

WORKFORCE DEVELOPMENT FOR ENERGY EFFICIENCY IN NEW JERSEY AND PENNSYLVANIA

In partnership with the Energy Efficiency Alliance

PREPARED BY M.S. SUSTAINABILITY
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LIST OF ACRONYMS + ABBREVIATIONS

BPA: Building Performance Association

BPI: Building Performance Institute

CBE: Certified Business Enterprises

CBO: Community-based Organization

CEF: Clean Energy Fund

DC: District of Columbia, Washington

DCSEU: District of Columbia Sustainable Energy Utility

DEP: Department of Environmental Protection

DE&I: Diversity, Equity, & Inclusion

DOE: Department of Energy

EE: Energy Efficiency

EEA: Energy Efficiency Alliance

GHG: Greenhouse Gas

HVAC: Heating, Ventilation, and Air Conditioning

KEEA: Keystone Energy Efficiency Alliance

MOCJ: New York City Mayor's Office of Criminal Justice

NJ: New Jersey

NYSERDA: New York State Energy Research and Development Authority

PA: Pennsylvania

QCN: Quality Contractor Network

RGGI: Regional Greenhouse Gas Initiative

SEICBP: The Train Green Sustainable Energy Infrastructure Capacity Building and Pipeline Program

SBC: System Benefits Charge, or a utility bill charge

SUMA: Master of Science in Sustainability Management Program

TULA: Tennessee Urban League Affiliates

TVA: Tennessee Valley Authority

WAP: Weatherization Assistance Program

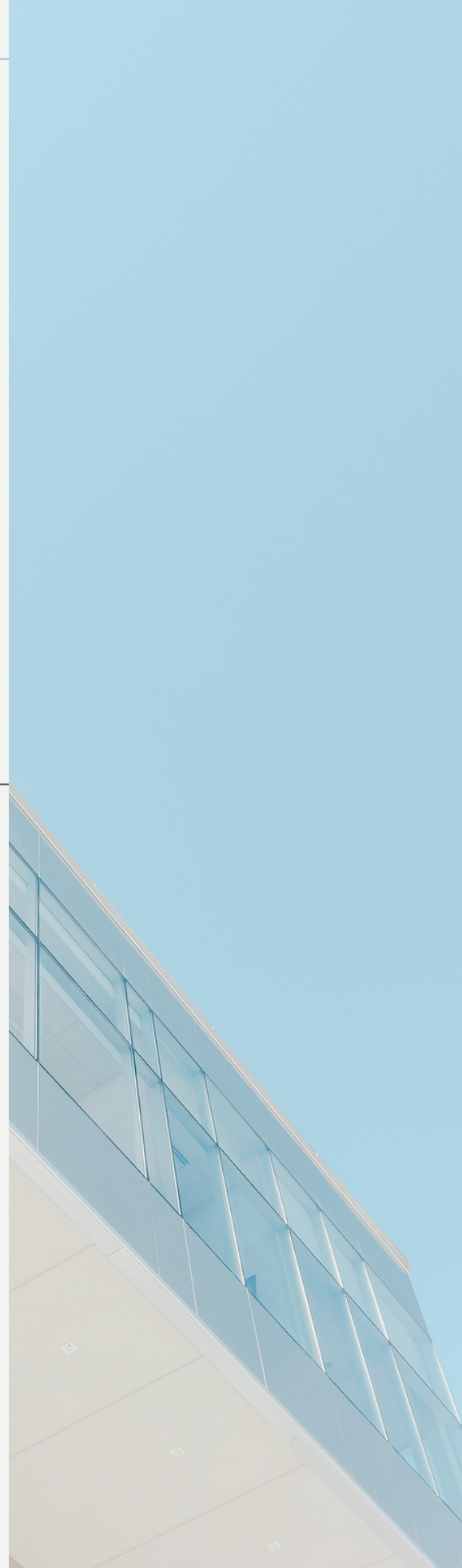
WIOA: Workforce Innovation and Opportunity Act

COLUMBIA UNIVERSITY M.S. SUSTAINABILITY MANAGEMENT

This report was prepared by graduate students from Columbia University's M.S. in Sustainability Management program (SUMA). The SUMA degree provides interdisciplinary education to enable graduates to support non-profit, public, and private organizations in developing and implementing sustainability strategies. The program explores the intersection of environmental science, business management, and equitable society, ensuring that graduates are equipped to address the defining problems of our time.

INTEGRATIVE CAPSTONE WORKSHOP

This report is the outcome of a semester-long effort from eight students in SUMA PS520: Integrative Capstone Workshop in Sustainability Management. The Capstone course is a client-based consulting project that students undertake to address critical sustainability management topics. The course is designed to incorporate the program's five distinct curriculum areas: integrative sustainability management, economics, and quantitative analysis, environmental science, public policy, and financial management. Each section of the Capstone course consults with a different non-profit or public client. This report resulted from a successful collaboration with the Energy Efficiency Alliance and was submitted for final evaluation in August 2022.



ACKNOWLEDGMENTS

The team would like to thank all SUMA faculty who have taught our team the skills and knowledge necessary to complete this program and this capstone course. We look forward to translating what we have learned in the classroom into the real world towards a more sustainable future. Thank you to our capstone advisor Natalie Unwin-Kuruner for guiding us through this process while letting us take the lead. Without you, this project would not have been possible, as you have kept us on the right track and helped us through many challenges. It has been a great experience, and we have learned so much from your insights and experiences.

This report could not have been possible without the team's support at the Energy Efficiency Alliance. Jeaneen Zappa and John Kolesnik have engaged and guided our group through the research process while helping us immerse ourselves in the energy efficiency industry. Thank you for allowing us to contribute to your mission of increasing workforce development in the energy efficiency industry.



EXECUTIVE SUMMARY

The energy efficiency (EE) workforce encompasses producing and installing energy-saving products and undertaking services that reduce energy consumption. These jobs focus on helping others use less energy to perform the same task by eliminating energy waste. Currently, more than 2.1 million Americans work in the industry, outnumbering coal, electricity, oil, and gas production jobs, making EE the largest and fastest-growing energy sector (Energy Efficiency Jobs in America, 2022). Most of these jobs (1.4 million) are in construction, while the rest are in installation, administration, wholesale, distribution, manufacturing, business services, management, and more. The technology installed includes traditional HVAC, efficient lighting, recycled building materials, efficient appliances, and renewable energy (United States Energy & Employment Report, 2021).

While the demand for EE jobs across the United States is rising, and ample jobs are available in the industry, there is a workforce shortage. This is due to various factors, including but not limited to, an aging workforce, unskilled labor, recruitment gaps, inadequate funding, and a negative perception of EE work. The industry also faces a lack of diversity among workers, especially in the national workforce, and presents a clear need for increased representation from women and workers of color.

To help the Energy Efficiency Alliance (EEA), the team conducted extensive research to develop resources that highlight opportunities and gaps in the EE workforce. The team's goal was to make recommendations for various stakeholders on how to fill these workforce gaps on behalf of EEA. The team developed this final report, a Workforce Development Ecosystem Map, a stakeholder directory, and a policy statement for the client.

OVERVIEW OF RECOMMENDATIONS

Employers

- Make opportunities for growth and upward mobility available and clear to showcase career value to candidates and increase retention.
- Offer employee benefits and connect employees with resources for wrap-around services, such as childcare and transportation.
- Encourage continued education and upskilling post-hiring by incentivizing on-the-job learning of new skills.
- Collaborate with energy efficiency training programs to host interns, providing potential candidates with hands-on training and matching education with relevant training experience.
- Develop human resources capacity for targeted outreach and understand the business value of diversity, equity, inclusion, and accessibility.

Governments and Policymakers

- Incentivize energy efficiency education with tax incentives, grant offerings, and wrap-around services to support individuals pursuing training and certification in the energy efficiency field.
- Offer funding for energy efficiency training programs that have metrics for recruiting trainees from underrepresented communities, including rural areas.
- Support and value workers transitioning away from the fossil-fuel industry.
- Begin introducing environmental studies, climate change, and energy efficiency concepts and career tracks early in the public school curriculum
- Ensure federal and state governmental interdepartmental collaboration

Community-Based Organizations

- Partner with local training providers and employers and support access to information and wrap-around services

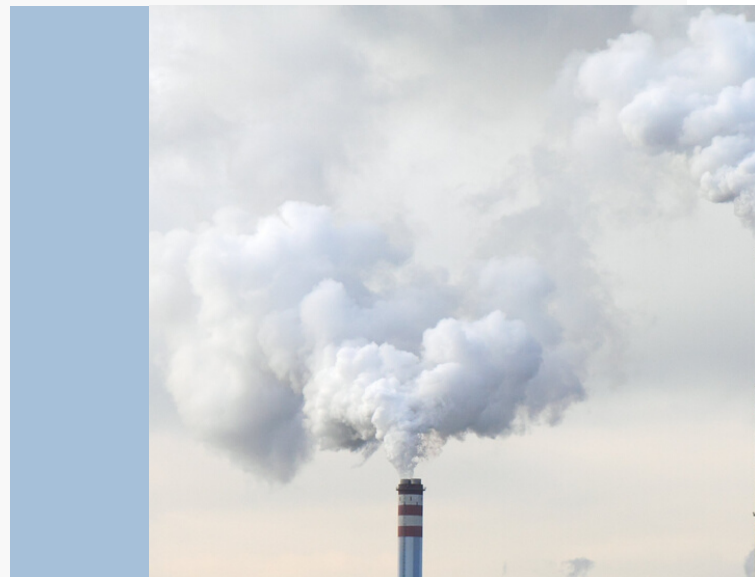
Training Providers

- Identify local community centers as in-person locations for communities to procure information about energy efficiency careers.
- Strengthen partnerships with local employers to offer on-the-job training as part of educational programs to ensure education matches real-time energy efficiency workforce needs.
- Coordinate training scheduling with local employers to ensure graduated trainees will enter the workforce when local contractors have job opportunities readily available.
- Seek funding opportunities to eliminate out-of-pocket costs for trainees and offer wrap-around services to increase the inclusion of unemployed, under-employed, and disadvantaged communities.
- Partner with state funding sources to curate a business network of job opportunities, in which businesses are incentivized with wage funding support to recruit from underrepresented communities. Share these opportunities on a streamlined online platform.
- Utilize technology and media to recruit from a broader pool of candidates.
- Offer contractor training programs to upskill small and minority-owned energy efficiency businesses, supporting business development of soft skills and contractor certifications.
- Ensure program advisory boards include employers so that curriculums match real-time workforce needs.
- To reach rural communities, consider partnering with existing local organizations to offer mobile and remote recruitment and training sessions to leverage resources across a broader area.

INTRODUCTION

Increasing the EE workforce is critical for the environment and society to reduce climate change's impacts. The effects of climate change are being seen globally—from rising temperatures, flooding, droughts, wildfires, and sea level rise, to loss of species, health risks, poverty, displacement, and food shortages. Driving these disasters is the mass burning of fossil fuels, which releases carbon dioxide, methane, nitrogen oxide, and other greenhouse gasses into the atmosphere. Trapping the sun's heat, this chemical accumulation leads to global warming and climate change (Causes and Effects of Climate Change, 2022). The building sector contributes 50% of total global emissions from building operations, materials, and construction (U.S. Department Of Energy, 2021). These emissions can be reduced by improving the EE of buildings. Demand for EE in the built environment is rising rapidly, but since there is a workforce shortage, buildings are not seeing the increase in EE needed to lower emissions. Overall, workforce shortages are hindering the success of EE improvements and the industry's potential growth. The EE industry is the largest energy sector in terms of available jobs. Across New Jersey (NJ) and Pennsylvania (PA), there are approximately 100,000 jobs in the industry (Faces Of EE, 2021). These jobs are in construction, installation, administration, wholesale, distribution, manufacturing, business services, and management.

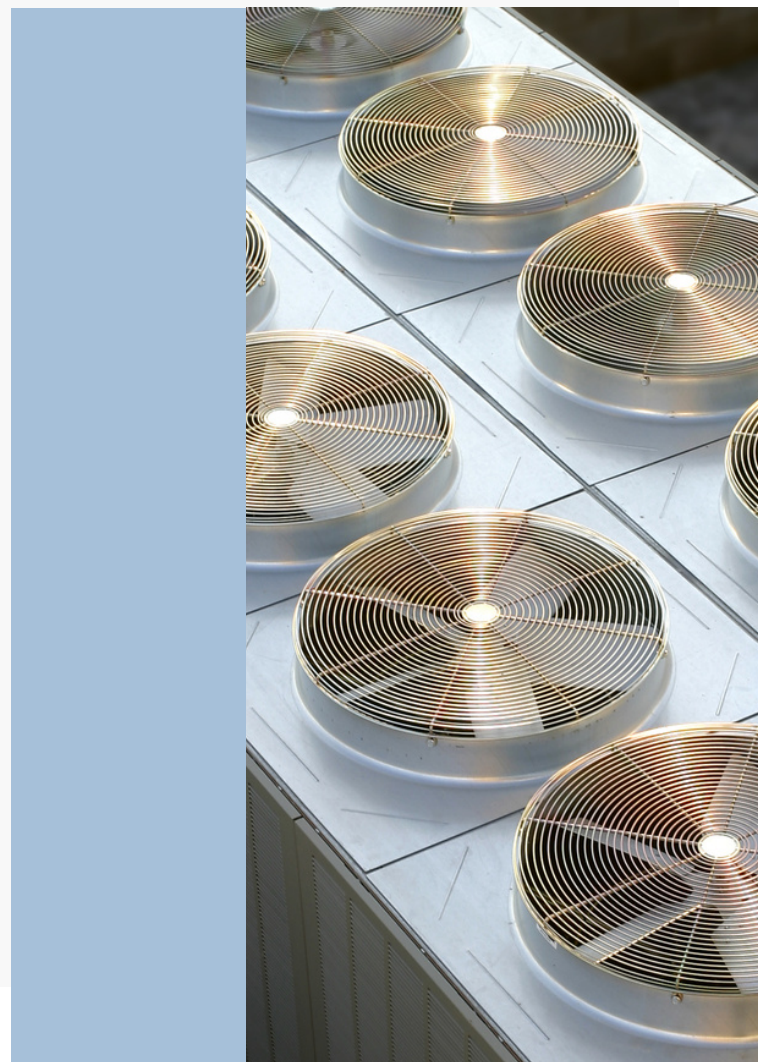
This report focuses on workers such as traditional HVAC, efficient lighting, recycled building materials, efficient appliances, and renewable energy installers (United States Energy & Employment Report, 2021). Despite these available jobs, roles are not currently being filled for several reasons, including a small applicant pool, inexperienced workers, and competition from other industries. The small applicant pool is driven by the aging of workers, the undesirability of jobs due to misconceptions about the industry, and the lack of a talent pipeline. The workforce also lacks diversity, specifically female, black, and hispanic workers. There is a clear need for diversity, equity, and inclusion metrics in the industry. Without direct intervention to drive a worker pipeline, increased demand for EE projects will be met with an undersupply of workers to carry out these jobs.



This report focuses on both NJ and PA, so looking at the specific context for both states is essential. As of June 2021, there were 32,936 jobs in NJ (Faces of EE, 2021). However, various barriers prevent these jobs from being filled, such as a lack of training, awareness, access, and institutional inequality. On average, 11,000 new EE jobs will be created each year in NJ between 2025 and 2050, and companies are scrambling to meet these demands (Castigliero and Stanton, 2022). Before the pandemic, the EE industry in PA saw impressive growth. Between 2017 and 2019, the sector grew by 9% (Pennsylvania Department of Environmental Protection, 2021).

However, during the pandemic between March and December 2020, the industry in PA lost about 13,200 jobs (Ibid.). The state has been slowly rebuilding and recovering since this job loss. As of June 2021, there were 65,687 jobs in PA (Faces of EE, 2021). Even before the pandemic, PA saw difficulties within the workforce, with 8 in 10 clean energy employers reporting difficulty hiring workers (Pennsylvania Department of Environmental Protection, 2021).

Reasons for these difficulties in PA include a small hiring pool, lack of work experience in a similar position, job competition with other industries, and lack of training or education required (Ibid.). By addressing workforce shortage issues and the drivers behind the problem, this report aims to make suggestions on how to increase the EE workforce in order to meet demand for clean energy. Meeting the EE demand with a steady supply of skilled workers will ultimately help NJ and PA meet their climate goals.




THE ENERGY EFFICIENCY ALLIANCE

The Energy Efficiency Alliance (EEA) comprises three organizations. EEA is a 501 (c)(3) that aims to advance EE in the Mid-Atlantic through educating stakeholders and raising awareness. Keystone Energy Efficiency Alliance (KEEA) and Energy Efficiency Alliance of New Jersey (EEA-NJ) are both 501(c)(6)'s and trade associations for PA and NJ, respectively. EEA's mission is to expand the market for EE by growing the local workforce while reducing pollution and bolstering the local economy. EEA does this by deploying education, strategic outreach, and policy innovation. The trade associations carry out EEA's mission by engaging with legislative and regulatory bodies to educate decision-makers on the benefits of EE. KEEA was founded in 2006 to align PA's policy with national best practices and helped pass and defend Act 129 - PA's EE law. EEA expanded to NJ in 2018. Currently, EEA, KEEA, and EEA-NJ are made up of five employees: Jeaneen Zappa (Director), Mary Jacobson (Development Specialist), John Kolesnik (Policy Counsel), Katie Thompson (Communications & Events Manager), and Rachel Goodgal (Government Affairs Manager). They are also looking to add a Program Coordinator to the team. Their board of directors is composed of 13 representatives from the EE industry.

Overall, EEA serves as a voice for businesses, workers, and customers, specifically their members. Their membership comprises 72 companies— all of which are stakeholders in the EE industry, and all pay membership dues to EEA. Membership companies include consulting services, software companies, advocacy organizations, construction companies, contracting companies, implementers, and utilities.





All members are companies that actively engage in helping residents and businesses save energy and money while addressing climate, socioeconomic, and energy issues. Small, medium, large, and global companies are evenly represented in their membership; these members serve commercial, residential, and industrial sectors. Members in NJ are mostly in HVAC, EE solutions, consultancy, data analytics, financial services, advocacy, planning, forecasting and modeling, and insulation. Partnering with EEA helps members network with relevant stakeholders and help them understand and keep up to date on energy regulations, ongoing legislation, and local programs.

EEA earns revenue in three areas: philanthropic donations, membership dues, and event sponsorships. Their philanthropic funders include the Energy Foundation, the George & Miriam Martin Foundation, the Heinz Endowments, the Hillman Family Foundation, the Metropolitan Edison & Pennsylvania Electric Sustainable Energy Fund, and the Staso Family Foundation.



SCOPE AND METHODOLOGIES

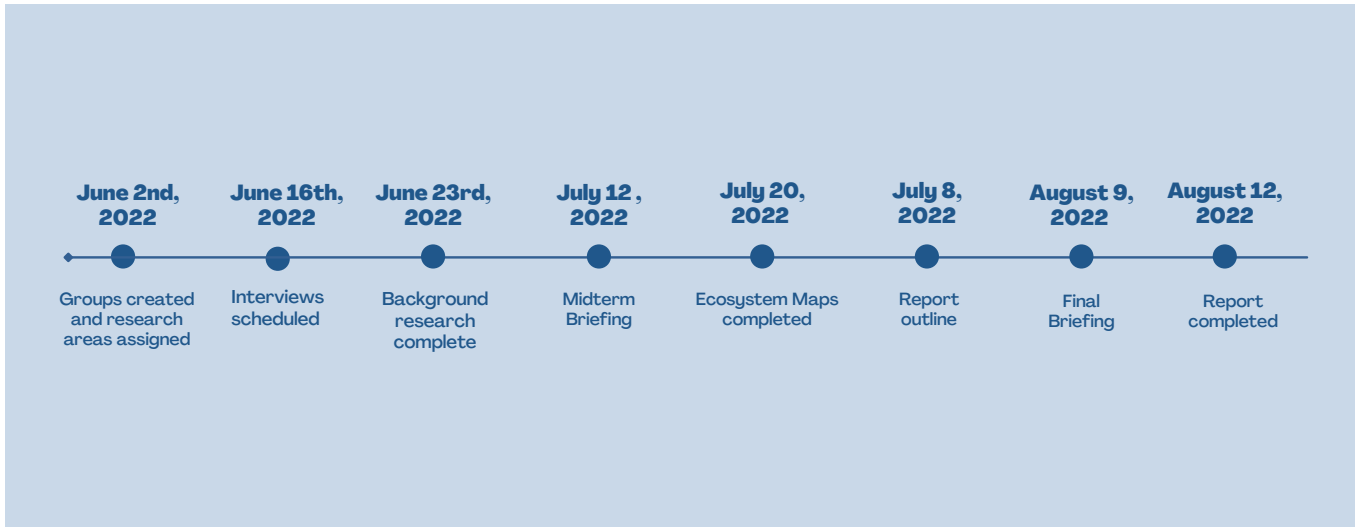
REPORT BOUNDARIES

The main aim of this report is to guide EEA in its mission to increase the EE workforce. It is not meant to outline an exhaustive and prescriptive list of recommendations for EEA and stakeholders in the EE space. Instead, the narrative of this report is centered on how EEA can support various groups of stakeholders in the directory (federal and state government agencies, workforce development advocacy organizations, workforce development training providers, employers, and the workforce). Recommendations revolve around seven impact categories that the team determined to be the most relevant, especially to training providers and employers. These categories are: funding, social inclusion metrics, recruitment strategies, costs and services, internships, certifications, and business networks.

ABOUT THE DELIVERABLES

Our research resulted in three deliverables and this written report: a Workforce Development Ecosystem Map, an accompanying directory of NJ and PA industry stakeholders, and a policy statement. The Workforce Development Ecosystem Map (Figure 2 and Figure 3 in the report) visualizes the EE ecosystem showing key stakeholders, their relationships, and financial flows. This map aims to illustrate the ecosystem's gaps, complexities, and fragmentation so that policymakers, funders, and EEA members can better understand the industry. To compile this map, the team took research findings and worked together with EEA to visualize the workforce ecosystem. The team also compiled an extensive directory for NJ and PA to accompany the map, including federal and state government agencies, workforce development advocacy organizations, workforce training providers, and employers. This directory is meant to be used internally by EEA to help connect to stakeholders in the industry. This list was compiled through extensive industry research by the state teams. Lastly, the state teams wrote a policy statement on behalf of EEA, outlining policy levers that can be used to improve workforce development. This statement identifies which problems are most relevant to EEA's members and what actions EEA-NJ and KEEA can take to address these issues.

TIMELINE



TEAM STRUCTURE

To complete this project, the team distributed tasks in smaller groups and individual roles. The Manager and Deputy Manager divided the team into three subgroups: a NJ team, a PA team, and a Case Study team. Within the NJ and PA teams was a group leader, an outreach coordinator, and a scribe. The group leaders from the state teams managed subgroup objectives and progress. They presented subgroup findings to the team, specifically on research into their state's key EE industry stakeholders, policies, funding strategies, and workforce. The outreach coordinators led interviews with stakeholders, and the scribe took notes for the subgroups and assisted with research and tasks as assigned by the group leader. The case study team spearheaded research into training programs from other states and had a scribe and a group lead. There was also a team analyst that led team synthesis, note taking, and file organization. A graphics team of two designed the presentations and report, and two presenters spoke during the briefings.

DESKTOP RESEARCH

To start research, the team underwent desktop research by first looking over literature provided by EEA. These resources included reports and surveys from E4TheFuture, the Building Performance Association (BPA), the Department of Energy (DOE), the Rocky Mountain Institute, PSE&G, the Pennsylvania Department of Environmental Protection (PA DEP), and Pennsylvania Clean Energy. Once the initial background research was completed, the state subgroups dove deeper into researching workforce development in NJ and PA, including federal funding for in-state job training, existing state policies and training programs, and the make-up of EE jobs by state. The case study team researched EE workforce development programs and apprenticeships in NJ, PA, and other states. Lastly, the outreach coordinators conducted interviews.





INTERVIEWS

EEA facilitated the team's connection with several interviewees. These contacts covered a range of stakeholder groups, which was necessary due to the complexity of the sector and specific problems surrounding EE workforce development. Interviewees included representatives from the following organizations:

- U.S. Department of Energy
- Pennsylvania Departments of Environmental Protection
- New Jersey Departments of Environmental Protection
- National Association of State Energy Officials
- Energy Coordinating Agency
- Building Performance Association
- Northeast Energy Efficiency Partnerships
- CLEAResult
- Sealed
- Urban Efficiency Group
- BlocPower

The team drafted interview questions based on the expertise of each stakeholder, which was subsidized with further research by the outreach team into the specific organization. Interviews were conducted in 30 minutes to hour-long calls. Discussions began with introductions and a summary of the project, then proceeded with detailed questions about each stakeholder's role in the EE sector and workforce development experience and needs. The Manager and Deputy Manager also attended interviews and took notes when possible.

The team had the opportunity to sit in on an EEA Member Meeting, which included thirteen representatives from the industry. Companies represented included Evolution Sustainability Group, Sustainable Energy Fund, Northeast Energy Efficiency Program, Calico Energy, PSD Consulting, Sustainable Business Network Philadelphia, CC Energy Services, Grant Associates, DNV, Pittsburgh Gateways, Honeywell, Nuvinity, and DMI Companies. During this meeting, the team had the opportunity to ask questions to fill in remaining research gaps and gain valuable insight from EEA's members.

CASE STUDIES

There are several workforce development training programs in NJ and PA that EEA has worked closely with to develop community relationships, train workers, recruit talent, and streamline job placement. After conducting internal due diligence on these organizations to identify strengths and areas for improvement per workforce development trends, the team created strategic impact categories to properly analyze and compare what currently exists within each organization and where innovation is potentially applicable. The impact categories included the following:

1. **Funding:** How and by who the organization is financed.
2. **Social Inclusion Metrics:** How the organization accounts for diversity, equity, and inclusion, and more specifically, how they engage with disadvantaged communities, women, BIPOC, unemployed candidates, small businesses.
3. **Recruitment Strategies:** How the organization reaches out to talent, markets its offering and creates opportunities to get involved in their organization.
4. **Costs and Services:** What the cost of training tuition is, in addition to identifying all out-of-pocket expenses and any strategies for subsidizing or waiving stated costs.
5. **Internships:** What kind of internships, externships, fellowships, on-the-job training, and job placement programs exist.
6. **Certifications:** How workers get certified or advance their skill sets in the organizations.
7. **Business Networks:** How the organization engages with the community, businesses, and external stakeholders to facilitate full-time jobs, workforce development, and a flow of talent between groups.

These impact categories helped drive the team's synthesis and created strategic evaluation criteria that guided the team into the next research stage: external case studies. In addition to evaluating the workforce development landscape within NJ and PA, the team was tasked with finding external best practice frameworks that support businesses in their efforts to advance the EE workforce. The group broadened the geographic scope to the greater United States for existing frameworks and approaches to provide EEA with additional resources and guidance to promote and apply findings in NJ and PA. These additional frameworks were selected because they provided both innovative and replicable workforce development solutions across one or more of the team's impact categories. The team was careful to select case studies that provided workforce development examples that were within reach of both the EEA and their operating regions to ensure recommendations and analysis were calculated, deliberate, and realistic.

After evaluating workforce development frameworks within PA and NJ and in the broader United States, the team synthesized a comparative analysis matrix comparing and contrasting how all programs perform across the team's selected impact categories.

After evaluating programs within EEA's community, the team transferred findings into two uniform performance columns: NJ and PA. Thus, the findings across NJ and PA reflect an average performance across the individual stakeholders in each state to better highlight what is broadly available in each region and where improvement opportunities are available. After finalizing these results, the team then summarized findings for each external case study identified above to provide a comprehensive view of the strengths and weaknesses of each case. These findings can be found under Research Outcomes.



RESEARCH CHALLENGES

One of the challenges the team faced during the initial stages of research was the wide scope of research. Since quantitative data was unavailable, the team took a qualitative approach to identify insights for the various stakeholders. This meant the team had to look at a broad range of sources to identify academic literature and case studies relevant to the EE industry in NJ and PA.

The lack of clarity about the intended audience of the deliverables was also a headwind in the earlier stages of this project. Given the fragmented nature of the industry, synthesizing recommendations for the various stakeholders required a keen understanding of the role played by EEA in the ecosystem and how the team's contribution will aid EEA in its mission, and this was not completely clear to the team at the onset of the project.

Organizing stakeholder interviews also proved to be a challenge, given the short timeline for this project. Ideally, the team would have liked to interview multiple parties from the various types of stakeholders. The team hopes that EEA can continue actively engaging stakeholders in the EE space to adapt and finetune their initiatives to keep up with the latest developments.





RESEARCH OUTCOMES

CASE STUDY OUTCOMES

The New York State Energy Research and Development Authority (NYSERDA) Clean Energy Workforce Development

NYSERDA promotes EE frameworks and programs to advance clean energy within New York and aims to reduce emissions, accelerate economic growth, and reduce energy costs. To achieve these goals, NYSERDA launched The Clean Energy Fund (CEF) in 2016 (later modified in 2021) that committed \$100M through 2025 to advance clean energy training and workforce development (NYSERDA, 2022). CEF is funded through a System Benefits Charge (SBC), or an additional utility bill charge paid by New Yorker residents (NYSERDA, 2022).

NYSERDA's Workforce Development and Training programs focus on enhancing the clean energy talent pool of eligible workers within New York State through three distinct verticals: The Clean Energy Internship Program, the On-the-Job Training Program, and the Climate Justice Fellowship Program (NYSERDA, 2022). Within all three of these programs, NYSERDA arranges for new workers, students, recent graduates, and individuals from disadvantaged communities looking to enter the clean energy sector to get paid internships, fellowships, and jobs within the state. All three programs have incentive-based tools to connect businesses and workers. For example, participating businesses receive reimbursement for a percent of the workers' wages, and the worker receives competitive pay. A more detailed description of these programs can be found below in Table 1.

Based on the table, the team identified both advantages and disadvantages to NYSERDA's offering in direct comparison to the impact categories previously identified as most important to and within the EEA's capacity for implementation:



	Clean Energy Internship Program PON 4000	On-the-Job Training (OJT) Program PON 3982	Climate Justice Fellowship PON 4772
Program Summary	Funding for eligible clean energy businesses, organizations, and local municipalities to hire interns to work for a limited period of time in the clean energy sector to gain industry and professional experience.	Incentives for eligible energy efficiency and clean technology businesses to hire and provide on-the-job training for full-time, permanent new workers .	Funding for 12-month, full-time fellowships for individuals currently residing in disadvantaged communities or from priority populations to work within organizations and businesses that advance climate justice and clean energy priorities for disadvantaged communities.
Eligible Businesses / Organizations	Provide one or more eligible energy services in the following areas: energy efficiency, renewable electric power generation, grid modernization and energy storage, alternative transportation, and renewable fuels.	Provide one or more eligible energy services in the following areas: high-efficiency HVAC, water heating, lighting and controls renewable heating and cooling, insulation and/or air sealing; building automation and controls; smart grid; energy storage; building operations and maintenance; solar electric photovoltaics; solar thermal and related areas; and offshore and land-based wind and related areas.	Be a community-based organization, university, municipality, climate tech innovator/start-up, venture development organizations (e.g., incubators, accelerators, or other similar programs), clean energy business or a firm dedicated to advancing climate justice and clean energy priorities in disadvantaged communities.
Reimbursement Rate	75%-90% wage reimbursement on wages up to \$17/hr, depending on business size.	50%-75% wage reimbursement up to \$24/hr, depending on business size, business type, and worker being hired.	\$37,000 mandatory min salary per fellow, plus \$3,000 training/professional development.
Average Subsidy	\$6,500 per intern.	\$8,000 per new hire.	Maximum \$40,000 per fellow.
Length of Program	Minimum eight weeks or 80 hours and up to a maximum of 480 hours.	4-6 month on-the-job training period.	Must be a 12-month employment period.
Priority Populations and Disadvantaged Communities	Individuals currently residing in disadvantaged communities or from a priority population who do not meet college graduation and related requirements outlined in PON 4000 can be hired by approved businesses.	Individuals currently residing in disadvantaged communities or from a priority population are eligible to receive up to 960 hours of reimbursement.	Fellows must currently reside in a disadvantaged community or be from a priority population.

Table 1. Clean Energy Workforce Development Program Comparison (NYSERDA, 2022)

Impact Categories:

- **Funding:** NYSERDA has committed \$100M through 2025 to support workforce development and clean energy advancements (NYSERDA, 2022). The team believes that NYSERDA’s funding model has proven to be both effective and the most impressive framework compared to other clean energy funding models across the United States. That being said, in the context of NJ and PA, EAA would need to address the state's willingness to pay and manage a new fund, resident's willingness to pay increased utility bills, and the state's capacity to create a fund below, at, or above NYSERDA’s numeric baseline.

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- **Social Inclusion Metrics:** NYSERDA has a strong commitment to working with, including, and aiding workers from disadvantaged communities who want to enter the EE workforce. Diversity, Equity, and Inclusion (DE&I) are core values at NYSERDA, as the company is publicly committed to hiring and retaining a diverse and engaged workforce (NYSERDA, 2022). Comparatively, the team has concluded that NYSERDA has the most advanced social incentives between business and the labor force for acquiring and retaining workers from marginalized and disadvantaged communities: businesses get a larger % of salaries reimbursed alongside a longer contract duration, and businesses have no hiring cap specifically for workers from disadvantaged communities. Additionally, NYSERDA has specific support models in place for Minority-Owned, and Service Disabled Veteran Owned Businesses: businesses get to waive the entire salary of two employees and receive additional benefits like no hiring caps and other reimbursement percentages (NYSERDA, 2022).
 - **Recruitment Strategies:** NYSERDA markets all three programs (see Table 1) through social media, campus outreach, direct emails, and promotion by other state agencies, including the Department of Labor, training partners, and employers. To incentivize workers to join their programs, NYSERDA reaches out to candidates directly to apply for internships and works through employers to recruit them for on-the-job training and fellowship programs. The Department of Labor also helps NYSERDA identify individuals from disadvantaged communities, and training providers in the area work closely in their communities to recruit people from disadvantaged communities.
 - **Costs and Services:** As pictured in Table 1, NYSERDA's cost structure across all three Clean Energy Programs ensures that businesses receive reimbursement for a % of salary wages and that workers receive a competitive salary (Appendix A). The team has identified that this is a give-and-take framework with an ideal cost structure and can be mimicked in many other industries and environments.
 - **Internships:** NYSERDA supports training and workforce development through three verticals: The Clean Energy Internship Program, the On-the-Job Training Program, and the Climate Justice Fellowship Program.

-
- **Certifications:** NYSERDA offers a free database for workers and visitors to view a directory of free clean energy training (NYSERDA, 2022). Although the directory is free and provides a cost-effective outlet for workers to gain certifications, NYSERDA does not directly endorse any training in the database. Instead, the database lists what is currently available in the market. The team has discerned that while NYSERDA is focused on job placement, their certification and training vertical is less developed and has room for improvement, including endorsing, servicing, paying for, and supplying certifications to workers and other training frameworks within different organizations.
 - **Business Network:** NYSERDA has an extensive network of partner businesses across New York State (NYSERDA, 2022). The team has discerned that through a facilitated and managed business-labor relationship, clean energy frameworks can accurately and effectively incentivize businesses to participate in workforce development while fostering a stronger, more personable community relationship.

Key Takeaways

Partner with state funding outlets: NYSERDA has the most comprehensive workforce development program across all impact categories due to its specialized funding model that enables successful job placement programs with liveable wages.

Curate a defensible business network: NYSERDA's extensive business network ensures that all stakeholders are engaged, communicating, and connected across business needs and resources and also ensures an alignment between the skills being offered and the skills required for the open jobs in the workforce.



District of Columbia Sustainable Energy Utility (DCSEU) Workforce Development

The DCSEU was founded in 2011 and helps DC residents and businesses by facilitating energy savings. In addition to this broader work, they also have a curated professional development program with access to certification courses and on-site job placement in the EE sector (DCSEU, 2022). The DC Sustainable Energy Utility is funded through the Sustainable Energy Trust Fund (SETF) and the Renewable Energy Development Fund (REDF) (DCSEU, 2022). The first is a surcharge on electric and utility bills in DC, while the latter is a direct payment from energy suppliers.

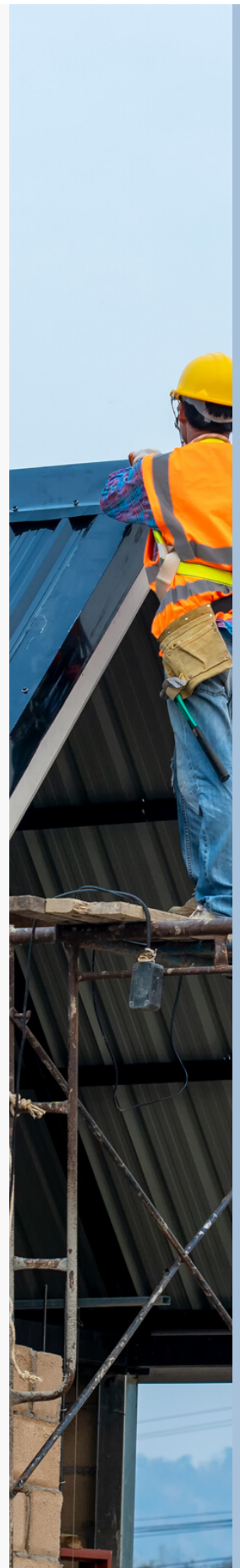
Through The Train Green Sustainable Energy Infrastructure Capacity Building and Pipeline Program (Train Green SEICBP), DCSEU provides training and certification programs for District Certified Business Enterprises (CBEs) and/or CBE-eligible firms — to help these businesses acquire and keep skill sets and learnings surrounding the changing and evolving EE space. The training and courses available cater to a wide range of workers, including building owners, property managers, building operators, electricians, plumbing, lighting, or HVAC technicians, engineers or energy service providers, architects, designers, and safety engineers, and renewable energy/solar providers (DCSEU, 2022). All the training and certifications have around a ~\$1,500 value per person for about four days of training and test-taking. Still, all training and certification courses are offered at no cost to participants on a first come, first serve basis (DCSEU, 2022). This means laborers have no direct costs for expanding their education and skill sets. To ensure that those interested find the courses most significant to their background, DCSEU also provides a SEICBP Train Green Program Access Form to filter and place interested participants (DCSEU, 2022).

Regarding their job placement offering, bi-annually, the program connects DC residents who are new to the workforce, in-between jobs, looking to enter the clean energy sector, or from disadvantaged communities with up to a 5-month paid externship working with local contractors and organizations in the EE sector. DCSEU specifically recruits unemployed and underemployed externs through partnerships with CBOs. By providing job placement, skills development, on-the-job training, and paid work, DC is working to build its green economy and bring new careers to the sustainability sector (DCSEU, 2022).

Our team has identified both advantages and disadvantages to DCSEU's offering in direct comparison to the impact categories previously identified as most important to and within the EEA's capacity for implementation:

Impact Categories:

- **Funding**: DCSEU is directly funded through a surcharge on DC residents' utility bills and from energy suppliers. Since 2012, DCSEU has created more than 420 full-time equivalent green jobs (88 in FY2021), in addition to spending more than \$60 million with District Certified Business Enterprises (CBEs) (\$10.2 million in FY 2021) (DCSEU, 2022).
- **Social Inclusion Metrics**: DCSEU directly states that they work at recruiting and addressing individuals from vulnerable communities. Although they make a good effort to note their inclusivity and desire to help individuals from vulnerable communities, the team has concluded that DCSEU can do a better job of putting these words into action. DCSEU can create incentives and recruitment strategies for financing, uplifting, and keeping vulnerable individuals in the workforce.
- **Recruitment Strategies**: Specific recruitment strategies are unknown. Although the team tried to interview representatives within the DCSEU community, the team could not obtain further information within the project's timeline.
- **Costs and Services**: In FY 2021, \$350,000 was available for funding their free certification and course offering, with 217 individuals participating (DCSEU, 2022). The team has identified that offering free courses (that can be taken virtually or in person) is extremely value-additive and a framework that is highly regarded in comparison to all other existing frameworks. This eliminates return on investment (ROI) concerns for workers to get the most out of their money and allows scheduling flexibility. Apart from these courses, through



DCSEU's externship program, they have committed to paying at least DC's Living Wage for District residents employed in their job placement initiatives (DCSEU, 2022). The team concludes that offering a livable and cost-competitive wage is an incentive and concern for workers looking to switch and/or enter the energy industry (Figure 1).

- **Internships:** DCSEU offers an extensive bi-annual externship program that pairs workers with businesses and organizations for the duration of a five-month contract. The team believes that, compared to other frameworks, DCSEU is highly specialized in this offering.
- **Certifications:** DCSEU has created a database of over 20 courses for workers to browse the most appropriate sources of additional education according to their occupation and level of skill sets (DCSEU, 2022).
- **Business Network:** DCSEU works directly with businesses and organizations in the DC region. While the organizations involved in DCSEU play a crucial role in hiring, training, and mentoring externs, there is little to no cost to their companies (DCSEU, 2022).

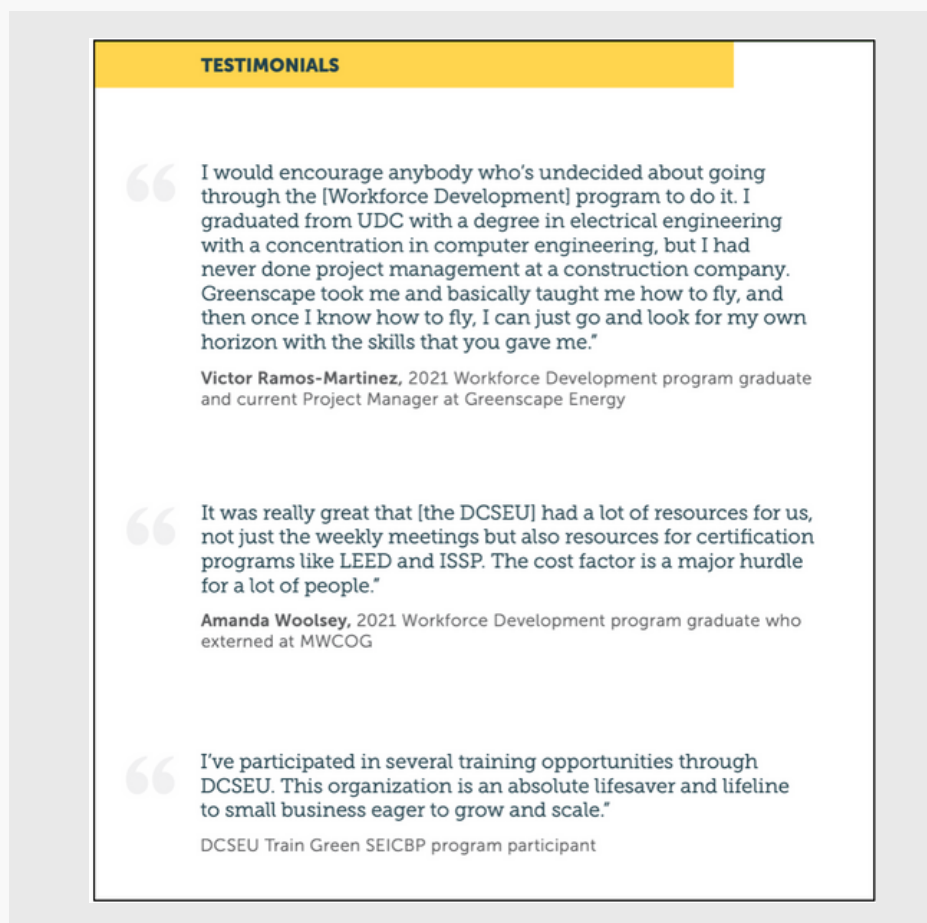


Figure 1. DCSEU Workforce Development Testimonials (DCSEU, 2022)

Key Takeaways

Eliminating out-of-pocket costs promotes community stewardship and increases the pool of eligible workers: DCSEU has the most extensive externship program that not only includes and recruits individuals from vulnerable communities, but also has an impressive cost structure that enables individuals to participate in their offerings free of charge.

A commitment to excellence across a specialized vertical creates a lasting impact: DCSEU has the most extensive externship program that differentiates the organization from all other organizations across the United States and has enabled the program to continue leveraging and improving upon its already solid foundation.



BlocPower's Civilian Climate Corps

Founded in 2014, BlocPower is a private climate technology company based in Brooklyn, New York. BlocPower uses software, project management, and clean energy project monitoring to upgrade heating and cooling systems in urban cities (BlocPower, 2022).

BlocPower's Civilian Climate Corps program trains participants with on-the-job experience in the green construction and clean energy industry. BlocPower partners with local employers, including HVAC and construction contractors, to place trainees. Trainees undergo 4-6 weeks of core training, covering basic construction, OSHA certifications, and low voltage electrical (BlocPower, 2022). Training is followed by 2 weeks of on-site specialization. The program fully covers the cost of trainee wages, so participating employers only need to provide a project site and tasks to participate. The program has helped over 1,300 individuals and has a 50% success rate for job placement after completion of the program (BlocPower, 2022).

Civilian Climate Corps recruits trainees from New York City communities at high risk of gun violence.

BlocPower works in partnership with the New York City Mayor's Office of Criminal Justice (MOCJ) through the Precision Employment Initiative. New York MOCJ awarded a \$37 million contract to BlocPower to start the program. This funding came from the federal level through the \$2.2 billion federal COVID-19 stimulus bill (BlocPower, 2022). BlocPower is able to continue the program into 2024, as funding for the Civilian Climate Corps is now part of the Mayor's baseline executive and criminal justice budget. The program is on track to grow in capacity to kickstart the careers of more trainees in partnership with NYC EE employers.



Impact Categories:

- **Funding**: The New York City Mayor's Office of Criminal Justice (MOCJ) awarded BlocPower a \$37 million contract, paid for with funding from the \$2.2 billion federal COVID-19 stimulus package to execute the Civilian Climate Corps program. The program is now part of the NYC Mayor's executive and criminal justice budget.
- **Social Inclusion Metrics**: Civilian Climate Corps recruits trainees from neighborhoods with high rates of gun violence across the five boroughs of New York City. 82% of participants were unemployed or under-employed before the program, and 27% of participants are women. Additionally, 22% were previously in the criminal justice system.
- **Recruitment Strategies**: BlocPower's recruitment strategy is to build relationships with trusted community organizations, such as faith institutions. By connecting with organizations that know their community well, BlocPower can better meet community needs to recruit local candidates into the program. BlocPower also leverages its success thus far by producing short films with an overview of the program and participant testimonials, reaching prospective participants through media content (BlocPower, 2021).



-
- **Costs and Services:** BlocPower offers trainees competitive wages and insurance, as well as remarkable wrap around services: transportation to and from the job site, childcare support, and extensive professional development workshops. Additionally, there is no cost to participating employer partners.
 - **Internships:** This program includes two weeks of on-the-job on projects, including electric heat pump installations, weatherization, and building energy audits.
 - **Certifications:** BlocPower is currently in the process of adding professional certification opportunities to the Civilian Climate Corps program.
 - **Business Network:** BlocPower partners with employers (12+) to place trainees. The program covers wages and other participant expenses. Employers only need to provide project sites and define areas of need.

Key Takeaways

On-the-job training on-site ensures education matches job demand and improves the connection from training to employment: By working directly with local businesses to meet their workforce needs with trainees, the Civilian Climate Corps program lessens the gap between educational content and real-time job demand. Trainees learn by doing, and employers receive incoming workers with hands-on, relevant experience.

Utilize technology and media to recruit from a broader pool of candidates: After a successful pilot run of the Civilian Climate Corps program, BlocPower created a series of short informational videos about the program, EE training, and career paths including short testimonials from trainees. BlocPower disseminated these videos and testimonials through online platforms. By generating short-form media content, the program can more effectively recruit interested individuals and provide successful case studies that viewers can identify with.



Tennessee Urban League Affiliates (TULA): Building Futures Minority Contractor Training

TULA is a member of the National Urban League, a CBO with a mission to empower Black populations and other underserved communities to succeed economically and socially. TULA includes chapters in Chattanooga, Knoxville, Memphis, and Middle Tennessee (National Urban League, 2022). Beginning in 2019, the Tennessee Valley Authority (TVA) provided funding to TULA to support the Building Futures Minority Contractor Training program. TVA is a federally owned agency and utility corporation providing power to the state of Tennessee and surrounding areas (Securities and Exchange Commission, 2022).

The Building Futures program allows minority contractors in Tennessee to join the TVA’s Quality Contractor Network (QCN). TVA taps into this Quality Contractor Network to install EE improvements tied to the Tennessee Valley EnergyRight program. Members of the Quality Contractor Network must meet specific TVA EnergyRight standards. Training in Building Futures varies across the four training providers listed in Table 2. All training providers aim to meet the QCN standards and cover EE improvement areas, such as weatherization and insulation (Shoemaker, Alaya, & York, 2020). Unemployed and underemployed contractors are able to receive upgrade training and improve their competitive advantage, increasing workforce representation in the contractor network (TVA EnergyRight, 2020). Approximately 40 women and minority-owned contractor businesses have graduated from the program.

Table 2. TULA Affiliate recruitment and training partners

Local TULA affiliate	Local recruitment partners	Technical training partners
Urban League of Chattanooga	Faith institutions, Association of General Contractors, Chattanooga State Technical College, grassroots organizations (e.g., Hope for the Inner City)	Green Spaces
Knoxville Area Urban League	Faith institutions, city and county government, business organizations (e.g., chamber of commerce), Knoxville Entrepreneur Center	Socially Equal Energy Efficient Development (SEED) Knoxville
Urban League of Middle Tennessee	Interdenominational Ministers Fellowship, Nashville State College, Nashville Career Advancement Center	Goodwill Industries
Memphis Urban League	Faith institutions, city and county government, business organizations (e.g., chamber of commerce), trade organizations, and grassroots nonprofits	Green and Healthy Homes Initiative

Source: S. Hart, project manager, Milepost Consulting, pers. comm., January 3, 2020.

Initially, in 2019, TVA awarded two grants with a total value of approximately \$1.2 million to TULA to initiate the program (Flessner, 2020). In 2020, TVA awarded an additional TULA of \$871,000 to continue the program in 2021 (Electric Energy Online, 2020). The team could not confirm if TVA continued to support TULA and Building Futures beyond 2021.

Impact Categories:

- **Funding**: TVA funds the minority contractor training partnership with TULA. Initial grants awarded in 2019 to TULA totaled \$1.2 million in funding. Additional funding of \$871,000 was awarded by TVA in 2021 as a donation to TULA to continue the program.
- **Social Inclusion Metrics**: TULA recruits only women and minority-owned contractors to participate in the Building Futures training.
- ***Recruitment Strategies***: Recruitment channels to reach local contractors include local faith institutions, city colleges, contractor associations, city government, county government, local career advancement centers, trade organizations, and grassroots organizations (Shoemaker, Alaya, & York, 2020).
- **Costs and Services**: The team could not get in touch with TULA to inquire about further information on costs to participants and additional services offered with the training program.
- **Internships**: Building Futures does not include internships because it is a contractor training program for small businesses.
- ***Certifications***: All curriculum is Building Performance Institute (BPI)-aligned and offered at four Tennessee community college programs – Green Spaces, Socially Equal Energy Efficient Development Knoxville, Goodwill Industries, Green and Healthy Homes Initiative (Shoemaker, Alaya, & York, 2020).
- **Business Network**: Building Futures provides business development opportunities to minority contractors to support increasing demand and funding for EE improvements. Participants are trained to join the Tennessee Quality Contractor Network, which completes installations for TVA EE improvement programs.

Key Takeaways

Use high demand for EE work as an opportunity to bring minority-owned businesses into the contractor network: The Building Futures program is unique from the other case studies because it focuses on the cross-section between increasing EE demand and minority contractor business opportunities. By guiding participants to enter the state contractor network, Building Futures improves representation, bolsters minority-owner business development, and meets EE improvement demand with a supply of contractors prepared to do the job.

Leverage existing education and training infrastructure: The Building Futures program utilizes community colleges and training centers to hone its mission to prepare contractors to meet TVA's QCN standards. The program leverages existing community relationships, funding, and educators to meet its objective without starting without a foundation.



Case Study Comparative Analysis

The team’s Case Study Comparative analysis table is shown in Table 3. The matrix rates each program across three evaluation points: Robust Part of the Program, Needs Improvement and Not Robust or Information Unavailable. Using this assessment guideline, the team could see where each program has been successful thus far and where each program may have room for improvement and innovation.

Based on these results, the team concluded that in direct comparison to external workforce development, both NJ and PA EE stakeholders might be able to learn from the frameworks that other industry stakeholders have designed to strengthen their network and service offerings better.

The team notes that these results are the conclusion of methodology, selection, assessment, and evaluation in line with the EEA’s project objectives. These results are subject to change under the scope of different projects and in other academic environments.

Green = Robust Part of the Program, Yellow = Needs Improvement, Red = Not Robust or Information Unavailable

	 NYSERDA	 DC SUSTAINABLE ENERGY UTILITY	 BLOC POWER	 Tennessee Urban League Affiliates
Funding Sources	✓	✓	✓	✓
Social Inclusion Metrics	✓	✓	✓	✓
Costs & Services	✓	✓	✓	✓
Internship	✓	✓	✓	✗
Certifications	✓	✓	✗	✓
Business Network	✓	✓	✓	✓

Table 3. SUMA Case Study Comparative Analysis

New Jersey Training Programs in Relation to Case Studies

NJ's EE training programs have focused on government and state-level funding strategies, such as The New Jersey Department of Labor and government grants. Rather than focusing on on-the-job training and workforce placement, the services in NJ have primarily focused on certifications. Although giving workers access to proper learning platforms to expand their skill sets is essential, it is also important to create a link between these certifications and jobs in the workforce to ensure an alignment between skilled workers and employment. To get properly certified, some of these certification programs in NJ can cost upward of \$2,000 with no evident support to help individuals make these payments. Across the team's costs and services impact category, NJ programs would be able to increase the number of individuals eligible to take the courses by leveraging a system that better aids or alleviates out-of-pocket costs. Current programs in NJ do not appear to operate under any social inclusion metrics, such as supporting workers from disadvantaged communities. By creating strategies that lift these groups and invite them to participate, NJ could increase the pool of workers ready to take the necessary steps for EE training and job placement. NJ's strength is its ability to offer strategic certification programs with the tests and courses that enable success in workforce environments. Still, by bolstering social inclusion and cost frameworks and creating a stronger link between certifications and job openings, NJ will be positioned to increase the flow of skilled workers ready to enter the EE field.



Pennsylvania Training Programs in Relation to Case Studies

PA EE training programs are funded through traditional community college state sources, grants, and program revenue from tuition. The programs emphasize professional certifications with solid working relationships with the BPI. Although certifications are essential to qualify for many roles in the EE industry, streamlining the relationship between training programs and employers is essential for appropriate skill matching for open job placement. Other than general community college career services, PA-based programs often do not offer internships or other opportunities for learning on the job. Additionally, training courses in PA frequently come with tuition costs ranging from \$200- \$2000 for participants and do not include support services, such as child care or transportation. Training costs are a significant barrier to entry for the pool of potential trainees. Across programs in PA, none disclosed key performance indicators associated with improving workforce diversity and representation for minority and underemployed communities. The strength of these existing programs lies in their ability to leverage existing training resources, funding, relationships, and infrastructure to meet EE industry workforce development needs better.



INTERVIEW OUTCOMES AND KEY FINDINGS

The interviews provided detailed and comprehensive insight into the challenges experienced by stakeholders in the EE sector and possible solutions. All interviewees saw the inherent complexity of the issues faced and interconnected solutions.

EMPLOYERS

Much of the EE workforce is employed by smaller local businesses, which mainly advertise open positions through word of mouth and local networks. With increasing EE work demanded, there is a lack of ability by these smaller businesses to recruit and retain qualified individuals due to insufficient human resources staff or lack of training in professional people management. Interviewees introduced potential solutions to recruit and retain workers including directly correlating EE jobs to fighting climate change to increase enthusiasm among applicants. Adding employee development benefits, like career development potential and life-long learning opportunities, were also suggested.

FUNDING AND COMMUNITY ENGAGEMENT

While there is existing state and federal funding for a variety of energy-related programs, interviewees questioned the effectiveness of funding, with some saying it comes too late or that programs have not been well coordinated with local communities. Some organizations, however, make large use of different state and federal funding sources ranging from the Department of Housing and Urban Development, the Environmental Protection Agency, and national and state Departments of Labor, Energy, and Environmental Protection. Despite these funding sources, a major gap in the efficacy of any workforce development program is genuine community engagement to use existing community resources and connections. Programs seeking to reach under-represented communities must build relationships with trusted community centers to act as a pipeline of information, aid, and connection to wrap-around services.

EMPLOYEES AND TRAINEES

Interviewees also shared insights on issues directly impacting the EE workforce. Many interviewees pointed out the lack of wage consistency in the sector, unfavorable working conditions, and lack of transparency regarding career advancement. All of these issues primarily pertain to entry-level positions or more physically demanding roles in the industry. While average wages in this field are growing, they are not increasing uniformly (Appendix A). One interviewee pointed out a need for value propositions beyond wage. Some suggested that the state governments could incentivize these jobs in some way through tax credits. Others suggested that employers change their relationship with employees and focus on their holistic wellbeing, especially ones in physically demanding positions, by offering other incentives. In reference to transitioning fossil fuel workers to EE jobs, one interviewee stated that the task is not as straightforward as some make it out to be. There are psychological barriers to transitioning, like uncertain industry wages and the need to acquire new training credentials that dissuade switching industries. While both in the energy industry, they are not perfectly translatable sectors. Lastly, many interviewees emphasized the need to aid trainees and employees in finding and affording wrap-around services, like childcare and transportation.

TRAINING

Interviewees cited gaps and solutions in workforce training, including a lack of training standardization and consistency across programs. Several interviewees recommended an earlier introduction and exposure to EE concepts and trade skills in schools. They also noted the benefits to companies and trainees of employers partnering with training centers for free or reduced-cost training.



DESKTOP RESEARCH OUTCOMES

Funding Gaps

NEW JERSEY CONTEXT

NJ reentered the Regional Greenhouse Gas Initiative (RGGI) in 2018 after withdrawing in 2011 (NJDEP-Air Quality, Energy & Sustainability, 2022). The state then updated its Energy Master Plan in 2019 to include strategies such as reducing consumption, increasing efficiency, and expanding the clean energy innovation economy (Energy Master Plan, 2022). The team's research and interviews identified a clear need to tie greenhouse gas (GHG) reductions to the EE workforce. Doing so would allow money linked to GHG reductions to be tied directly to EE workforce development efforts. While there are various clean energy funds within the state, these are not meant to be used for creating a workforce that supports clean energy providers. This further exacerbates the gap between funding supply and worker demand.



PENNSYLVANIA CONTEXT

PA has a variety of programs to improve workforce development in the EE industry. The most well-known and connective of these programs is PAsmart. This offers Industry Partnership Grants and an online database for workers to find new opportunities and apprenticeships (Department of Labor & Industry, 2022). Another funding source is the Schools-to-Work program grant funding. There are \$2.5 million dollars available for registered pre-apprenticeship programs designed to prepare students for the workforce through classroom training, workplace visits, internships, apprenticeships, mentorships, employment opportunities, job shadowing, externships, and more (Governor Wolf, 2022). This is being rolled out in 2022, so the team cannot see exactly how this program will accelerate the EE industry. Grants in PA are primarily accessible for apprenticeships and training providers, and there is a lack of funding for individuals looking to attend training programs that require out-of-pocket tuition costs. There is also a lack of funding and grants to help individuals transition into EE careers in PA. While programs help provide workforce development policies, such as Back to Work PA, none directly address the EE or clean energy industries and their specific challenges.

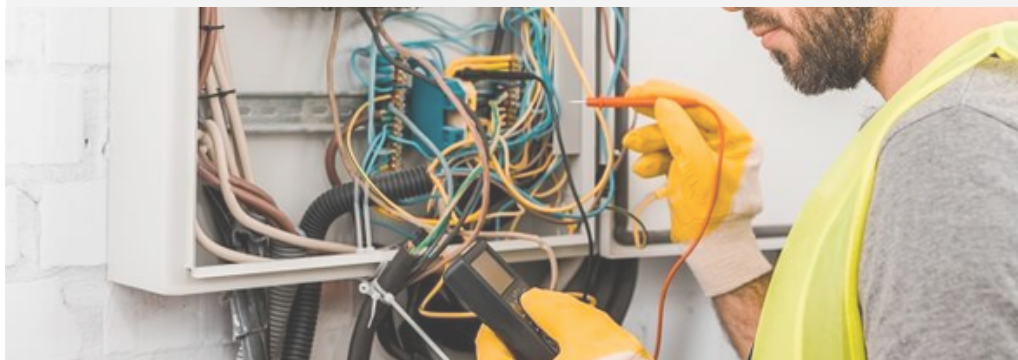
FEDERAL AND INTER-STATE CONTEXT

On the federal level, the Workforce Innovation, and Opportunity Act is designed to help job seekers access employment, education, training, and support services to succeed in the labor market and to match employers with skilled workers they need to compete in the global economy. WIOA requires states to strategically align their workforce development programs with the needs of job seekers and employers. WIOA provides training providers and employers funding through state government workforce development boards (Workforce Innovation and Opportunity Act, 2022).

Another comprehensive funding program is the DOE's program WAP, which helps residents lower their energy costs by increasing the energy efficiency of their homes. In this program, funding flows from the DOE to state and territorial governments and then to local governments and weatherization agencies. A portion of these funds go to national training and technical assistance; in 2021, 5 million dollars were reserved for these activities (Congressional Research Service, 2021). In 2022, only 3 million dollars were put aside for training and technical assistance. WAP sub-grantees are able to receive training in weatherization at IREC-accredited training providers. Specifically, WAP offers expense reimbursement for direct-hire workers and subcontractors to continue their education through certain training centers and offers reimbursements for related travel (Clean Energy Center, 2022).

PA and NJ joined Regional Greenhouse Gas Initiative (RGGI) and nine other states, hoping to develop the economy and support over 30,000 jobs (RGGI, Inc., 2022). This initiative is meant to reduce GHG emissions from the power sector via a cap and investment model. Investments are made to accelerate the adoption of renewable energy technologies and improve energy efficiency.

There are also various federal funds and grants available. However, after speaking with EEA members during an open listening session in July 2022, they expressed that these programs are not very agile, and their needs have changed by the time the funds are approved. In addition to a slow funding process, identifying eligible funds is extremely difficult and convoluted.



FUNDING TAKEAWAYS AND NEEDS

While many government agencies work together within each state, there is limited inter-departmental cooperation and program development. Additionally, community stakeholders are often not included in program development to address the gaps in creating funding programs that are beneficial on a community level. Specifically, there are many rural communities within PA, and these locations lack attention and funding. There is also low awareness of current programs and grants in these areas, leading to inefficiencies in these funding programs. As large funding increases are coming, it brings into question their effectiveness and how the money will be allocated. Determining these gaps is the first step in addressing the problems in the EE workforce and how to solve them.

Industry Gaps

TRAINING GAPS

The team has discerned that to create a flow of workers going in and out of the EE sector, workers and trainees need better access to proper training programs and resources to gain the necessary skills for available jobs.

PA is the third largest coal-producing state and the second largest natural gas producer (U.S. Energy Information Administration, 2022). With all of these coal and gas workers in the state, there is an enormous opportunity to transition the workforce from one energy sector toward EE work. However, switching from working in the fossil fuel industry to working in EE is not straightforward, as the industries require different skill sets and psychological mindsets and have different wages. Therefore, the first identified gap in training is the lack of pipeline between non-renewable and clean energy jobs. Individuals need training support to be effective in new environments, responsibilities, and roles. Not only do oil, gas, and coal workers not know where to gain additional training, but the training required is often not adequately stated or outlined by employers or job postings. Overall, there needs to be more robust support from employers looking to hire workers from the fossil fuel industry.



Another training gap found in research is in recruiting students using DE&I principles. As the pool of trainees and skilled workers increases, it is important to uphold DE&I principles and social inclusion metrics. Uplifting and including individuals from vulnerable and disadvantaged communities increases the inflow of eligible workers and ensures that stakeholder groups are transitioning together — without leaving disadvantaged groups or organizations behind. Valuable DE&I strategies implemented in the EE sector thus far include alleviating training costs, recruiting across income levels, creating partnerships with community groups, increasing access to women, small business owner-employees, and veterans, and creating incentives for training programs to teach workers from various demographics.

RECRUITMENT GAPS

The first recruitment gap found in research is in human resource capabilities among employers. Expanding human resource capabilities and outreach is necessary to strengthen the relationship between employers and the workforce. Through strategic research and first-hand interviews, the team has concluded that a fragmented hiring runway confuses workers and leaves eligible workers and community groups out of the process. Many human resource teams in the EE sector, especially among smaller companies, lack recruitment capacity or are non-existent, where most jobs are filled by word-of-mouth or through local communities. While community stewardship is vital, human resource groups need to expand to reach more workers and more accurately detail the paths for recruitment. Because of limited human resource capabilities, there is a gap in recruitment strategies used by employers. One of the reasons behind smaller applicant pools for EE jobs is a lack of awareness of job opportunities. Limited recruitment channels lead to a smaller audience, meaning less workforce will be aware of an open position.



As seen in Figure 4 below, word of mouth and online job sites are EE employers' most frequently used hiring methods. Less frequently used methods include working with training providers, hiring interns, and having apprenticeships. One method not listed in the chart that came up often in interviews is the need for more community-based recruitment efforts. There is a clear gap in the workforce as many training programs and employers are not building local relationships to hire within underrepresented communities. Because of the limited recruitment channels used by employers, applicant pools are often homogenized. Expanding recruitment efforts beyond word of mouth and job sites would increase the diversity of applicants.

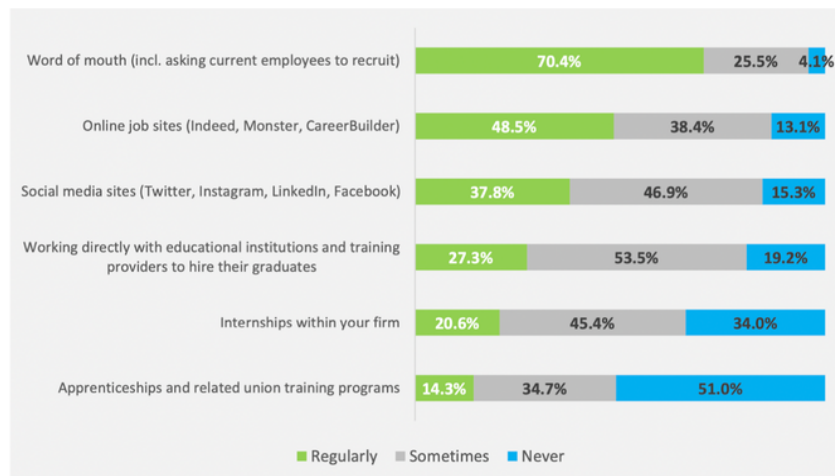


Figure 4. Frequency of Use for Various Hiring Channels Among EE Employers in PA (Workforce Development Needs Assessment & Gap Analysis, 2021)

Another gap between employers in recruiting applicants is how they frame jobs and how they appeal to the workforce. The team's research revealed that employers are not always framing their jobs to appeal to their audience and, as mentioned in the interview outcomes, employers are not offering enough value propositions to attract workers. This narrows the applicant pool and keeps people from applying who otherwise would if it were framed more appealingly. For example, workers are often not drawn to EE jobs because of negative preconceptions about the work being unglamorous, dirty, or paying less. To make these jobs desirable, employers need to offer applicants other reasons to apply for the job, like higher wages (Appendix A), benefits, or psychological fulfillment.

Lastly, there is a clear need for DE&I metrics in recruitment for both jobs and training programs. Diversity is often not measured in hiring processes from employers, leading to a very homogenous workforce, especially compared to the national workforce. A report from ACEEE found that there are 50% fewer black workers, 90% fewer women, and 20% fewer Hispanic workers than the national average (Shoemaker, Alaya, & York, 2020). This is often due to a lack of access to training and lack of awareness of opportunities, therefore employers and training programs can play a large part in increasing diversity.

RURAL EMPLOYMENT GAP

The team identified the last gap in EE workforce development in rural areas. Looking into EE in rural areas is important, as rural households in the United States have a higher energy burden than urban areas, meaning they spend a higher percentage of their income on energy bills (Ross, Drehobl, and Stickles, 2018). With more energy-efficient homes and appliances, these energy costs would drop - EE upgrades can lower household energy burdens by as much as 25% (Ibid). Unfortunately, many low-income households in rural areas cannot financially invest in energy-efficient equipment and upgrades or do not have access to workers to make these upgrades possible. The team found this issue true for PA, which has the third largest rural population in the nation, with 75% of the land being rural (Kopko, 2021). This reality that affects individual energy consumers also affects training and employment in the EE industry. Rural areas are also less population-dense, creating issues when trying to cite training for maximum enrollment or justify citing a permanent EE company because of the fewer potential clients for their services. Any rural energy efficiency workforce development program should not merely focus on job training but also include measures to strengthen the overall EE sector in these rural areas to broadly increase people's access to energy efficiency services. These are the key issues that must be considered and addressed in creating any rural EE services or development access program.



ECOSYSTEM MAPS

The Workforce Development Ecosystem Map below (Figure 2 and Figure 3) is one of the team's final deliverables for EEA and shows many gaps and complexities in the ecosystem responsible for workforce shortages

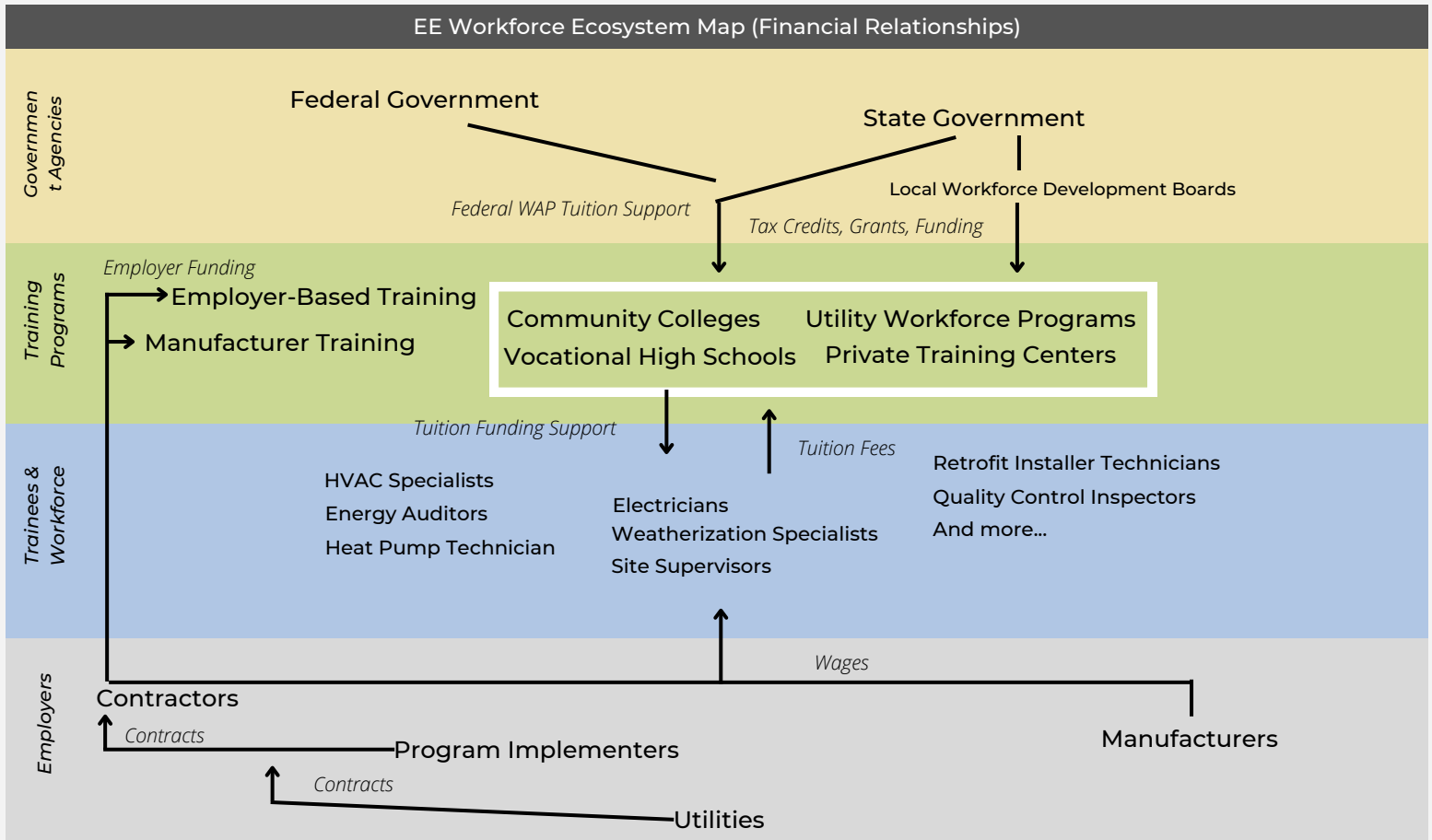


Figure 2. Workforce Development Ecosystem Map - Financial Relationships

Figure 2 shows the financial relationships between stakeholders in the industry, showing the flow of funds from one actor to another. Starting at the top, the federal government directs funds to the state government, which funds training programs directly or through local workforce development boards. These funds come from tuition support for the workforce, tax credits for training programs, and grants for trainees and training programs. Tuition support comes directly from the federal government through the Weatherization Assistance Program (WAP) to help pay for EE training. Funds received by training programs then flow to trainees and the workforce in the form of tuition funding support or go towards operating the training programs. Training programs then receive tuition fees from the workforce, either from trainees paying the full price or trainees receiving tuition help. Employers, including manufacturers, contractors, program implementers, and utilities, all direct financial flows to the workforce through wages. Most EE jobs listed on the map fall under the contractor category. Utilities often hire program implementers who hire contractors to carry out work. Lastly, some employers (typically large utility companies) use funds to carry out their employee training, and manufacturers direct funds to train workers on how to install their products.

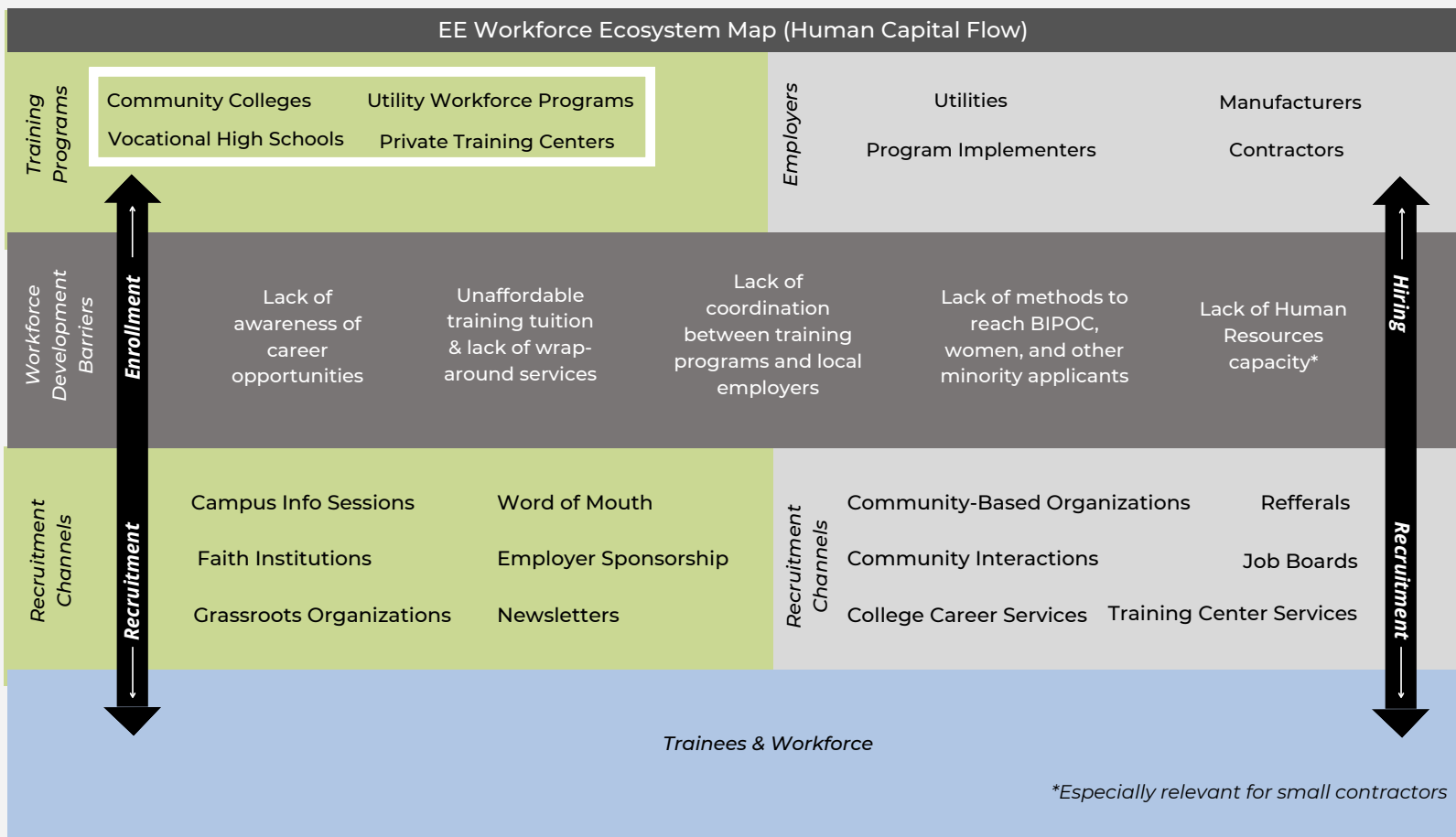


Figure 3. Workforce Development Ecosystem Map - Human Capital Flow

Figure 3 shows the human capital relationships in the ecosystem, mapping out different stakeholder groups and how people flow between them. The top left offers training programs, including community colleges, utility workforce programs, vocational high schools, and private training centers. These programs recruit from the workforce through channels including information sessions, faith institutions, grassroots organizations, word of mouth, employer sponsorship, and newsletters. Employers, on the top right, including utilities, manufacturers, program implementers, and contractors, also recruit from the workforce. Recruitment channels used to hire include CBOs, community interactions, college career services, referrals, job boards, and training center services. There are several barriers to recruitment, including the lack of awareness of opportunities from the workforce, unaffordable training tuition and lack of wrap-around services, lack of coordination between training programs and local employers, lack of methods to reach BIPOC, women, and other minority applicants, and the lack of human resources capacities often in smaller companies. To support these maps, the team also created a more simplistic visual showing these flows from one stakeholder group to another without detailed stakeholder lists (See Appendix).

STAKEHOLDER DIRECTORY

To accompany the Ecosystem Map, the team created a directory of stakeholders visualized on the Ecosystem Map in NJ and PA, along with ways to contact these organizations. These stakeholders are categorized by federal government support, state government agencies, workforce development advocacy organizations, workforce development training providers, and employers. These categories were further broken up by type listed in the Ecosystem Maps. For example, federal government support included tax credits, grants, and funds, while training providers included training centers, colleges, apprenticeships, vocational high schools, and employer workforce programs. In total, the team identified 140 relevant stakeholders. Along with category and subcategory, each resource included an email, phone number, address, website, important notes, as well as their county and associated utility. Several stakeholders on the list also have a contact name at the organization.





RECOMMENDATIONS

The team makes the following recommendations while keeping in mind that not all stakeholders have the capacity, funding, or time to complete these actions. These recommendations are based on the team's research and are not all-encompassing and have been chosen based on their feasibility and importance to workforce development.

EMPLOYERS

Make opportunities for growth and upward mobility available and clear to showcase career value to candidates and increase retention.

Employers should, where possible, offer opportunities for employee advancement and upward mobility. They should make these known to candidates when recruiting to incentivize EE jobs and increase employee retention.

Offer employee benefits and connect employees with resources for wrap-around services, such as childcare and transportation.

Insights from interviews revealed the importance to employees of increasing the value proposition for EE jobs in other ways than increased pay. Offering other benefits, including days off for physically demanding positions and resources to support access to wrap-around services such as childcare and transportation, can help further incentivize jobs, increase the industry's overall attractiveness, and promote overall employee wellness.

Encourage continued education and upskilling post-hiring by incentivizing on-the-job learning of new skills.

Given employee desire for advancement, directly or indirectly facilitating upskilling or further education can help retain employees and fill higher level positions. Collaborate with energy efficiency training programs to host interns, providing potential candidates with hands-on training and matching education with relevant training experience.

Employers should collaborate and coordinate with local training centers to share real-world knowledge and offer internships to trainees to better match needed skills. The research found during interviews revealed a slight preference by employers for their own internal training over independent training programs. This can be a barrier for job applicants who put additional time, energy, costs, and effort into getting properly certified or trained only to find they need to be re-trained by their employer. By combining training with on-site work, trainees can learn in real-world environments with the confidence that they will be contracted or employed at the same work institution once their training is finished. On-site work also creates a sense of loyalty and respect between employers and trainees, as employers can view the trainees' work ethic, teamwork, and personality before hiring them full-time. By strengthening the relationship between employers and training providers, the EE sector will see a more efficient flow of talent between all stages of development and fewer lag times between training completion and job placement.

Develop human resources capacity for targeted outreach and understand the business value of diversity, equity, inclusion, and accessibility.

While many smaller businesses cannot afford to increase their human resources capacity drastically, small increases and optimization of current resources for specific and targeted outreach can maximize quality recruitment.

- To reach underrepresented applicants, survey target communities to determine where people gather, network, and receive their information to find the best channels for recruitment communications
- Engage with community members to determine applicant preferences for jobs in order to frame openings based on more appealing value propositions
- Leverage technology such as text-based marketing and online job boards to expand recruitment strategies and reach more diverse applicants

TRAINING PROVIDERS

Identify local community centers as in-person locations for communities to procure information about energy efficiency careers.

Training providers should work with trusted local gathering centers to connect with communities for effective local recruitment. These include recreational centers, schools, churches, and other faith institutions. By connecting with these physical locations and organizations, training providers can learn how to create a mutually beneficial connection to the community, using resources and recruitment methods to reach and benefit community members.

Strengthen partnerships with local employers to offer on-the-job training as part of educational programs to ensure education matches real-time energy efficiency workforce needs.

As mentioned in the recommendations for employers, strengthening the relationship between employers and training providers will allow the EE sector to have a more efficient flow of talent.

Coordinate training scheduling with local employers to ensure graduated trainees will enter the workforce when local contractors have job opportunities readily available.

Unaligned training program timing is a common pain point for EE employers. While local programs may be training for the right skills, employers have an ebb and flow

of job openings for contracted projects. If the timing of a program ending and employer openings are not coordinated, the workforce may become discouraged by the lack of immediate job openings.

Seek funding opportunities to eliminate out-of-pocket costs for trainees and offer wrap-around services to increase the inclusion of unemployed, under-employed, and disadvantaged communities.

Training programs must be made more accessible to individuals across all income levels. This should be done by alleviating out-of-pocket expenses, increasing recruitment strategies by working with community groups and on-the-ground organizations, working with funding groups to offer wrap-around services, and engaging with individuals on a personal level to understand their career goals and workforce needs better. By eliminating costs, more individuals can buy into training program environments without sacrificing financial stability. Even more, by engaging with community groups, be it through churches, high school groups, social events, fundraisers, or health care providers, training programs can better understand the needs, background, and drivers of individuals in their local area. By creating a platform with greater access, inclusion, diversity, and equity, the EE sector can advance trades, skill sets, and the economic stability of local communities.

Partner with state funding sources to curate a business network of job opportunities, in which businesses are incentivized with wage funding support to recruit from underrepresented communities. Share these opportunities on a streamlined online platform.

Training providers that utilize state funding sources can build a strong network of businesses that are properly incentivized and equipped to hire EE trainees. Similar to the case study frameworks analyzed in this report, states can create workforce development funds by adding an additional tax on specific utility bills. These taxes are then used to fund workforce development programs and help alleviate downstream costs on individuals and businesses. The team found that by eliminating or subsidizing costs associated with hiring new employees, businesses are more willing to take on new hires and train them in on-the-job roles for longer periods. Even more, the payment structure allows for incentive-based hiring by strategically paying for a larger percentage of an individual's salary if they come from a disadvantaged community. Additionally, by having one centralized platform to apply for on-the-job training, view cost structures, and identify a comprehensive list of participating employers and businesses in the state, training providers and businesses can increase the number of on-the-job training opportunities.

Utilize technology and media to recruit from a broader pool of candidates.

The team found a lack of online resources and media for training candidates to quickly learn about EE careers and training programs in a quick, accessible way. For example, training programs can create short introductory videos about EE career paths and training programs and disseminate these through online platforms. This would improve industry messaging and reach more potentially interested candidates.

Offer contractor training programs to upskill small and minority-owned energy efficiency businesses, supporting business development of soft skills and contractor certifications.

The increased demand for EE projects can be leveraged to bring business development opportunities to small and minority-owned contractors. With fewer resources to pay for costly certifications and standards to join contractor networks, small and minority-owned contractors are not afforded the same opportunities for business growth. This can mean, for example, taking on the less lucrative role of subcontractor rather than the prime contractor. This results in the systemic exclusion of minority-owned contractors from the same business development opportunities. Training programs can support small and minority-owned businesses by offering standard certification seminars and training for soft skills and business development.

Ensure program advisory boards include employers so that curriculums match real-time workforce needs.

Workers coming out of training programs often struggle to find a job because of a mismatch in skills. Placing employers on the advisory boards of training programs would ensure that curriculums align with employer workforce needs. This way, employers can more easily engage with training programs and validate curriculums before they are taught. Placing employers on advisory boards would also allow training programs to coordinate their course schedules with local employers to ensure that trainees enter the workforce when local employers have job openings.

To reach rural communities, consider partnering with existing local organizations to offer mobile and remote recruitment and training sessions to leverage resources across a broader area.

Many rural areas do not have the capital to support a full-time independent energy efficiency training center because of a lack of jobs, human capital, and financial support. To solve this issue, urban training providers could work with local organizations such as CBOs or employers to extend their reach and provide mobile remote workforce training in rural towns.

GOVERNMENT AND POLICYMAKERS

Incentivize energy efficiency education with tax incentives, grant offerings, and wrap-around services to support individuals pursuing training and certification in the energy efficiency field.

State governments should continue incentivizing the workforce's transition to a clean energy economy. While tax subsidies and grants exist for training programs and trainees, they should be more accessible and marketed to employers or training programs that would benefit from increased funding. Employer-based training is commonly used to ensure employee skills match up with a job, as gaps between training providers and employer needs remain present. Until these gaps are filled, funding and tax breaks for employers that train their new employees would help lessen the financial burden on employers and increase their intake of entry-level workers. There is a common perception that funding is lacking within EE training, showing a clear need for this funding to be streamlined and more accessible. Through state and national governments, grants and tax incentives must be shared and promoted to employers, training centers, and vocational schools that could benefit from this funding.

Offer funding for energy efficiency training programs with metrics for recruiting trainees from underrepresented communities, including rural areas.

Federal and state governments should financially incentivize programs using metrics to recruit trainees from underrepresented communities. With low diversity, equity, and inclusion in the EE workforce, this is an opportunity for targeting low-income or disadvantaged groups. State governments can also help employers and training programs increase diversity by suggesting methods for and rewarding the use of DE&I metrics. EE jobs lead the energy sector in employing veterans because of their targeted outreach to the group, showing how targeting specific groups for funding and training needs can be a successful tactic in this industry (Energy Efficiency Jobs in America, 2022).

Support and value workers transitioning away from the fossil-fuel industry.

As fossil fuel energy jobs start to decline, government agencies should help realign and support workers in their transition toward green jobs. An example of this type of federal support is the Advanced Energy Manufacturing and Recycling Grant Program, starting in 2022.

This program will allocate grants to small businesses undertaking energy technology projects in communities impacted by the closures of coal mines or coal-fired power plants (Energy Efficiency Jobs in America, 2022). State governments need to design and prioritize policies like these to assist the transition towards a clean energy economy. Another way to support and encourage workers transitioning from the fossil-fuel industry is by increasing the value of clean energy careers. Similar to how the federal government offers benefits for individuals in the military, the government should support the EE workforce for it to grow at a rate that matches necessary demand. This can be done by removing barriers to EE training through tuition reimbursement and loan forgiveness to incentivize and value the transition into the EE workforce.

Begin introducing environmental studies, climate change, and energy efficiency concepts and career tracks early in the public school curriculum.

State governments should adopt broader environmental studies curricula for public secondary schools. While there may already be courses in public schools that discuss the environment, such as chemistry, biology, and geology, the offering should be expanded to include subjects such as energy management. These concepts may include climate change, energy efficiency, water management, and environmental public health. By introducing these concepts early, schools can leverage these concepts into career tracks early on. These career tracks can be developed into community pipelines to local EE employers to strengthen the community's economic health overall.

To support this recommendation, further research needs to be done looking into current curriculum modules created in other states or countries that can be adapted and used widely. If no curriculums exist, state and federal labor departments, state and federal education departments, and others can work with the EE industry to create a valuable and relevant curriculum with inter-departmental collaboration. Even without waiting for state or government collaboration, some schools may be able to implement the EE curriculum within the existing curriculum requirement frameworks.

Additionally, EE curriculums should be developed for vocational high schools as a specialization. While it will take resources to develop, an EE-specific track would increase awareness of EE career opportunities and expand the pool of potential candidates. For example, vocational high schools with electrical engineering and construction curriculums can integrate EE concepts to showcase career opportunities to students and allow for an EE specialization.

Ensure federal and state governmental interdepartmental collaboration

There is little to no standardization for workforce development, so there needs to be a collaboration between government agencies, both federally and state-wide. There should be increased cooperation between the Department of Labor, the Department of Environmental Protection, and the Department of Energy, as well as sub-departmental collaboration. Each department needs to be in touch with the funding and policies that the other departments are releasing to work together and create efficient workforce development solutions.

COMMUNITY-BASED ORGANIZATIONS

Partner with local trainers and employers.

CBOs are mainly facilitatory, acting as hubs for information and encouraging the formation of local networks. Their role is vital for efficiently allocating time and money across the sector. CBOs should partner with regional EE training providers to host in-person information sessions for community members to procure information about EE careers. Additionally, they should foster partnerships with local EE employers to understand workforce needs to better support employers with recruitment and job placement and convey workforce needs to local trainers to more effectively meet employer and market needs. These partnerships should include outreach into rural areas via the hosting of mobile, rotating, and remote training offerings. Services should also include support for rotating EE professionals in rural areas to expand access to EE products and services that more inclusive local training and partnerships will bolster.

Support access to information and wrap-around services.

CBOs should support community members pursuing training and certification in EE careers by providing information on or directly offering wrap-around services support, like child care assistance and transportation to and from jobs or training. Finally, CBOs can help bridge the recruitment gap and elevate the sector by supporting activities, for example by hosting speaker events to showcase EE career success stories from within the community as informative and recruitment tools.

COLLABORATION BETWEEN STAKEHOLDERS

While most of the recommendations made above are for stakeholders to carry out on their own, many require collaboration. This includes collaboration between employers and training providers, between CBOs, employers, training providers, and the workforce, and between federal and state government agencies. Mutually beneficial relationships between stakeholders are crucial and should be leveraged to bolster the EE ecosystem. EEA is uniquely positioned to encourage and coordinate collaborative efforts between stakeholders. EEA should aim to create an environment that allows for open communication between stakeholders so that these recommendations can be implemented.



CONCLUSION

The team conducted research and formulated recommendations in only ten weeks between May 24th, 2022, and August 9th, 2022. Considering the project's time constraints, the team efficiently produced this report and the deliverables. With more time, the team could have conducted further research by interviewing more stakeholders and by looking into different case studies. This could have allowed the team to make more detailed, formulated and better informed recommendations. Nonetheless, the team is confident with these recommendations and hopes EEA will support the listed stakeholders in carrying out these ideas.

This project was carried out in order to help support the EE workforce, as workforce shortages are hindering the success of the industry despite the high demand and rapid growth. EE workers are fundamental to producing and installing energy-saving products and undertaking services that reduce energy consumption of buildings. Decreasing energy consumption of the built environment is imperative to decreasing greenhouse gas emissions and reaching many climate goals, such as the goal to reach a 100% clean-energy economy in NJ and PA. Overall, the building sector needs EE workers to carry out this work. The recommendations compiled in this report are made for EE industry employers, training providers, CBOs, and government agencies through research and work with EE stakeholders. If followed, these recommendations will improve and widen recruitment strategies, increase retention, improve efficacy of training programs, expand the diversity of the workforce, increase government support of workforce development, and encourage collaboration between these stakeholders. To support these recommendations, the capstone team compiled multiple deliverables for EEA, including a Workforce Development Ecosystem Map, a stakeholder directory, and a policy statement. To arrive at these recommendations and deliverables, the team underwent several weeks of research that entailed interviews, case studies, and academic literature. Overall, the recommendations and deliverables serve as preliminary guidance for EEA moving forward.

ABOUT THE AUTHORS

Alan Chen led the New Jersey team through strategic research and data collection to generate a map visualizing the relationships between energy efficiency groups in the state. Alan served as the SUMA Student Association president and has experience consulting for various industries, including government and utilities.

Whitney Davis conducted due diligence on case study research, evaluation, selection, and synthesis. She earned her Bachelor of Arts from the University of California, Berkeley in Economics and has previous experience in ESG investing and venture capital.

Andrew McCracken identified and interviewed individuals within the energy efficiency field to gain valuable first-hand insights from stakeholder groups. He graduated magna cum laude from the University of Lynchburg with a joint major in environmental science and international relations. Andrew has curated a strong foundation of skill sets during his time in SUMA that he hopes to translate into real-world applications.

Caroline Murphy served as Deputy Manager facilitating efficient work plans and communicating directly with the EEA and Project Manager to execute deliverables. She has experience in corporate sustainability reporting and graduated magna cum laude from the University of Southern California.

Lucy August-Perna served as the outreach coordinator for New Jersey, conducting stakeholder interviews within the state and facilitating key takeaways and recommendations back to the team. She has strong management experience leading global sustainability teams and received a Bachelor of Arts from the University of California, Santa Barbara.

Charlotte Silverman managed the project's main objectives and deliverables from start to fruition as the Project Manager. Charlotte worked closely with the EEA and the team to direct workflows utilizing her previous experience leading groups. Charlotte graduated with a Bachelor of Arts from the University of St Andrews.

Zhong Yi Lee was the Team Analyst, conducting external due diligence on the energy efficiency sector, facilitating write-ups, and representing the team in capstone presentations. He has experience in international affairs, working to innovate and streamline Singapore's sustainable maritime efforts.

Allison Zhang organized the Pennsylvania team, leading research and analysis on existing stakeholder groups in the state to illustrate working relationships, inflows, and outflows of people and resources. Allison has a Bachelor of Science from the University of Richmond and previous experience in waste management and sustainability consulting.

REFERENCES

- Blocpower. 2022. Team - BlocPower. [online] Available at: <<https://www.blocpower.io/blocpower-team>> [Accessed 23 July 2022].
- Blocpower. 2022. BlocPower's Civilian Climate Corps. [online] Available at: <<https://www.blocpower.io/workforce-development>> [Accessed 23 July 2022].
- Blocpower. 2021. BlocPower Producing Short Film Series Documenting its Civilian Climate Corps. [online] Available at: <<https://www.blocpower.io/press-release/blocpower-producing-short-film-series-documenting-its-civilian-climate-corps>> [Accessed 23 July 2022].
- Castigliego, J. and Stanton, L., 2022. New Jersey's Clean Energy Transition: Economic Impacts. [online] Available at: <https://static1.squarespace.com/static/5936d98f6a4963bcd1ed94d3/t/629f8481dbaaee655a1714d61/1654621315515/New+Jersey+Jobs_Webinar_AEC_2Jun2022.pdf> [Accessed 24 July 2022].
- Congressional Research Services. 2021. The Weatherization Assistance Program Formula. [online] Available at: <<https://sgp.fas.org/crs/misc/R46418.pdf>> [Accessed 3 Aug. 2022]
- Clean Energy Center. 2022. PA WAP Continuing Education Reimbursement Guidelines. [online] Available at: <<https://www.pct.edu/media/481/download>> [Accessed 3 Aug. 2022]
- DCSEU. 2022. About the DCSEU | DC Sustainable Energy Utility. [online] Available at: <https://www.dcseu.com/about?gclid=CjwKCAjwquWVBhBrEiwAt1KmwqjAindL4IXV4HPw6dHfvWXqaEKQziiqygPQ3VLDaVXE9IMOFg47GBoCnGoQAvD_BwE> [Accessed 23 July 2022].
- DCSEU. 2022. Capacity Building Training Opportunities | DC Sustainable Energy Utility. [online] Available at: <<https://www.dcseu.com/contractors/cbe-capacity-trainings-certifications>> [Accessed 23 July 2022].
- DCSEU. 2022. Workforce Development | DC Sustainable Energy Utility. [online] Available at: <<https://www.dcseu.com/workforce-development>> [Accessed 23 July 2022].
- DCSEU. 2022. Annual Report 2021. [online] Available at: <<https://www.dcseu.com/Media/Default/docs/about-us/DCSEU-FY2021AnnualReport-web.pdf>> [Accessed 23 July 2022].
- Department of Labor & Industry. 2022. Industry Partnerships. [online] Available at: <<https://www.dli.pa.gov/Businesses/Workforce-Development/Pages/Industry-Partnerships.aspx#:~:text=PA%20Smart%20Industry%20Partnership%20grants%20provide,educational%20needs%20of%20Pennsylvania%20industries.>> [Accessed 25 July 2022].
- E4thefuture.org. 2022. Energy Efficiency Jobs in America. [online] Available at: <<https://e4thefuture.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019-National-Summary.pdf>> [Accessed 25 July 2022].
- Eia.gov. 2022. U.S. Energy Information Administration - EIA - Independent Statistics and Analysis. [online] Available at: <<https://www.eia.gov/state/?sid=PA>> to Employment. [online] Available at: <<https://www.governor.pa.gov/newsroom/governor-wolf-announces-2-5-million-in-schools-to-work-grants-to-create-student-pathways-to-employment/>> [Accessed 25 July 2022].

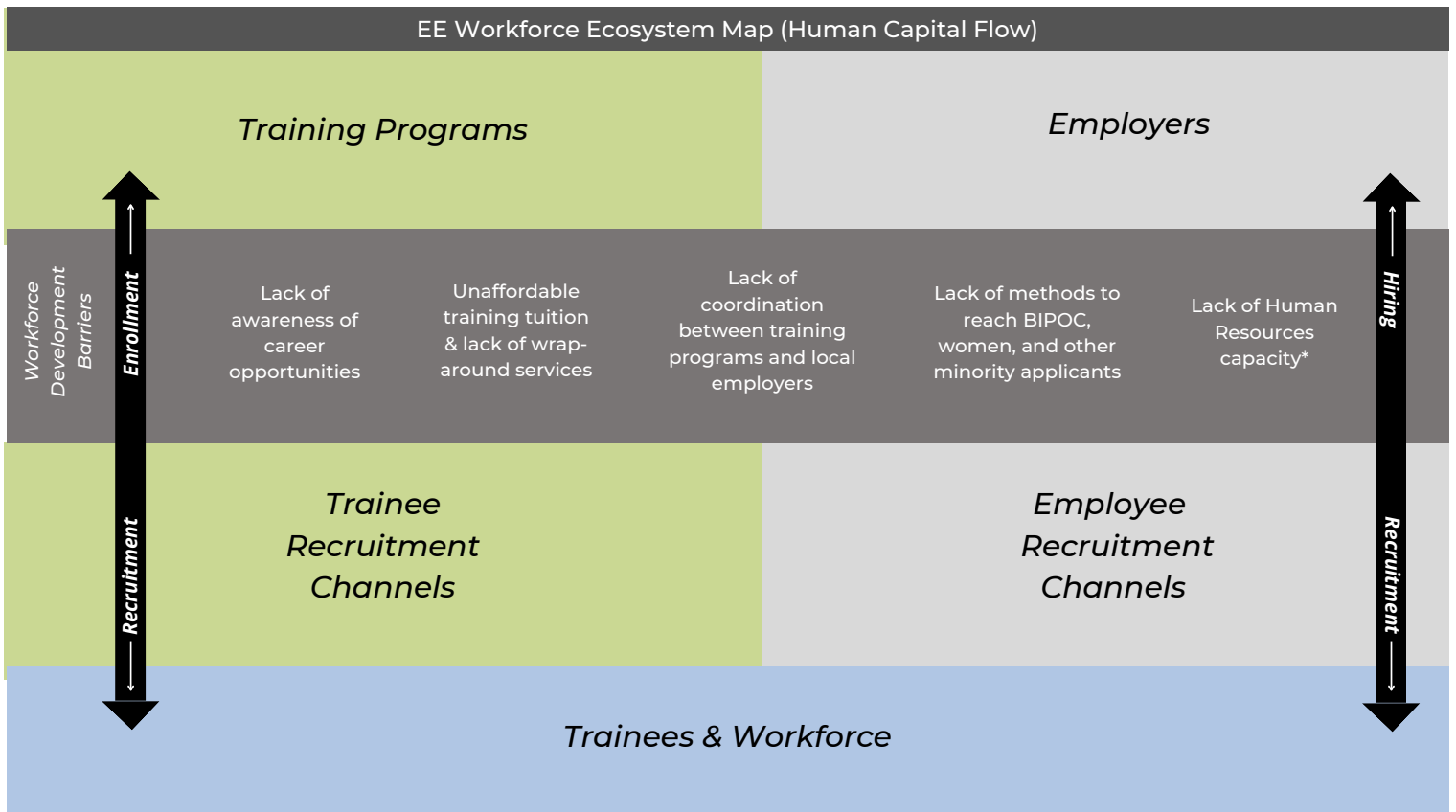
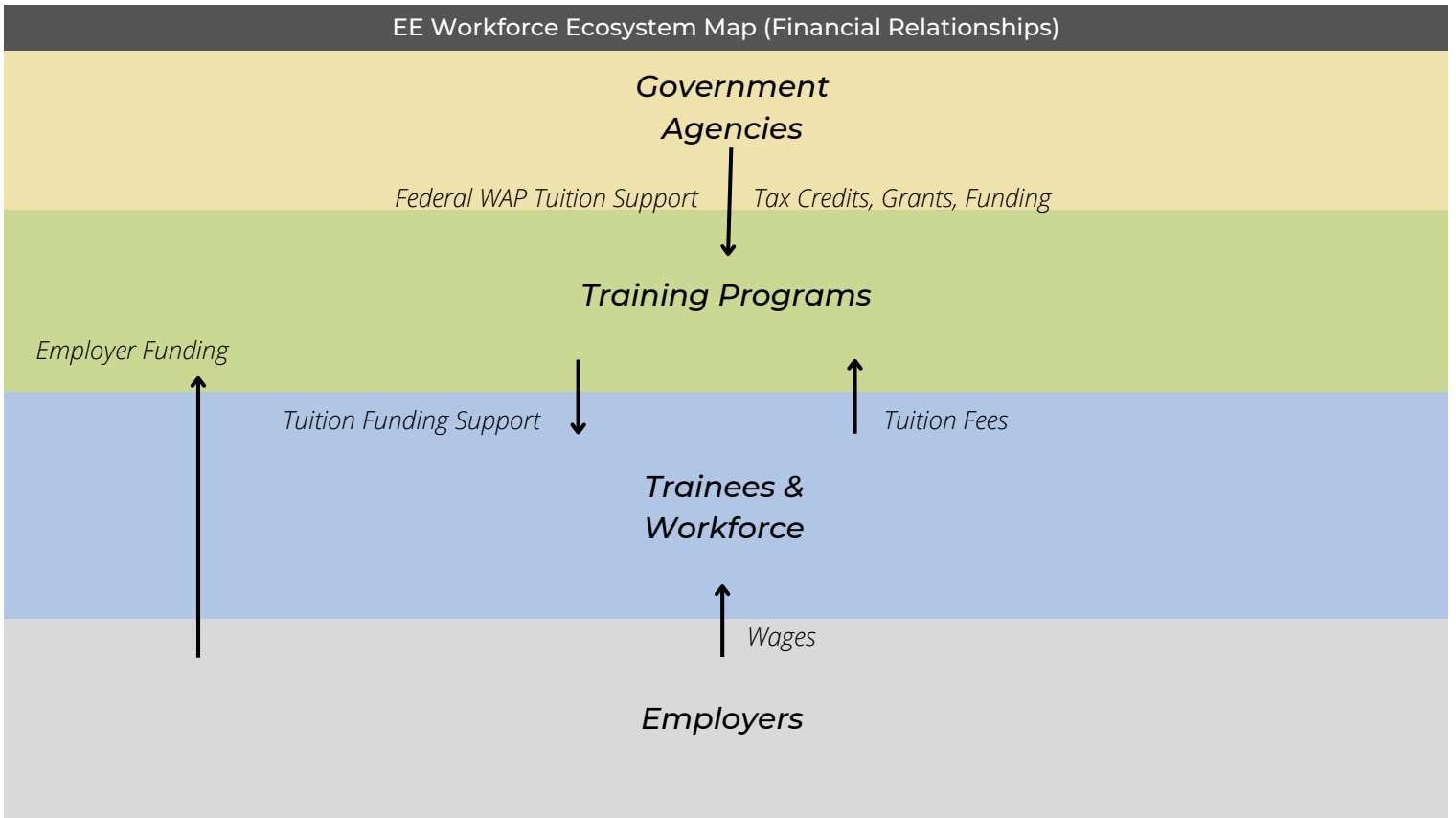
-
- Kopko, K., 2021. Pennsylvania Senate State Government Committee Hearing. [online] Center For Rural Pennsylvania. Available at: <<https://stategovernment.pasenategop.com/wp-content/uploads/sites/30/2021/05/CRP-Rural-Demographics-May-2021.pdf>> [Accessed 30 July 2022]
 - National Urban League. 2022. Local Affiliates. [online] Available at: <<https://nul.org/local-affiliates>> [Accessed 23 July 2022].
 - Electric Energy Online. 2020. Tennessee Valley Authority Awards Tennessee Urban League Affiliates \$871,000 to Continue Energy Efficiency Training. [online] Available at: <<https://electricenergyonline.com/article/energy/category/climate-change/82/866247/tennessee-valley-authority-awards-tennessee-urban-league-affiliates-871-000-to-continue-energy-efficiency-training-program.html>> [Accessed 23 July 2022].
 - Employment and Training Administration. 2022. Workforce Innovation and Opportunity Act. [online] Available at: <<https://www.dol.gov/agencies/eta/wioa>> [Accessed 27 July 2022].
 - Energy.gov. 2022. U.S. Department of Energy Offers Targeted Technical Assistance for Manufacturers in Former Coal Communities. [online] Available at: <<https://www.energy.gov/eere/amo/articles/us-department-energy-offers-targeted-technical-assistance-manufacturers-former>> [Accessed 25 July 2022].
 - Faces of EE. 2021. Support Your Local Energy Efficiency Industry. [online] Available at: <<https://e4thefuture.org/how-we-help/faces-of-ee/>> [Accessed 2, Aug. 2022]
 - Flessner, David. Chattanooga Free Times Press. November 2020. TVA extends energy efficiency training programs by Tennessee’s Urban League chapters. [online] Available at: <https://www.timesfreepress.com/news/business/aroundregion/story/2020/nov/10/tvextends-energy-efficiency-training-programs/535826/> [Accessed 23 Jul. 2022].
 - Governor Tom Wolf. 2022. Governor Wolf Announces \$2.5 Million in ‘Schools-to-Work’ Grants to Create Student Pathways to Employment. [online] Available at: <<https://www.governor.pa.gov/newsroom/governor-wolf-announces-2-5-million-in-schools-to-work-grants-to-create-student-pathways-to-employment/>> [Accessed 25 July 2022].
 - Kopko, K., 2021. Pennsylvania Senate State Government Committee Hearing. [online] Center For Rural Pennsylvania. Available at: <<https://stategovernment.pasenategop.com/wp-content/uploads/sites/30/2021/05/CRP-Rural-Demographics-May-2021.pdf>> [Accessed 30 July 2022].
 - National Urban League. 2022. Local Affiliates. [online] Available at: <<https://nul.org/local-affiliates>> [Accessed 23 July 2022].
 - Nj.gov. 2022. NJDEP-Air Quality, Energy & Sustainability. [online] Available at: <<https://www.nj.gov/dep/aqes/opea-clean-energy.html>> [Accessed 27 July 2022].
 - Nj.gov. 2022. Energy Master Plan | About the Energy Master Plan. [online] Available at: <<https://www.nj.gov/emp/energy/>> [Accessed 27 July 2022].
 - NYSERDA. 2022. About NYSERDA - NYSERDA. [online] Available at: <<https://www.nyserda.ny.gov/About>> [Accessed 23 July 2022].
-

-
- NYSERDA. 2022. Funding - NYSERDA. [online] Available at: <<https://www.nyserderda.ny.gov/About/Funding>> [Accessed 23 July 2022].
 - NYSERDA. 2022. Clean Energy Workforce Development - NYSERDA. [online] Available at: <<https://www.nyserderda.ny.gov/all-programs/clean-energy-workforce-development>> [Accessed 23 July 2022].
 - NYSERDA. 2022. Diversity, Equity, and Inclusion at NYSERDA - NYSERDA. [online] Available at: <<https://www.nyserderda.ny.gov/About/Diversity-Equity-and-Inclusion-at-NYSERDA>> [Accessed 23 July 2022].
 - NYSERDA. 2022. Doing Business with NYSERDA - NYSERDA. [online] Available at: <<https://www.nyserderda.ny.gov/About/Doing-Business-with-NYSERDA>> [Accessed 23 July 2022].
 - Pennsylvania Department of Environmental Protection. 2021. 2021 PENNSYLVANIA CLEAN ENERGY INDUSTRY Workforce Development Needs Assessment & Gap Analysis. [online] Available at: <https://files.dep.state.pa.us/Energy/Office%20of%20Energy%20and%20Technology/OETDPortalFiles/2021CleanEnergyGapAnalysis/PA_2021_Clean_Energy_Gap_Analysis_Report.pdf> [Accessed 22 July 2022].
 - Rggi.org. 2022. New Jersey Participation | RGGI, Inc.. [online] Available at: <<https://www.rggi.org/program-overview-and-design/design-archive/nj-participation>> [Accessed 27 July 2022].
 - Ross, L., Drehobl, A. and Stickles, B., 2018. The High Cost of Energy in Rural America: Household Energy Burdens and Opportunities for Energy Efficiency. [online] Aceee.org. Available at: <<https://www.aceee.org/sites/default/files/publications/researchreports/u1806.pdf>> [Accessed 22 July 2022].
 - Securities and Exchange Commission. 2022. Tennessee Valley Authority Form 10-Q. [online] Available at: <<https://www.sec.gov/Archives/edgar/data/1376986/000095014407007844/g08970e10vq.htm#102>> [Accessed 23 July 2022].
 - Shoemaker, Mary. Alaya, Roxanna, York, Dan. American Council for Energy Efficiency Economy. October 2020. Expanding Opportunity Through Energy Efficiency Jobs: Strategies To Ensure A More Resilient, Diverse Workforce. [online] Available at: <https://www.aceee.org/sites/default/files/pdfs/u2010.pdf> [Accessed 23 Jul. 2022].
 - TVA EnergyRight. 2020. Brandon Bacon helps Chattanooga contractors find work with EnergyRight's Quality Contractor Network. [online] Available at: <https://energyright.com/2020/02/04/brandon-bacon-helps-chattanooga-contractors-find-work-with-energyrights-quality-contractor-network/> [Accessed 23 Jul. 2022].
 - United Nations. 2022. Causes and Effects of Climate Change | United Nations. [online] Available at: <<https://www.un.org/en/climatechange/science/causes-effects-climate-change>> [Accessed 23 July 2022].
 - U.S. Department Of Energy. 2021. United States Energy & Employment Report 2021.
 - 2021. Why The Building Sector? – Architecture 2030. [online] Available at: <<https://architecture2030.org/why-the-building-sector>> [Accessed 25 July 2022].
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APPENDIX

	Skill Level	New Jersey	Pennsylvania
Minimum Wage	N/A	\$13.00	\$7.25
Fast Food	Entry	\$13.07	\$12.47
Oil Field Worker	Average	\$18.28	\$17.31
HVAC Installer	Entry	\$27.79	\$25.10
Energy Advisor	Average	\$35.57	\$33.70
Building Engineer	Average	\$32.76	\$31.04
Quality Control Inspectors	Entry	\$20.14	\$19.08
Electricians	Entry	\$25.49	\$24.15
Weatherization Specialists	Entry	\$12.90	\$13.22
Heat Pump Specialists	Average	\$21.64	\$21.64

Appendix A: Average and Entry Level Wages for EE Workers in NJ and PA



Appendix B: EE Workforce Ecosystem Maps (Simple Versions)