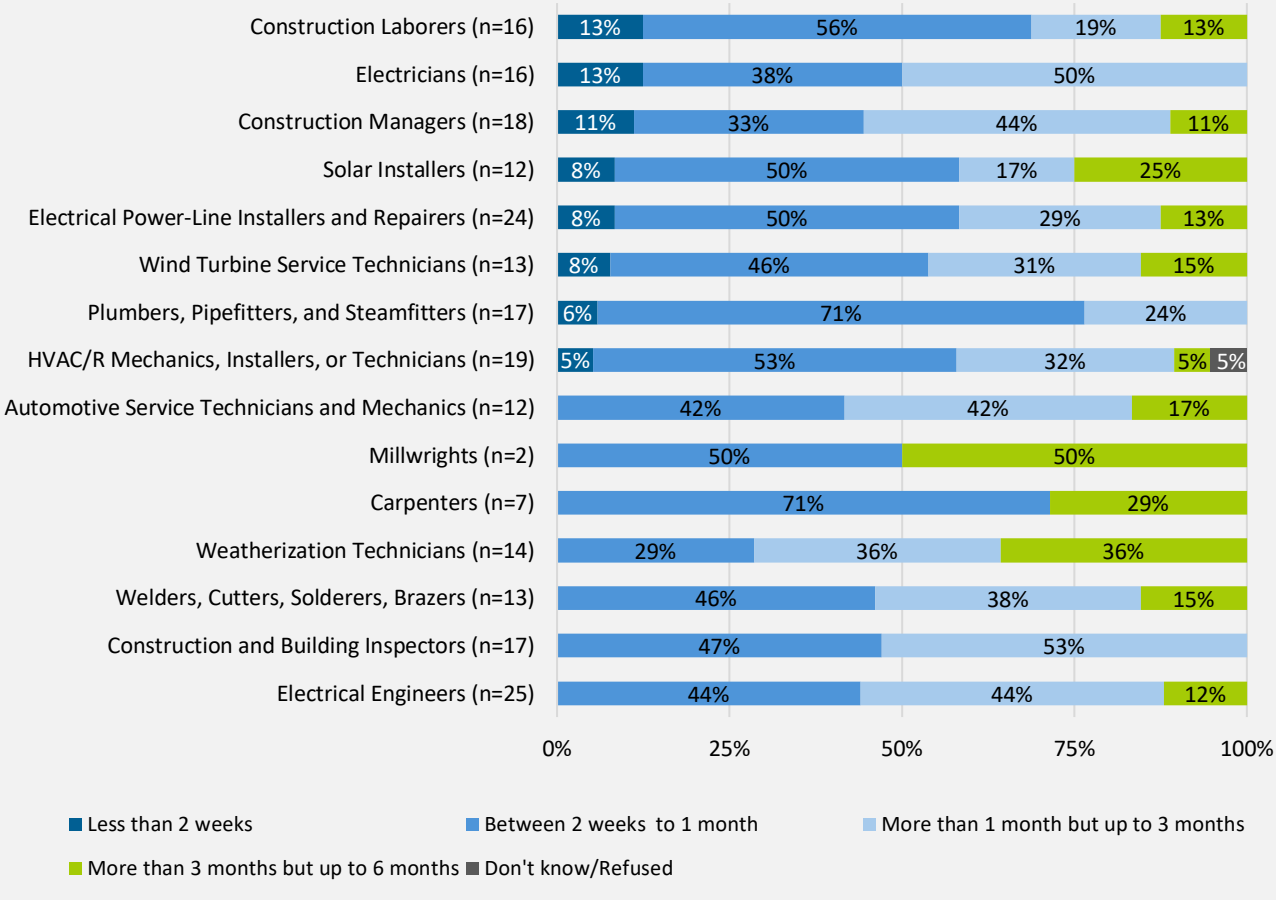
Over 50% of firms indicated hiring difficulties for Construction Managers, Weatherization Technicians, and Automotive Service Technicians and Mechanics are driven by competition with other industries. Hiring difficulties driven by high turnover rates is most prevalent for Welders, Cutters, Solderers, Brazers; Carpenters; and Plumbers, Pipefitters, and Steamfitters. Hiring difficulties driven by lack of experience or industry-specific knowledge are most prevalent for Carpenters, Electrical Engineers, and Construction Managers (Figure 39).

Figure 39. Top Three Reasons for Hiring Difficulty, by Occupation - Multiple responses permitted; Percentages may sum to more than 100%



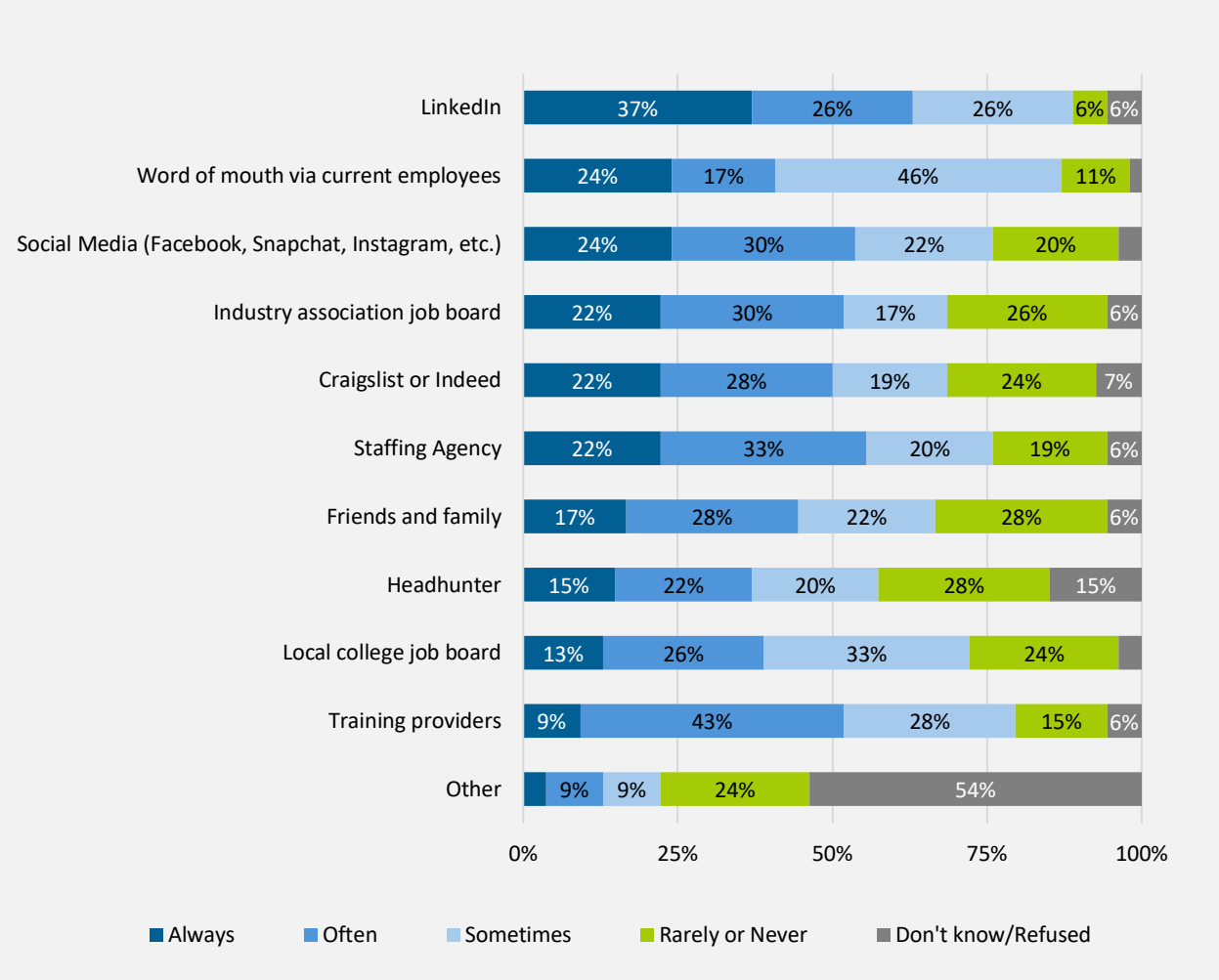
The approximate time to find and hire qualified workers varied by occupation. Weatherization Technicians, Automotive Service Technicians and Mechanics, and Electrical Engineers had the highest share of firms reporting that it took more than one month but up to six to find and hire qualified candidates. In contrast, Plumbers, Pipefitters, and Steamfitters, Carpenters, and Construction Laborers had the highest share of firms reporting it took less than one month to find and hire qualified workers.

Figure 40. Approximate Time to Find and Hire Qualified Workers, by Occupation



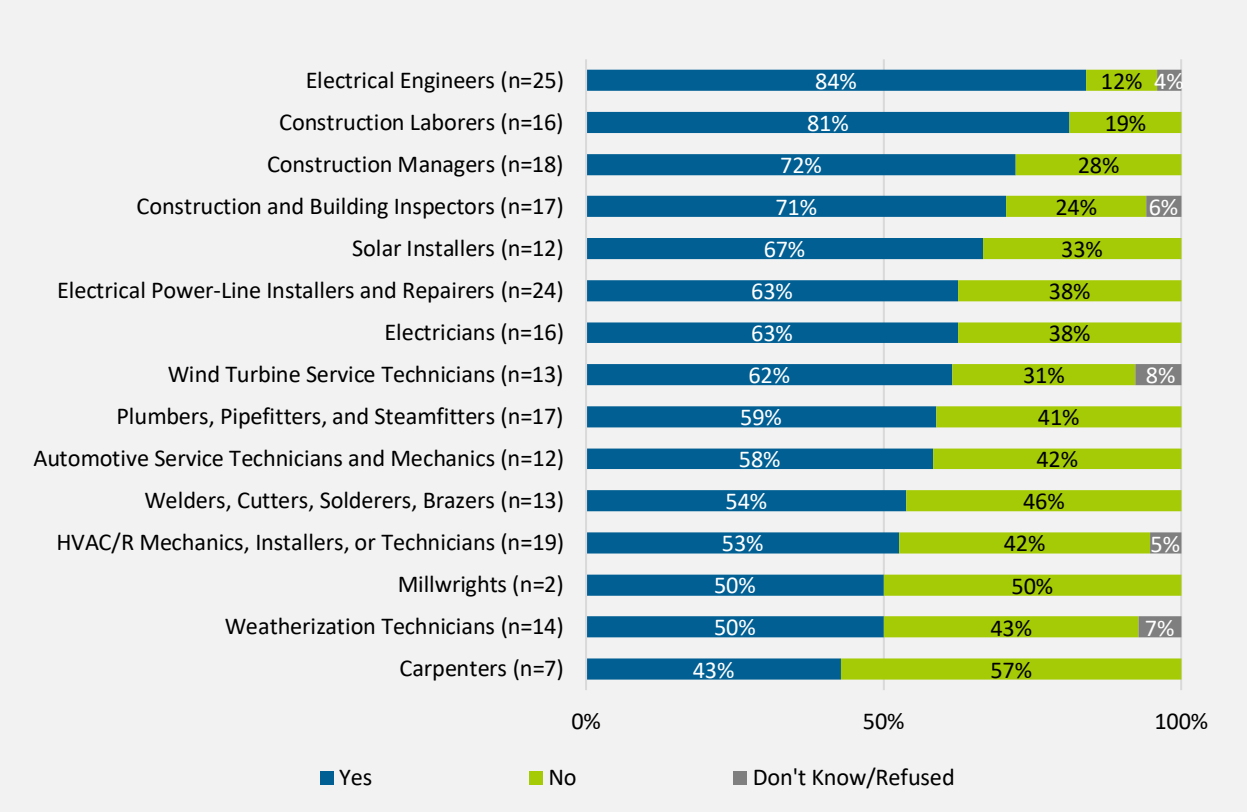
LinkedIn, staffing agencies, training providers, and industry association job boards are the most utilized recruitment and hiring resources among surveyed firms. Nearly two-thirds (63%) of firms indicated they "always" or "often" use LinkedIn to find and hire potential workers, while 55%, 52%, and 52% of firms indicated the same for staffing agencies, training providers, and industry association job boards, respectively (
Figure 41).

Figure 41. Resources Used to Find and Hire Potential Workers



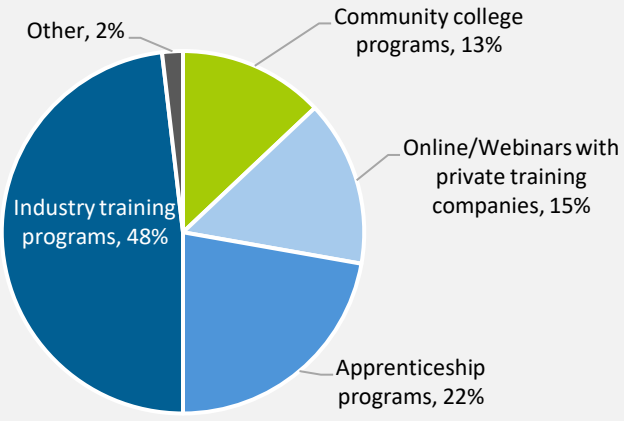
Electrical Engineers, Construction Laborers, and Construction Managers have the highest rates of Collective Bargaining Agreement, Project Labor Agreement, or Union coverage. Additionally, 50% or more firms indicated a majority of their workers are covered by a Collective Bargaining Agreement, Project Labor Agreement, or other union coverage for all occupations except Carpenters (Figure 42).

Figure 42. Are a Majority of Workers Covered by a Collective Bargaining Agreement or Project Labor Agreement, or Otherwise Covered by a Labor Union?



Firms indicated some type of degree or certification is preferred for each key occupation. A breakdown of firms' most cited occupations is contained in Table 16. Additionally, 70% of firms indicated their workers receive certifications from industry training and apprenticeship programs (Figure 43).

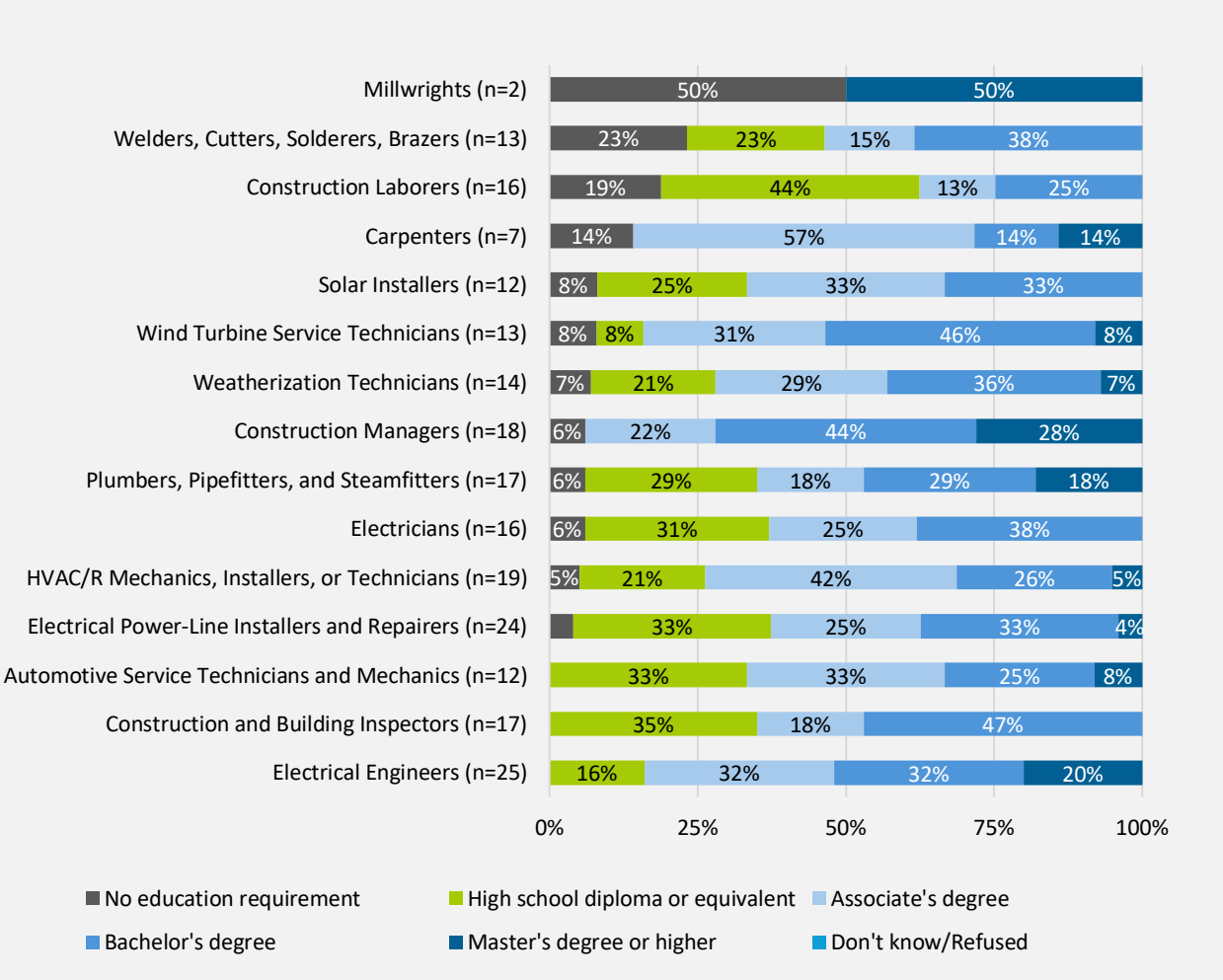
Figure 43. Certification Sources for Current Employees



Skill, Education, & Workforce Pipeline Profile

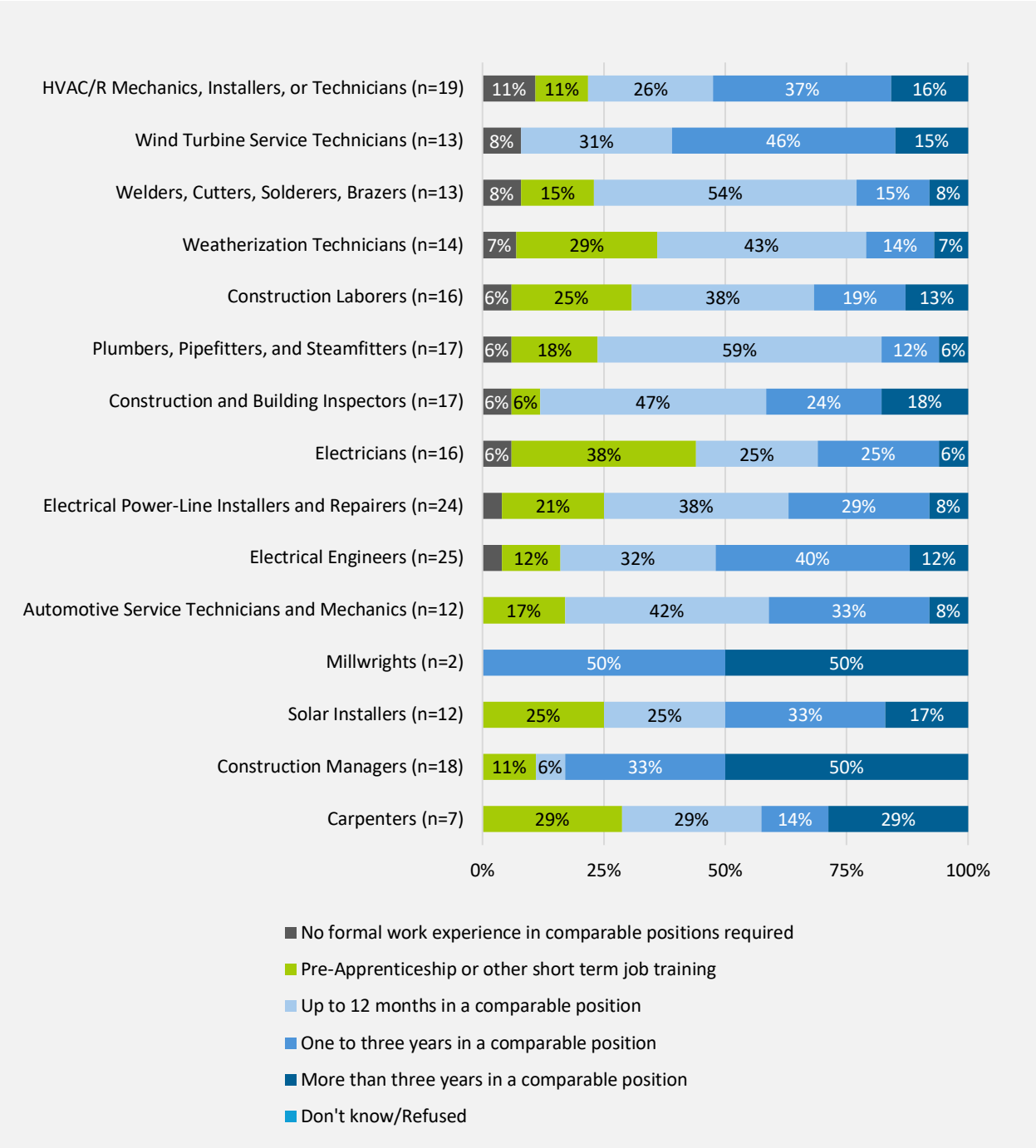
Construction Managers, Wind Turbine Service Technicians, and Carpenters are most frequently reported to require an Associate's degree or higher, with approximately nine in ten surveyed firms (94%, 85%, and 85%, respectively) indicating an Associate's degree, Bachelor's degree, or Master's degree or higher is required of these positions. Construction Laborers and Welders, Cutters, Solders, Brazers have the lowest educational requirements, with 63% and 46% of firms requiring a high school diploma or less for these positions (Figure 44).

Figure 44. Highest Education Level Required of Qualified Applicants, by Occupation



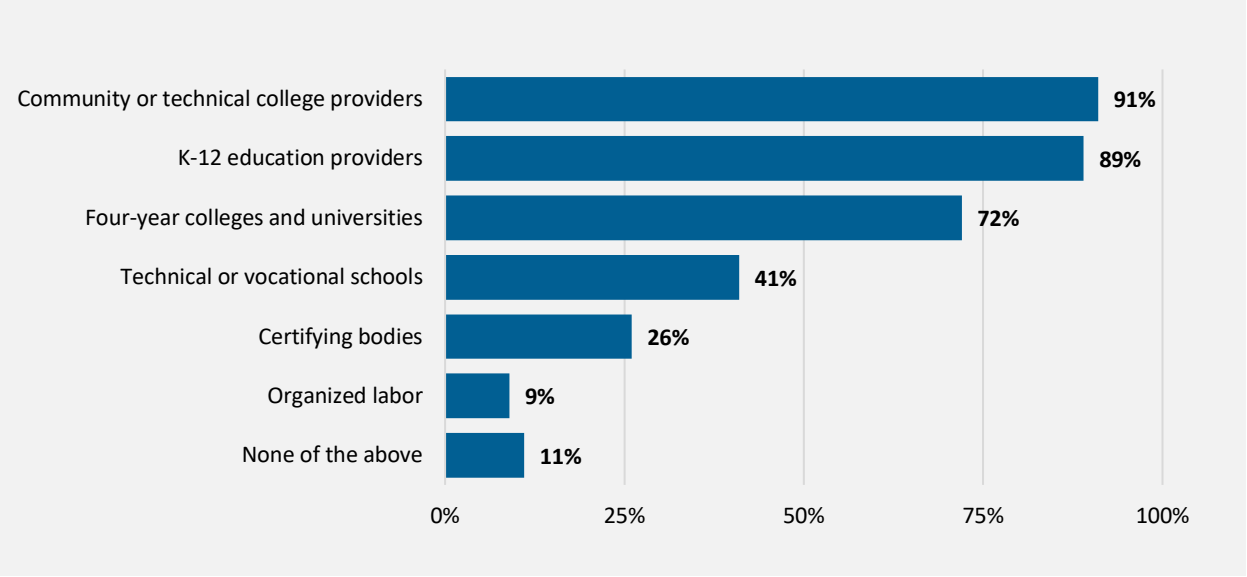
Approximately nine-in-ten surveyed firms required at least some form of prior work experience for entry-level applicants. Construction Managers and Carpenters had the highest level of prior work experience with 50% and 29% of firms requiring more than three years in a comparable position. Electricians, Carpenters, and Weatherization Technicians had the highest share of firms citing only a pre-apprenticeship or other short term job training needed for entry-level applicants at 38% and 29%, respectively.

Figure 45. Minimum Level of Prior Experience Required of Qualified Applicants, by Occupation



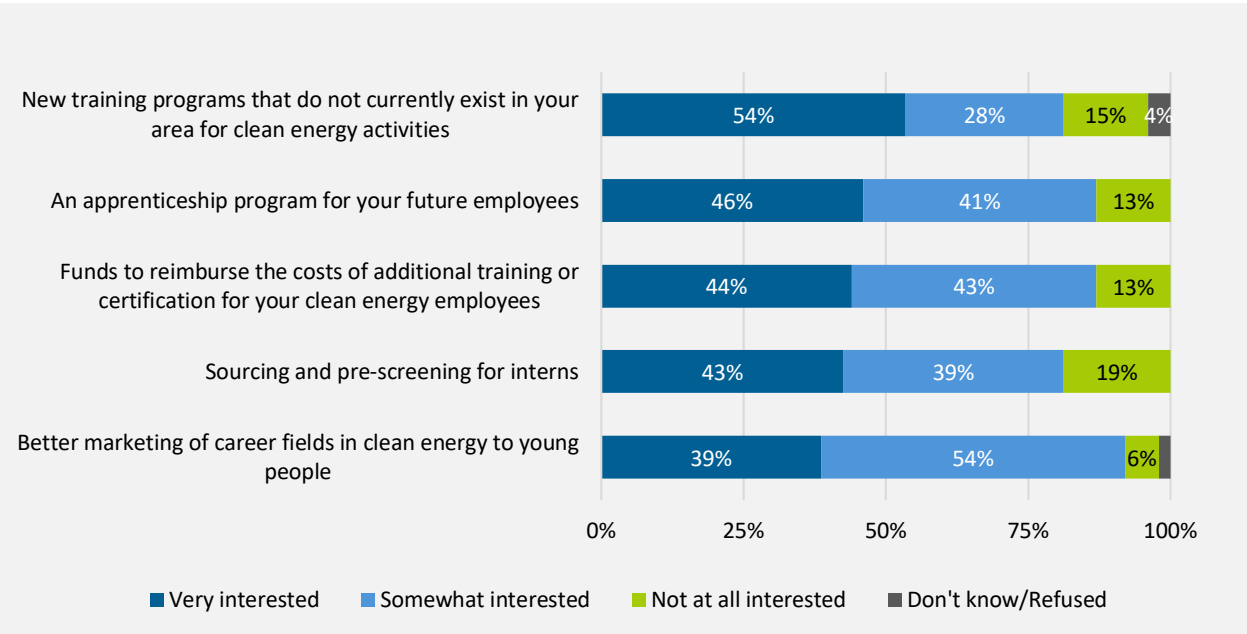
Nine in ten surveyed firms partner with community or technical colleges (91%) and K-12 education providers (89%) to meet their workforce needs. Approximately seven in ten (72%) firms partner with four-year colleges and universities, while four in ten firms partner with technical or vocational schools. Only one in ten (9%) firms have existing partnerships with organized labor (Figure 46).

Figure 46. Firm's Partner Organizations - Multiple responses permitted; Percentages may sum to more than 100%



Surveyed firms are most interested in developing new clean energy training programs to support their workforce needs, with one in two firms indicating they are "very interested" in the development of such programs. 46% of firms are "very interested" in developing an apprenticeship program pipeline, while 44% of firms are "very interested" in developing a funding reimbursement program to mitigate the costs of additional training or certification for their existing clean energy employees (Figure 47).

Figure 47. Firm's Expressed Interest in Programs, Services, and Resources to Support Workforce Needs



Three in four surveyed firms hire from existing Delaware-based Apprenticeship programs (76%) and indicate participation in these programs improved job performance (74%). One-fifth

(20%) of firms indicated they do not hire from Delaware-based apprenticeship programs in any capacity, while 17% of firms indicated that participation in these programs did not improve job performance (Figure 48,
Figure 49).

Figure 48. Firms that Hire from Delaware-based Apprenticeship Programs

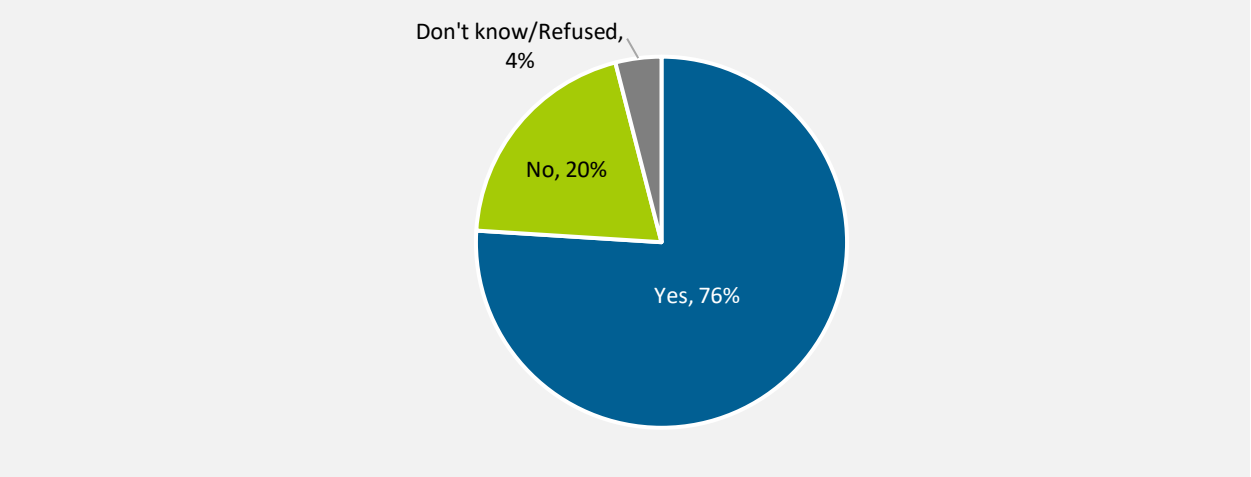
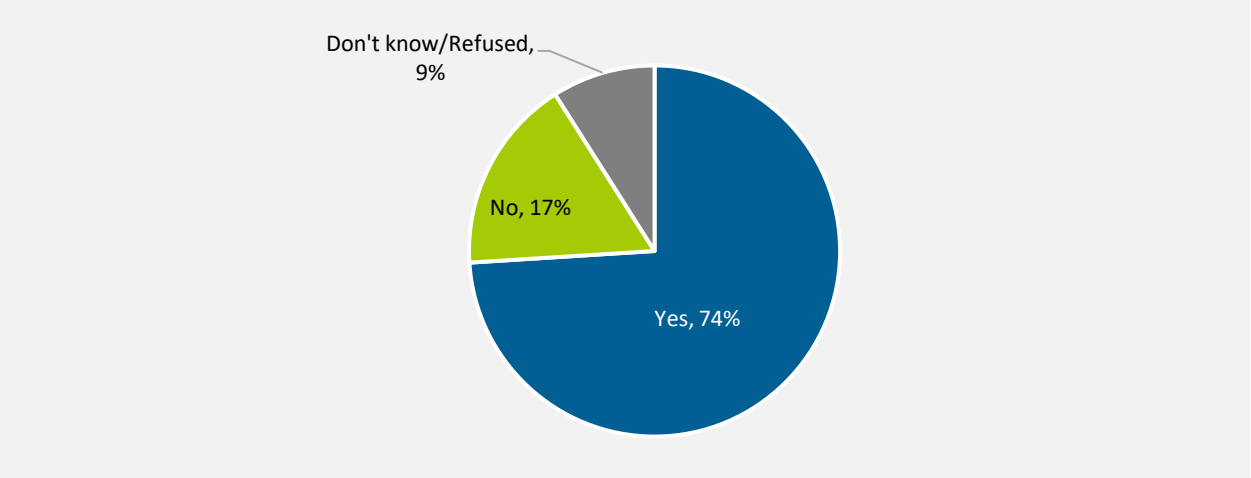


Figure 49. Did Participants in Apprenticeship Programs Improve Job Performance at your Firm?



While just over three in four surveyed firms (78%) conduct criminal background screening on potential applicants, only one in two firms (54%) conduct substance use screening (Figure 50, Figure 51**). Additionally, a majority of firms have no special hiring initiatives to target female, minority, or LGBTQ+ hires.** Only 6% of firms have specific strategies, policies, or programs to increase female hires (Figure 52), while only 7% of firms have strategies to increase LGBTQ+ hires. However, 15% of firms have strategies to increase minority hires of any ethnicity (Figure 53).

Figure 50. Does your Firm Conduct Substance Use Testing for Potential Applicants?

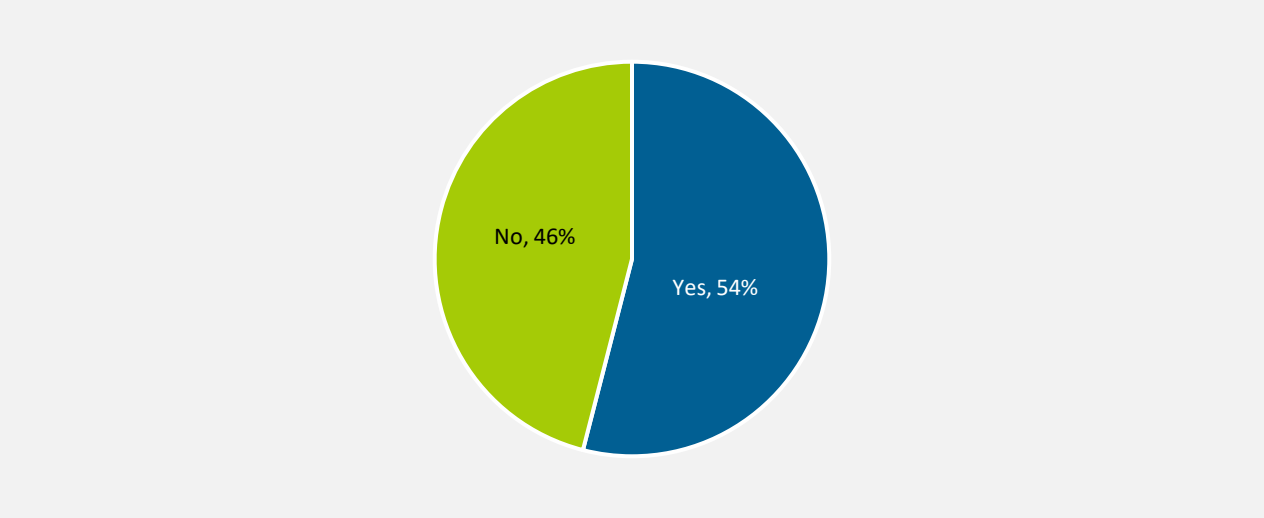


Figure 51. Does your Firm Conduct Criminal Background Checks for Potential Applicants?

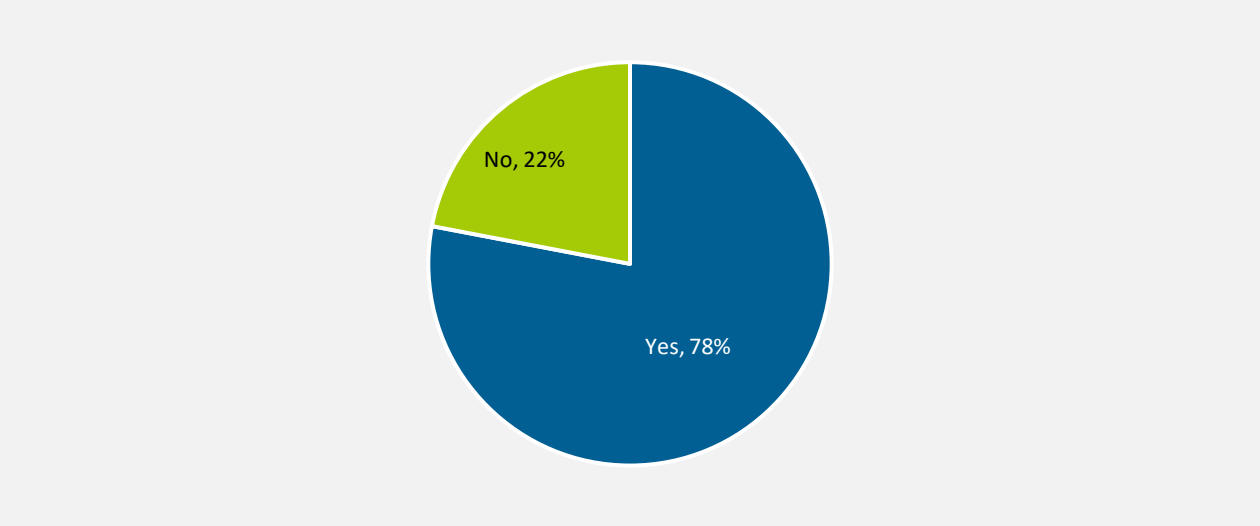


Figure 52. Does your Firm have any Specific Strategies, Policies, or Programs to Increase Female Hires?

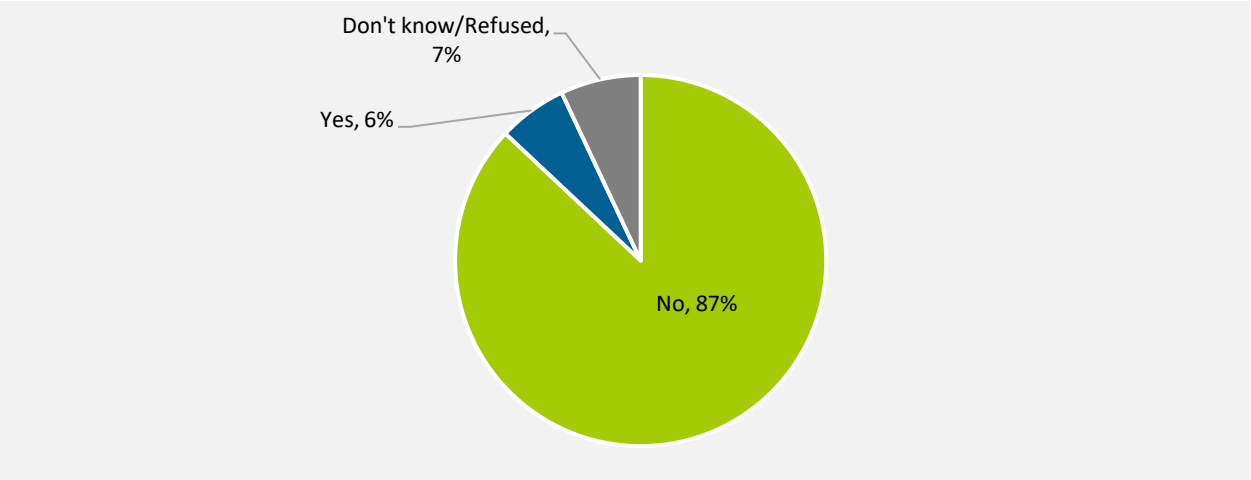


Figure 53. Does your Firm have any Specific Strategies, Policies, or Programs to Increase Minority Hires?

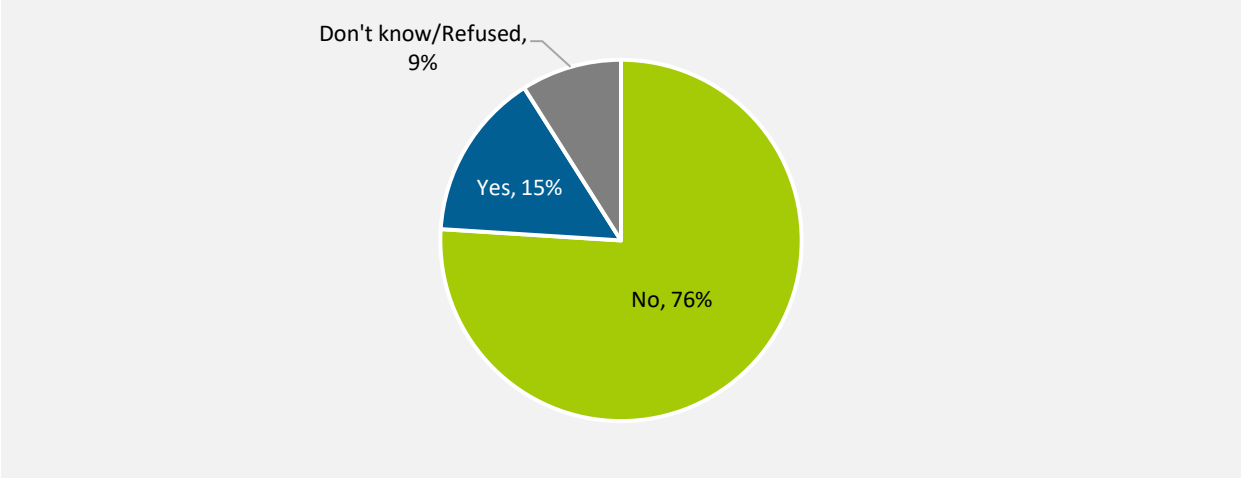
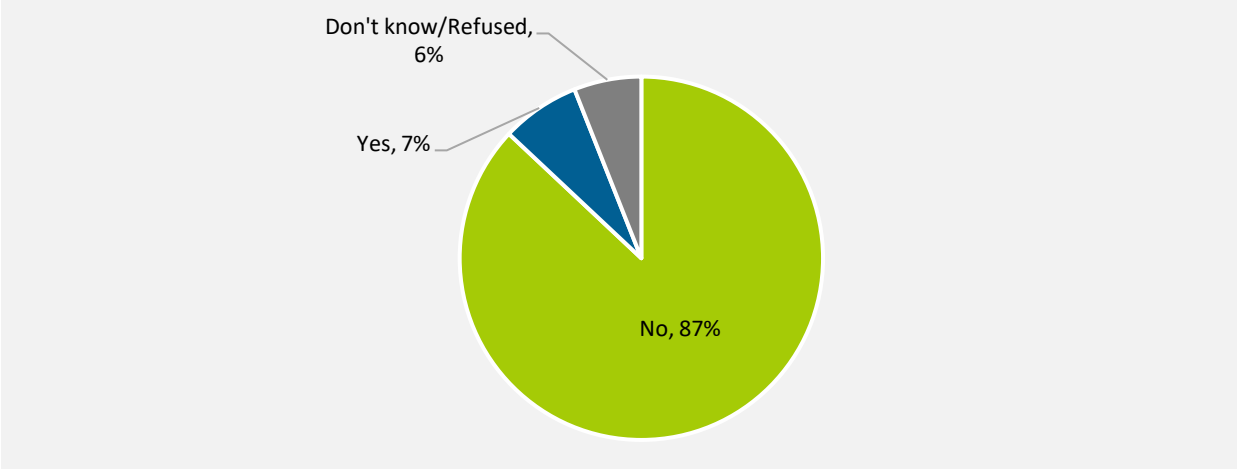


Figure 54. Does your Firm have any Specific Strategies, Policies, or Programs to Increase LGBTQ+ Hires?



Other Firm Characteristics

Figure 55. Primary Clean Energy Sub-Technology Focus Among Clean or Alternative Fuels Firms

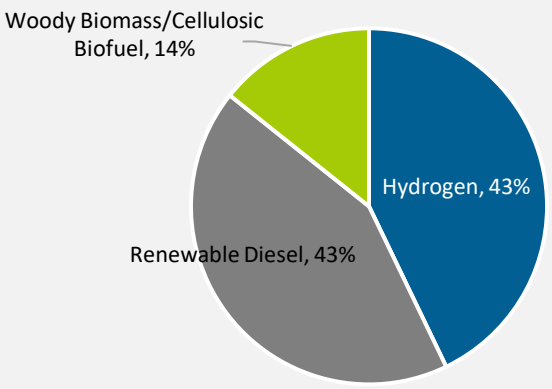


Figure 56. Primary Clean Energy Sub-Technology Focus Among Electric or Other Alternative Transportation Firms

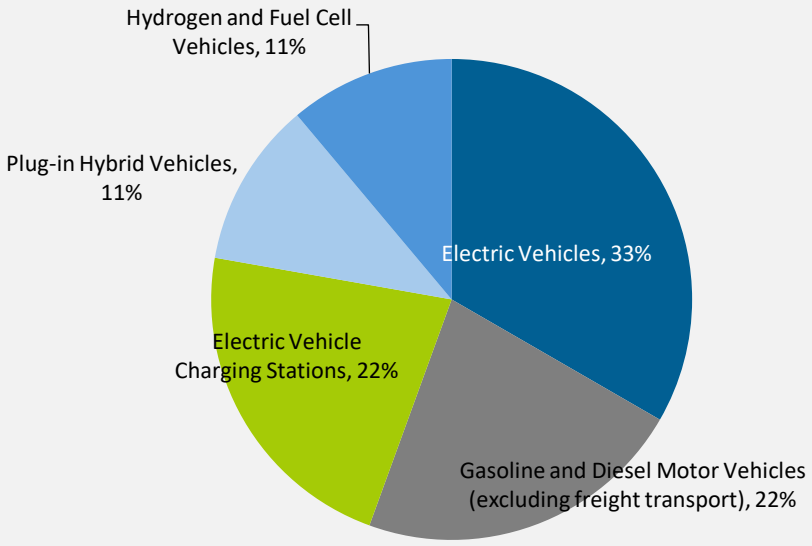


Table 16. Preferred Certifications, by Occupation

OCCUPATION	CERTIFICATION 1	CERTIFICATION 2	CERTIFICATION 3	CERTIFICATION 4
Electrical Engineers	Professional Engineer (PE) License	Certified Energy Manager (CEM)	IEEE Certification	Certified Electrical Safety Compliance Professional (CESCP)
HVAC/R Mechanics, Installers, or Technicians	EPA Section 608 Certification	HVAC Excellence Certification	ASHAE Certification	
Electricians	Board Certification/ Electrician License	National Electrical Code (NEC) Certification		
Construction and Building Inspectors	Building Performance Institute (BPI) Certification	Home Energy Rating System (HERS) Rater	Certified Energy Auditor (CEA)	International Code Council (ICC) Credential
Welders, Cutters, Solderers, Brazers	American Welding Society (AWS) Certified Welder	American Welding Society (AWS) Certified Welding Inspector	OSHA 10 Certification	
Weatherization Technicians	Building Performance Institute (BPI) Certification	ASHRAE Certification		
Plumbers, Pipefitters, Steamfitters	NITC Certification	Gas Welding Operation Certification	American Welding Society (AWS) Certified Welder	Master Plumber License
Carpenters	OSHA 10 Certification	National Center for Construction Education and Research (NCCER) Certification		
Wind Turbine Service Technicians	Basic Wind Energy Technician Certificate	IEC 61400 Certification	The American Wind Energy Association (AWEA) Certification	Global Wind Organization (GWO) Certification
Construction Managers	Bachelor's Degree in Construction Management	Construction Management Association of America (CMAA) Certification	Project Management Professional (PMP) Certification	
Electrical Power Line Installers and Repairers	Journeyman Lineman Certification	Board Certification/ Electrician License	National Center for Construction Education and Research (NCCER) Certification	Power Line Installers Certificate
Solar Installers	PV Installation Professional (PVIP) Certification	Solar Energy International (SEI) Solar Professionals Certification	Board Certification/ Electrician License	

Millwrights	Millwright Apprenticeship		
Construction Laborers	First Aid/CPR Certification	Construction Workers Safety Training Certificate	OSHA 10 Certification
Automotive Service Technicians and Mechanics	Automotive Service Excellence (ASE) Certification		

Skill, Education, & Workforce Pipeline Profile

Table 17. Average Number of Special Population Employees at Surveyed Firms

SPECIAL POPULATION TYPE	AVERAGE NUMBER OF EMPLOYEES
Veteran Employees	12.4
Disabled Employees	4.5
Formerly Incarcerated Employees	2.9

Appendix F: Stakeholder Learnings

Key findings from the one-on-one stakeholder interviews have been incorporated throughout the report. This Appendix outlines BW Research's learnings from Senator Stephanie Hansen's stakeholder engagement sessions that occurred between April and June 2024 as well as the main takeaways from the in-person stakeholder workshop in July 2024.

BW Research Notes from Senator Hansen's Stakeholder Engagement Meetings[95]

- Utility companies: experiencing a high rate of retirements, do a lot of in-house training, want to increase awareness of utility sector jobs
- "Credentials and Value" program: a new program in development from the WDB and Jon Wickert, the Department of Education's Director of Career and Technical Education and STEM Initiatives
    - An effort to identify and group foundational, mid-level, and higher-level credentials for students to obtain during secondary or high school to help them increase their employability upon graduating; but the WDB needs more input from employers to identify how to best "bucket" these credentials and share accurate information with the students
- The University of Delaware has many types of programs related to climate and clean energy, including two energy-related minors, an Industrial Assessment Center, Loop Labs for solar trainings, the Offshore Wind Skills Academy (OWSA), and a Graduate Certificate in Wind Power Science Engineering and Policy, but expressed needs more students to participate in its energy and sustainability related programs
- Employers expressed interest in a job board
- Skills and abilities among job applicants that solar employers seek:
    - Ability to do site assessments, maintenance & troubleshooting
    - Solar skills and knowledge - design, processes, and equipment
    - Electrical skills and knowledge - electrical - code, wiring
    - Engineering skills and knowledge - wiring design, interconnections, structural analysis
    - Sales
- Solar employers expressed interest in creating a solar academy at the University of Delaware similar the OWSA; the University of Delaware was responsive but was concern about getting interested students to participate
- Employers expressed interest in the following types of training programs:
    - Pre-apprenticeships for greater exposure to utility sector and trades jobs
    - Evening or weekend training programs for full-time workers who cannot attend during the work week
    - In-state trainings for solar and electric workers that can run over a longer time span instead of out-of-state trainings that cover a lot of information in a short time span

[95] These notes were developed independently by BW Research staff, based on virtual observation of meetings.

- Employer spoke about successful experience with training and hiring formerly incarcerated individuals at a construction company in which many individuals earned career advancement and lowered re-incarceration rates
- Employer spoke about successful experience with trade school apprentices who tend to have a better understanding of the work and are often, compared to non-trade school apprentices
- Workforce Development Board has ability to fund and develop new training programs in Delaware, but they need better communication and collaboration from employers to identify which programs to fund or develop
- FERC Order 1920 is in motion, with some appeals. It requires 20-year long-term planning of utility companies and, among other things, the quantification of benefits from transmission projects and considerations for alternative transmission technologies and an ex-ante cost allocation methodology before finalization of long-term plans. Under this order, benefit-based cost allocation is the new focus instead of cost allocation based on those driving the changes. Stakeholder from David Gardner and Associates encouraged the energy stakeholders to push for an independent facilitator to be involved in the discussions around implementing Order 1920 measures so that is not solely utility-led or state-led.

BW Research Findings from the Stakeholder Workshop

1. **There is optimism for the expansion of clean energy and climate-related technologies within the state.** Delaware is well-positioned to develop market leadership within several clean energy technologies, including hydrogen, offshore wind, solar, and electric vehicles. The capital-intensive nature of these sectors, coupled with necessary infrastructure development (such as pipelines and transmission systems), presents substantial job growth opportunities.

2. **Expectations for workforce funding in support of that growth are partially tempered by anticipated challenges utilizing that funding**. Delaware will have access to extensive funding for clean energy and climate-related workforce needs. However, these funds often come with complex requirements and lack clear implementation guidelines, posing challenges to effective access and utilization.

3. **The Delaware political environment is currently supportive of clean energy, but there are concerns about its sustainability**. The state benefits from a supportive political climate regarding clean energy initiatives, with strong interest and active engagement at all levels to accompany and leverage available funding. Despite the strong political and economic environment, there are questions about whether Delaware can sustain its momentum and political commitment over the long term, particularly regarding the viability of funding and job creation after federal support phases out, similar to trends seen with ARRA.

4. **Regional collaboration could mitigate uncertainty and expand opportunities beyond the state's borders**. Adopting a regional approach could enhance Delaware's ability to capture additional opportunities, mitigate the risks associated with fluctuating federal support, and broaden benefits for local workers and businesses.

5. **The state already possesses healthy existing capacity for workforce development**. Delaware is well-positioned for workforce development with robust apprenticeship programs, strong training capacities, and leading educational institutions. However, there is a need for

improved wraparound services and future innovation, including cross-training of adjacent skills, specifying training initiatives for occupations, and building pipelines.

6. **Productive partnerships already exist between workforce stakeholders**. Delaware benefits from robust connections between educators, the private sector, and workforce organizations, which enhances collaborative efforts and mutual understanding. But collaborations within the clean energy and climate sectors are still forming due to gaps in data and information (due to #7 and #10 below).

7. **Developing a workforce strategy for clean energy and climate tech is complicated by uncertainty about roles, certifications, and future technologies.** There is a need for clearer information on job titles and requirements, curriculum development, and occupational needs. The state needs to find the balance between upskilling the current workforce and training new workers.

8. **Increasing awareness and interest in clean energy jobs among both students, teachers, and parents is paramount.** This involves improving climate education in K-12 schools, addressing misconceptions about trades, and marketing these careers as viable, non-college pathways while targeting both students and parents.

9. **Delaware's small size is seen as a rose, thorn, and bud**. It fosters communication and collaboration among stakeholders but also creates competition for resources and the potential for siloing.

10. **Engagement of and collaboration with clean energy employers needs to improve**. Employers must be kept engaged to address what training needs are, concerns and future expectations for hiring, and new employee requirements. Clean energy sector employers in Delaware are not as available or well-connected as other industries and are not able to fully contribute to workforce strategies and conversations.

11. **Delaware's clean energy and climate-related workforce strategy will benefit from increased statewide dialogue and coordination.** Establishing a centralized agency could help avoid duplication of efforts, but clarity on decision-making (who is making decisions about what issues) is essential. Coordination among existing research streams and working groups on clean energy workforce needs is also necessary. One next step will be to achieve more clarity and alignment among stakeholders, government and the private sector, which will support a committed and coordinated approach to advancing climate and clean energy workforce development in Delaware.

Appendix G: Training Inventory

The research team developed a comprehensive inventory of 105 publicly available training and credentialing programs based in Delaware that serve the 13 key occupations. These trainings were identified by looking at programs offered at the state's community college system, career technical education school districts, labor unions, and other local entities. All programs included in the inventory were publicly available during the time the research was completed. Training programs that were not offered to the public or were not marketed to the public are therefore excluded from the inventory. Similarly, programs that serve Delaware residents but are hosted outside of Delaware, such as in nearby states like Maryland, Pennsylvania, or Virginia, are excluded from the inventory. The research team collected information related to the program name, host institution name, host institution type, program partners, zip code, primary occupational focus, and degree or outcome.

Programs for Automotive Service Technicians and Mechanics make up the largest concentration (17%) of identified Delaware-based training programs, followed by programs for Electricians (14%). There are very limited trainings for Wind Turbine Service Technicians, Solar Photovoltaic Installers, Electrical Power-Line workers, and Construction and Building Inspectors (Table 18). These occupations have training programs serving Delaware residents but are not located in the state and are therefore excluded from the training inventory.

A few programs are not targeted to a specific occupation but are instead designed for multiple pathways. For example, a construction technology program at the community college system was developed to expose participants to various types of trades work and give them a wide range of foundational knowledge and skills, allowing them to specialize later, once employed.

Significantly, almost half (47%) of the identified trainings are Career Technical Education (CTE) programs[96] (30) or apprenticeships[97] (20) (
Table 19) and half (51%) of the overall identified programs are hosted by vocational-technical schools or training centers. Delaware's community college system and universities in Delaware together host a quarter (25%) of programs (Table 20).

Table 18. Number of Identified Training Programs by Primary Occupational Focus

PRIMARY OCCUPATIONAL FOCUS	NUMBER OF PROGRAMS	PERCENT OF TOTAL
Automotive Service Technicians and Mechanics	18	17%
Electricians	15	14%
Electrical Engineers	11	10%
HVAC Technicians and Mechanics	11	10%
Welders, Cutters, Solderers, and Brazers	11	10%

[96] CTE programs or courses at vocational-technical or public high schools

[97] Apprenticeship programs at adult education vocational-technical schools, labor unions, community college, or industry associations

Carpenters	9	8%
Construction Laborers	7	7%
Construction Managers	7	7%
Plumbers, Pipefitters, and Steamfitters	7	7%
Multiple occupations[98]	3	3%
Construction and Building Inspectors (Energy Auditors, HERS Raters)	3	3%
Electrical Power-Line Installers and Repairers	1	1%
Solar Photovoltaic Installers	1	1%
Wind Turbine Service Technicians	1	1%

Table 19. Number of Identified Training Programs by Degree or Outcome

DEGREE/OUTCOME	NUMBER OF PROGRAMS	PERCENT OF TOTAL
CTE Program	30	28%
Apprenticeship	20	19%
Certificate (credit-bearing, from academic institution)	11	10%
Job Readiness only	8	8%
Master's Degree	8	8%
Pre-apprenticeship/Apprenticeship readiness	5	5%
Certificate (non-credit bearing, from bootcamps, workforce training centers, etc.)	4	4%
Apprenticeship Classroom Instruction	4	4%
General Industry Professional Development	4	4%
Bachelor's Degree	3	3%
Associate Degree	3	3%
Continuing Education Unit (CEU) Credits	3	3%
Doctorate Degree	1	1%
Test Preparation	1	1%

Table 20. Number of Identified Training Programs by Institution Type

Institution Type	Number of Programs	Percent of Total
Vocational Technical School or Training Center	54	51%
Community College	15	14%
College/University (incl. Technology Institute)	12	11%

[98] Designed for multiple pathways, typically to provide foundational skills for participants who may choose whether and how to specialize at a later time.

Industry Association	8	8%
Labor Union	5	5%
Private Training Company	5	5%
Government Agency	2	2%
Public High School	2	2%
Utility Company	2	2%

Among the 105 total training programs identified in Delaware that are publicly listed, eight are offered online, with the remaining 97 hosted in-person. Critically, the few training programs that are publicly listed and available for Solar Photovoltaic Installer and Construction and Building Inspector jobs are not offered at any in-person Delaware location; they are offered online only.

New Castle County hosts the greatest number of in-person trainings. The map in Figure 57 also shows that New Castle County has a larger variety of programs than Kent or Sussex Counties, though New Castle County has a higher population density.[99] The U.S. Environmental Protection Agency's defined Disadvantaged Communities (DACs)[100] in Delaware are generally spread across the state, as shown in the map. These DACs encompass Environmental and Climate Justice Program communities[101] and DACs designated in the Climate and Economic Justice Screening Tool (CEJST).[102] Larger geographic areas of DACs are concentrated more in Kent County. While Kent and Sussex Counties have smaller population densities, it appears that residents of these Counties, especially those in DACs, may still need to travel further distances to access training programs for the key occupations than residents in New Castle County.

Table 21. Number of Identified Training Programs by County/Location and by Occupation

	Number of Programs by County/Location			
Primary Occupational Focus	**Kent County**	**New Castle County**	**Sussex County**	**Online**
Automotive Service Technicians and Mechanics	4	9	5	
Carpenters		6	3	
Construction and Building Inspectors (Energy Auditors, HERS Raters)				3
Construction Laborers	2	5		
Construction Managers		7		
Electrical Engineers	1	9		1

[99] https://www.arcgis.com/home/item.html?id=b66e5a3949b64c4dab8c47594987f792

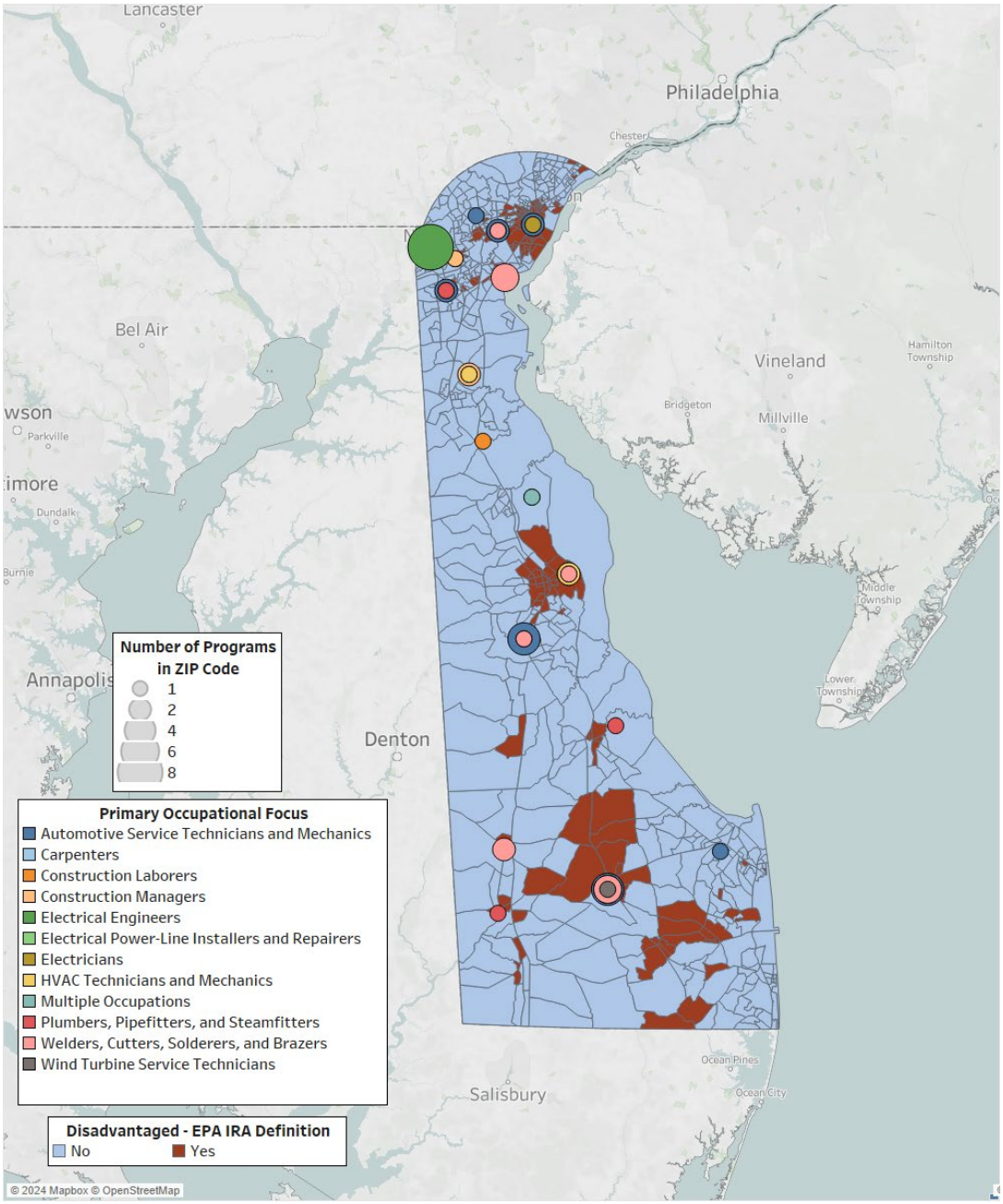
[100] "Inflation Reduction Act Disadvantaged Communities Map." U.S. Environmental Protection Agency. Accessed 5 July 2024. https://www.epa.gov/environmentaljustice/inflation-reduction-act-disadvantaged-communities-map

[101] "Inflation Reduction Act Environmental and Climate Justice Program." U.S. Environmental Protection Agency. Accessed 5 July 2024. https://www.epa.gov/inflation-reduction-act/inflation-reduction-act-environmental-and-climate-justice-program

[102] Climate and Economic Justice Screening Tool. U.S. Council on Environmental Quality. Accessed 19 July 2024. https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5

Electrical Power-Line Installers and Repairers	1			
Electricians	3	6	3	3
HVAC Technicians and Mechanics	2	5	4	
Multiple occupations	1	1	1	
Plumbers, Pipefitters, and Steamfitters	1	2	4	
Solar Installers				1
Welders, Cutters, Solderers, and Brazers	2	4	5	
Wind Turbine Service Technicians			1	
GRAND TOTAL	**17**	**54**	**26**	**8**

Figure 57. Map of Identified Training Programs and Disadvantaged Communities in Delaware[103]



After extensive research, the team found that most training programs didn't provide information on program enrollment, capacity, graduation rates, or job placement data. The information found was sourced from Delaware JobLink, which provided some statistics for programs at Sussex Tech Adult Education and the University of Delaware. The retrieved data showed that, on average, 86% of

[103] Based on The Environmental Justice Screening and Mapping Tool (U.S. Environmental Protection Agency https://www.epa.gov/ejscreen) and The Climate and Economic Justice Screening Tool (U.S. Council on Environmental Quality https://screeningtool.geoplatform.gov/en/#3/33.47/-97.5) to indicate EPA Disadvantaged Communities in Delaware.

students at Sussex Tech Adult Education successfully complete their courses, with 100% being employed two quarters after graduating. Nearly half of the programs training Automotive Service Mechanics mentioned providing students with Automotive Service Excellence (ASE) certifications. Programs at New Castle County Vocational Technical School District training Electricians and Carpenters often provided certifications from the National Center for Construction Education and Research (NCCER) in their respective industries, while OSHA certifications were most often found in Welding and Electrician training programs.

Table 22.Training Inventory of Delaware-based and Publicly Listed Training Programs Serving the Key Occupations

INSTITUTION NAME/PROGRAM HOST	PROGRAM NAME	COUNTY
Dawn Career Institute	HVAC Technician	New Castle County
New Castle County Vocational Technical School District - Hodgson Vo Tech HS	Auto Body	New Castle County
New Castle County Vocational Technical School District - Hodgson Vo Tech HS	Auto Technology	New Castle County
New Castle County Vocational Technical School District - Hodgson Vo Tech HS	Carpentry	New Castle County
New Castle County Vocational Technical School District - Hodgson Vo Tech HS	Electrical Trades	New Castle County
Plumbers and Pipefitters UA Local 74	Plumbers and Pipefitters Apprenticeship	New Castle County
Delaware Technical Community College	Construction Management Technology	New Castle County
Delaware Technical Community College	Electrical and Computer Engineering Transfer Option	New Castle County
Delaware Technical Community College	Environmental Technology: Environmental Engineering Technology	New Castle County
New Castle County Vocational Technical School District - St. Georges Technical HS	Auto Technology	New Castle County
New Castle County Vocational Technical School District - St. Georges Technical HS	Carpentry	New Castle County
New Castle County Vocational Technical School District - St. Georges Technical HS	Electrical Trades	New Castle County
New Castle County Vocational Technical School District - St. Georges Technical HS	HVAC	New Castle County
Construction Craft Laborers Training and Apprenticeship Fund of New Jersey and Delaware (CCLTAFNJDE)	Construction Craft Laborer	New Castle County
Delaware Technical Community College	Automotive Technician Studies	New Castle County
The Associated General Contractors of America	Lean Construction Education Program	New Castle County
University of Delaware	Construction Engineering and Management	New Castle County
University of Delaware	Construction Engineering and Management/Computer Science 4+1 (BCEM/MS)	New Castle County
University of Delaware	Electrical and Computer Engineering	New Castle County
University of Delaware	Electrical Engineering	New Castle County

University of Delaware	Electrical Engineering/Business Administration 4+1 (BEE/MBA)	New Castle County
University of Delaware	Electrical Engineering/Cybersecurity 4+1 (BEE/MS)	New Castle County
University of Delaware	Electrical Engineering/Data Science 4+1 (BEE/MS)	New Castle County
University of Delaware	Electrical Engineering/Electrical & Computer Engineering 4+1 (BEE/MSECE)	New Castle County
University of Delaware	Electrical Engineering/Materials Science and Engineering 4+1 (BEE/MMSE)	New Castle County
University of Delaware	PhD in Electrical & Computer Engineering	New Castle County
Associated Builders and Contractors Delaware	CPM for Scheduling & Disputes	New Castle County
Associated Builders and Contractors Delaware	How to Navigate the Volatile Construction Market in 2024	New Castle County
Associated Builders and Contractors Delaware	Rigger and Signaling Certification Review Course	New Castle County
Associated Builders and Contractors Delaware	Transitioning a Journeyman to a Crew Leader	New Castle County
Delaware Skills Center	Carpentry Program	New Castle County
Delaware Skills Center	Electrical Trades	New Castle County
Delaware Skills Center	Evening Welding	New Castle County
Delaware Skills Center	HVAC Energy Technician	New Castle County
Delaware Skills Center	Plumbing	New Castle County
Delaware Skills Center	Welding and Fabrication	New Castle County
Delaware Technical Community College	Construction Technology	New Castle County
Delaware Technical Community College	HVAC Technician Certificate	New Castle County
Delaware Technical Community College	Welding Technician Certificate WIOA	New Castle County
Eastern Atlantic States Carpenters Technical Centers	Carpentry Apprenticeship	New Castle County
International Brotherhood of Electrical Workers (IBEW) Local 313	Electrical Training	New Castle County
Odessa High School	Construction, Machinery Operator Pathway	New Castle County
New Castle County Vocational Technical School District - Howard HS of Technology	Auto/Diesel Technology	New Castle County
New Castle County Vocational Technical School District - Howard HS of Technology	Carpentry	New Castle County
New Castle County Vocational Technical School District - Howard HS of Technology	Electrical Trades	New Castle County
New Castle County Vocational Technical School District - Howard HS of Technology	Engine Technology	New Castle County
Ironworkers Local 451	Ironworker Apprenticeship	New Castle County
New Castle County Vocational Technical School District - Delcastle Technical HS	Auto Body	New Castle County
New Castle County Vocational Technical School District - Delcastle Technical HS	Auto Technology	New Castle County

New Castle County Vocational Technical School District - Delcastle Technical HS	Carpentry	New Castle County
New Castle County Vocational Technical School District - Delcastle Technical HS	Electrical Trades	New Castle County
New Castle County Vocational Technical School District - Delcastle Technical HS	HVAC	New Castle County
New Castle County Vocational Technical School District - Delcastle Technical HS	Welding/Fabrication Technology	New Castle County
Thomas McKean High School	Automotive Technology	New Castle County
Delaware State University	Physics and Engineering BS: Electrical Engineering	Kent County
Polytech School District - Polytech Adult Education	Construction Laborer	Kent County
Polytech School District - Polytech Adult Education	Electrical	Kent County
Polytech School District - Polytech Adult Education	Electrical & Electronic Systems	Kent County
Polytech School District - Polytech Adult Education	HVAC & Plumbing Maintenance	Kent County
Polytech School District - Polytech Adult Education	HVAC-R	Kent County
Polytech School District - Polytech Adult Education	Plumbing	Kent County
Polytech School District - Polytech Adult Education	Welding & Metal Fabrication	Kent County
Delaware Technical Community College	Construction Technology	Sussex County
Delaware Technical Community College	HVAC Technician Certificate	Sussex County
Delaware Technical Community College	Welding Apprenticeship Program	Sussex County
Delaware Technical Community College	Welding Technician Certificate WIOA	Sussex County
Delaware Technical Community College	Automotive Technician Studies	Sussex County
Delaware Technical Community College	Offshore Wind - Global Wind Organization Basic Safety Training (GWO BST)	Sussex County
Eastern Atlantic States Carpenters Technical Centers	Carpentry Apprenticeship	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Automotive Technician	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Automotive Technologies	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Carpentry	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Electrical	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Electrical Service Technician	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	HVAC-R	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	HVACR Refrigerant Transfer & Recovery	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Learn to Weld	Sussex County

Sussex County Vocational Technical School District - Sussex Tech Adult Education	Plumbing	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Welding	Sussex County
Sussex County Vocational Technical School District - Sussex Tech Adult Education	Workforce Plumbing Training	Sussex County
Sussex County Vocational Technical School District - Sussex Tech HS	Automotive Technologies	Sussex County
Sussex County Vocational Technical School District - Sussex Tech HS	Carpentry and Construction Management	Sussex County
Sussex County Vocational Technical School District - Sussex Tech HS	Electrical and Green Energy Technologies	Sussex County
Sussex County Vocational Technical School District - Sussex Tech HS	HVAC Technologies	Sussex County
Sussex County Vocational Technical School District - Sussex Tech HS	Welding and Fabrication technologies	Sussex County
Hertrich	Auto Tech Apprentice Program	Sussex County
Delaware Rural Water Association	Water/Wastewater Apprenticeship	Sussex County
UA 486 apprenticeship program	UA Local 486 Plumbers & Steamfitters Apprenticeship	Sussex County
Delaware Municipal Electric Corporation	DEMEC Member Training	Kent County
Delaware Municipal Electric Corporation	Lineman Apprentice Training - Fundamentals, Lab 1	Kent County
Polytech School District - Polytech Adult Education	Automotive Technician	Kent County
Polytech School District - Polytech Adult Education	G1 Auto Maintenance & Light Repair	Kent County
Polytech School District - Polytech High School	Automotive Body Repair	Kent County
Polytech School District - Polytech High School	Automotive Technology	Kent County
Polytech School District - Polytech High School	Building Construction	Kent County
Polytech School District - Polytech High School	Electrical Trades	Kent County
Polytech School District - Polytech High School	Welding and Fabrication	Kent County
Delaware County Community College	PV101 Solar Energy Training course	online
Delaware County Community College	Home Inspection Certificate	online
Department of Natural Resources and Environment Control	Certified Construction Reviewer (CCR) Recertification	online
Department of Natural Resources and Environment Control	Sediment and Stormwaters Program's Certified Construction Reviewer (CCR)	online
M.S. Electrical Training LLC	Understanding the 2017 National Electrical Code	online
M.S. Electrical Training LLC	Changes to the National Electrical Code, 2020	online
M.S. Electrical Training LLC	Delaware Online CEU	online
University of Delaware	Electrical and Computer Engineering, Master of Science (M.S.)	online