



# Connecting Pre-Apprenticeships

to Registered Apprenticeships in Clean Energy  
Occupations



## WHY APPRENTICESHIP?

Apprenticeship is an acknowledged best practice in preparing job seekers with the skills required to master a given trade. Registered Apprenticeship (RA) is a structured program that combines on-the-job training (OJT) and mentorship under a skilled craftsperson with classroom instruction. Pre-apprenticeship, through job site and classroom training, prepares participants for successful entry into RAs. Pre-apprenticeships expose participants to the hard, technical skills required to be successful in various related trades and help prepare them with the soft, employability skills they will need to be successful in any trade. The Office of Apprenticeship (OA) identifies six key characteristics of high-quality pre-apprenticeship programs:<sup>1</sup>

- ▶ Industry-aligned curriculum, covering skills and topics that are in demand by employers, particularly by apprenticeship providers
- ▶ Hand-on experience with job tasks on a work site
- ▶ Outreach and recruitment to diverse communities – Diversity, Equity, Inclusion, and Accessibility (DEIA)
- ▶ Sustainable partnerships with employers and apprenticeship providers
- ▶ Formal agreements with RAs that facilitate entry for successful pre-apprenticeship graduates
- ▶ Supportive, or wrap-around, services for pre-apprentices

Approximately 30 states promote high-quality pre-apprenticeship programs, and approximately 20 states formally recognize or register pre-apprenticeship programs that exhibit most if not all the characteristics of a high-quality pre-apprenticeship program. One characteristic that all have in common is that they require the pre-apprenticeship program to have an established, formal agreement with a Registered Apprenticeship Program (RAP) that gives high priority to successful pre-apprenticeship graduates for entry into an apprenticeship.

### What is clean energy and why is it important?

For this paper's purposes, clean energy is anything that reduces atmospheric carbon in the generation, distribution, and use of electricity. For example, wind and solar sources generate no carbon in the generation of electricity. Microgrids and battery storage are technologies that reduce the burden on the electricity distribution grid, so fewer sources of generation are required over time. Energy efficiency technologies come in many forms, like lighting or heating and air conditioning or building envelope technologies and reduce the overall demand for electricity. Atmospheric carbon is reduced by optimizing generation, distribution, and utilization of electricity through clean energy sources and energy efficient uses. In turn, this mitigates the harmful effects of climate change. Clean energy, wind and solar, accounted

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<sup>1</sup> <https://www.apprenticeship.gov/employers/explore-pre-apprenticeship>



for 81% of new energy capacity installed in the U.S. in 2021,<sup>2</sup> and the clean energy workforce in the United States accounted for 50% of the total energy workforce of 7.9M in 2019.<sup>3</sup>

Clean energy infrastructure and jobs are important to everyone on the planet but have particular benefits for historically disadvantaged communities. To address this, the bipartisan Infrastructure Investment and Jobs Act (IIJA) of 2021<sup>4</sup> invested \$400 billion into clean energy infrastructure and jobs in three key areas: Foundational Investments, remedial investments, and resilience investments.

Foundational infrastructure investments are needed to reduce the energy burden on disadvantaged communities, which historically pay two to three times the amount for energy as a percentage of household income to the national average. Likewise, both rural and indigenous communities bear the highest energy costs and greatest barriers to clean energy solutions in the country. Further, these communities are most likely to be impacted by climate change and to want to do something about it.

Remedial infrastructure investments include upgrades to aging power distribution infrastructure. Investments will fund the new infrastructure needed to prevent future deficiencies. Low-income, rural communities, and communities of color are disproportionately burdened with the economic, health, and environmental impacts of legacy infrastructure, and underprepared for the clean energy transition. Remedial investments address these burdens and facilitate equitable access to new clean infrastructure.

Resilience infrastructure investments deploy clean-energy and energy-efficiency technologies not only for climate mitigation and economic benefits, but also to bolster the ability of vulnerable, underserved communities to withstand the impacts of climate change. Economic and infrastructure disparities disproportionately affect these communities. Microgrids, distributed generation, distributed electricity storage, and home weatherization are examples of community-led resilience upgrades to local critical infrastructure.

### What are clean energy jobs, and what do they do?

All these clean energy infrastructure investments lead to career opportunities for new labor market entrants and career changers. Jobs identified as “Green,” with skills impacting the reduction in atmospheric carbon, have grown 50% since 2019, accounting for almost 3% of all U.S. job postings.<sup>5</sup> Most of the occupations involved in the delivery of clean energy are familiar, requiring upgraded skills: Power Plant Operators, Electrical Power Line Installers &

<sup>2</sup> See: Federal Energy Regulatory Commission, <https://cms.ferc.gov/media/energy-infrastructure-update-december-2021>

<sup>3</sup> International Energy Agency, World Energy Employment, September, 2022: <https://www.iea.org/reports/world-energy-employment>

<sup>4</sup> <https://bipartisanpolicy.org/explainer/improving-equity-outcomes-for-new-federal-investments-in-clean-energy-infrastructure/>

<sup>5</sup> Lightcast 2023 Global Talent Playbook, <https://lightcast.io/resources/research/2023-global-talent-playbook>





Repairers, etc. Some occupations have risen from emerging clean energy technologies, like Wind Turbine Technician, Solar Photovoltaic Installer, etc. Common construction occupations like Electrician, Heating, Air Conditioning, and Refrigeration Mechanics and Installers, and Carpenter are critical to implementing clean energy and energy efficiency technologies and are thus in greater demand.<sup>6</sup>

PetroLMI separates the transferability of skills for workers in traditional energy occupations into three categories:<sup>7</sup>

- ▶ **Direct:** Essentially the same core qualifications, technical knowledge, skills, and work environment with a high likelihood of recruitment and retention in the sector.
- ▶ **Refocus:** Similar work but some skill or knowledge upgrading is likely required to increase the chance of a successful transition.
- ▶ **Reboot:** The work is very different; there is a need to invest significant effort to qualify for a position.

Very few occupations in the energy or construction trades require a full reboot of skills and training to transition to clean energy generation and delivery. In a survey of knowledge, skills, and abilities (KSAs) required for conventional jobs versus those specifying clean energy, these commonalities and disparities were present for five high-demand construction occupations:

Clean Energy Occupations	Selected Foundational KSAs	Clean Energy KSAs
Carpenters	Reading and understanding blueprints and drawings	Experience in air sealing, insulation, venting to exterior, and other remodeling to make homes energy efficient.
Electricians	Occupational Safety and Health Act (OSHA) training Ability to interpret electrical schematics and blueprints.	Technical knowledge of electric vehicle (EV) chargers, solar power installations, or other applicable power electronics.
Plumbers, Pipefitters, and Steamfitters	Mechanically inclined with a preferred background in technical skills Perform physical activity with no restrictions in various climate conditions Ability to use power and hand tools	Heating Ventilation & Air Conditioning (HVAC) experience Heat pump installation
Roofers	Assess site prior to project start to obtain measurements. Ability to withstand different climates and temperatures. Knowledge of basic roofing tools	Make various repairs to home from solar installation including siding and drywall.
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Basic math computations needed to perform in the HVAC trade Working with hand and power tools Ability to lift up to 50 lbs., stand, bend, stoop, sit, reach from heights and crawl spaces. Possess strong mechanical aptitude.	Possess an understanding of the refrigeration cycle and how to accurately diagnose or install a heat pump. Possess CFC/EPA certification & Apprenticeship license for non-helper positions.

<sup>6</sup> [https://www.onetcenter.org/dictionary/22.0/excel/green\\_occupations.html](https://www.onetcenter.org/dictionary/22.0/excel/green_occupations.html)

<sup>7</sup> Careers in Energy, an initiative of PetroLMI (Canada), <https://careersinenergy.ca/assess-your-career-change/>



In addition, many of the occupations have KSAs in common, regardless of the trade. Here is a representative sample:

KSA Area	Occupations
Critical Thinking — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.	Carpenters Electricians Insulation Workers Plumbers Roofers HVAC Mechanics
Building and Construction — Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.	Carpenters Insulation Workers Plumbers Roofers HVAC Mechanics
Mechanical — Knowledge of machines and tools, including their designs, uses, repair, and maintenance.	Carpenters Electricians Insulation Workers Plumbers HVAC Mechanics
Problem Sensitivity — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.	Carpenters Electricians Plumbers HVAC Mechanics
Design — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.	Carpenters Electricians Plumbers
Deductive Reasoning — The ability to apply general rules to specific problems to produce answers that make sense.	Electricians Plumbers HVAC Mechanics
Mathematics — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.	Carpenters Electricians

Pre-apprenticeship programs that prepare participants in these areas are already preparing them with the foundational skills needed in clean energy jobs. A 2009 report by the Department of Labor even expressed concern about “boutique training providers within the green industry” offering training too narrow in scope for long term career and wage sustainability. Pre-apprenticeship and apprenticeship training programs should focus more broadly on these foundational skills to ensure employment beyond “immediate jobs.”<sup>8</sup>

Appendix A lists more than twenty apprenticeable jobs related to clean energy and energy efficiency accounting for over 700,000 annual openings through 2031. While there are new and emerging apprenticeable jobs in clean energy, many of the skills required to master a given trade that isn't expressly a clean energy trade are already required and easily transferred, regardless of whether or not the job is green. For example, while this paper has focused on more technical and trade occupations, many sales positions are apprenticeable;

<sup>8</sup> “The Greening of Registered Apprenticeship,” US Department of Labor Employment and Training Administration, p.20, [https://www.doleta.gov/oa/pdf/greening\\_apprenticeship.pdf](https://www.doleta.gov/oa/pdf/greening_apprenticeship.pdf)



sales skills are readily transferrable to clean energy, requiring only modest additional training in the energy product being sold. This is good news for pre-apprenticeship programs that are preparing students and job seekers for apprenticeships: Focus on the basics, and layer energy efficiency and clean energy concepts into instruction.

### Equitable access to pre-apprenticeships

DEIA creates opportunities for high-quality pre-apprenticeship programs to thrive. There are many structural and institutional factors involved, but young people from Black, Indigenous, and People of Color (BIPOC) communities historically have tended to be channeled into lower-skilled occupations and apprenticeships, like Helper occupations. This has led to outcome disparities with their non-disadvantaged peers who begin their careers from a higher point on the career ladder. It also has created disparities in access to skilled labor within those communities.<sup>9</sup>

Disadvantaged communities express greater concern than the general population over the effects of climate change. A community study by Puget Sound Sage found overwhelming support for carbon reduction strategies and deep concern over food insecurity as costs rise due to changing climate.<sup>10</sup> Clean energy jobs are important to these communities. High-quality pre-apprenticeships give participants greater access to RAs that enable them to acquire the skills needed to positively impact issues that matter to their communities.

Enriching RAs and the workforce at large with DEIA must begin with policy and planning that incorporates DEIA goals from the start. In addition to the accepted practices for a high-quality pre-apprenticeship, the Center for Law and Social Policy (CLASP) advocates that these goals be considered regarding disadvantaged and under-represented populations:<sup>11</sup>

- ▶ Increasing access to family-sustaining career paths for youth, low-wage workers, and adults who face barriers to employment
- ▶ Diversifying the workforce in an industry
- ▶ Preparing potential apprentices to pass entrance exams
- ▶ Providing wraparound supports for potential apprentices, such as childcare, transportation, etc.

Workforce stakeholders are thus served by satisfying community demand for access to family-sustaining jobs with benefits, industry demand for talent, funder demand for diverse workforce outcomes, and employer demand for experienced candidates.

### Some examples of high-quality pre-apprenticeship programs

Finally, interviews with and case studies of a few high-quality pre-apprenticeship programs yielded some differences in approach and some commonalities in emphasis.

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<sup>9</sup> Interview with Steve Gelb, Northwest Regional Director, Emerald Cities Collaborative, <https://emeraldcities.org>

<sup>10</sup> <https://pugetsoundsage.org/research/clean-healthy-environment/our-people-our-planet-our-power/>

<sup>11</sup> Excerpted from The Center for Law and Social Policy (CLASP), <https://www.clasp.org/publications/report/brief/principles-high-quality-pre-apprenticeship-model-advance-equity/>





The Kern County Electrical Apprenticeship, IBEW Local 428, established a pre-apprenticeship program to address what they saw as common deficiencies in apprentice candidates. Gaps identified were math skills and soft skills, like time-management, communication, and dependability. The pre-apprenticeship used two instructional partners, the Kern County Community College District<sup>12</sup> and the North American Building Trades Union (NABTU) Multi-Craft Core Curriculum (MC3).<sup>13</sup> MC3 covers multiple building trade occupations in a minimum of 120 instructional hours, including eight hours of green construction training. The community college program includes instruction in electric vehicle charging station installation and maintenance. All participants spend two days on job sites for all trades. Through formal agreements with employers, the Kern County pre-apprenticeship program has achieved an 85% placement rate for its graduates.<sup>14</sup>

The Southwest Mountain States Regional Council of Carpenters (Southwest Carpenters) uses a pre-apprenticeship curriculum developed by the Carpenters International Training Fund division of the United Brotherhood of Carpenters and Joiners of America. Career Connections' K-14 program<sup>15</sup> covers 14 different crafts and is used in ten southwestern states. Hard skills training includes fundamentals of math, tool familiarity, scaled projects in wood framing, metal framing, drywall applications, concrete formwork, and installation of doors and windows. Soft skills training includes dependability, reliability, work ethic, and teamwork. Career Connections emphasizes that its occupations are physically and environmentally demanding, so participants are exposed to many job site conditions to ensure that they are prepared for what they will face as apprentices. Career Connections has placed over 100 high school graduates into RAs since 2019, despite the global pandemic's challenges. The related Brothers Keeper<sup>16</sup> pre-apprenticeship for men and Bringing Outstanding Opportunities for Tradeswomen Skills (BOOTS)<sup>17</sup> pre-apprenticeship for women have an 80% placement rate into RAs. Graduates of these programs work on a number of clean energy applications, including wind turbines, solar installations, hydrogen fuel cells, geothermal construction, and carbon capture projects.<sup>18</sup>

YouthBuild San Joaquin (YBSJ) in Stockton, California is a program of the Building Futures Academy of the San Joaquin County Office of Education. Using Carpenters Union curriculum, the Paxton Patterson Building Skills Construction curriculum, and MC3, YBSJ operates a nine-week pre-apprenticeship program. YouthBuild includes two

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<sup>12</sup> <https://kccd.edu>

<sup>13</sup> <https://nabtu.org/apprenticeship-and-training/apprenticeship-readiness-programs/>

<sup>14</sup> Interview with Anthony Ausbie, Training Director, Kern County Electrical Apprenticeship JATC, <https://kerncountyjatc.com>

<sup>15</sup> <https://swmscarpenters.org/career-connections/>

<sup>16</sup> <https://www.swmsctf.org/programs-partnerships/brothers-keeper/>

<sup>17</sup> <https://www.swmsctf.org/programs-partnerships/bridging-outstanding-opportunities-with-tradeswomen-skills/>

<sup>18</sup> Interview with Jeffrey Scott, Outreach Director and other members of the Southwest Carpenters, <https://swmscarpenters.org>



weeks of Mental Toughness instruction, designed to remediate basic literacy and numeracy, and screen for participants' general aptitude for the building trades. During the program, participants can earn multiple industry-recognized credentials. YBJS pays for participant tools, safety equipment, and initiation fees. YBSJ negotiated direct entry agreements for its graduates with the Carpenters Training Council of Northern California with an innovative twist: one woman must be indentured before four men can be indentured, ensuring opportunities for women, who are traditionally under-represented in the construction trades. On successful completion, YBSJ graduates are given credit for their YouthBuild instruction, entering their apprenticeships as 2<sup>nd</sup> period apprentices.<sup>19</sup>

The Clean Energy Youth Apprenticeship Program (CEYA)<sup>20</sup> in North Carolina builds on a career pathway in utility-scale solar energy. Sponsored by the North Carolina Business Committee for Education, the State Energy Office, and North Carolina A&T University, CEYA starts high school students in a pre-apprenticeship program in solar energy, resulting in a North Carolina Pre-Apprenticeship Certification and an E-FLIP Energy Efficiency Certification. Participants do classroom work at local community colleges and are paid for their OJT through state grants; financial support includes wrap-around services like meals and transportation. The pre-apprenticeship is connected to an RA with Strata Energy, a utility-scale solar energy provider. Once enrolled as a registered apprentice, participants earn college credit for their related technical instruction and are entitled to free tuition at North Carolina community colleges under state law. Participants who complete their apprenticeship usually either enter full-time employment, use their apprenticeship credential and instructional credits to pursue a four-year degree, or both: work while taking college courses toward a degree. CEYA has further spawned STEPS4GROWTH, a \$23.7M grant-funded, clean energy sector workforce development program, including pre-apprenticeships and RAs in renewable energy, energy efficiency, clean vehicles, and grid resiliency.<sup>21</sup> In the summer of 2023, over 100 high school students are expected to participate in the program as pre-apprentices.<sup>22</sup>

### Suggested pre-apprenticeship best practices

The California Department of Industrial Relations, Division of Apprenticeship Standards (DAS), published an advisory of best practices for pre-apprenticeship programs preparing

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<sup>19</sup> Pathways to Apprenticeship: Profiles of YouthBuild Pre-Apprenticeship Programs, YouthBuild USA, November 2015

<sup>20</sup> <https://www.nccareerlaunch.org/career-pathways/clean-energy>

<sup>21</sup> <https://governor.nc.gov/news/press-releases/2022/08/03/governor-cooper-and-us-commerce-secretary-raimondo-announce-significant-federal-funding-build-clean>

<sup>22</sup> Interview with Caroline Sullivan, Executive Director, North Carolina Business Committee for Education: <https://ncbce.org>





participants for RAs.<sup>23</sup> These practices are reinforced by what was learned in interviews and case studies of high quality pre-apprenticeship programs:

Selected DAS Best Practices	Interviews & Case Studies
Pre-apprenticeships should include a mixture of hands-on training in the field and classroom training from industry practitioners. Participants should be pre-screened for their ability to do the work and provided remedial assistance if not.	Job site training should expose participants to the physical labor and sometimes harsh working conditions of clean energy jobs to establish participants' desire and aptitude for this type of work.
Participants should learn hard skills, like tool use, mechanical skills, etc.; literacy, numeracy, and communication skills; employability skills; and life skills, like time management, diversity, and sexual harassment training and prevention.	Numeracy and literacy are a common gap that pre-apprenticeships may have to address and remediate.
Participants should not pay a fee but may be paid a stipend; participants should never do productive work for private gain.	Stipends may also come in the form of college credit or tuition. Other supports, like meals and transportation, are important for bringing disadvantaged participants into the workforce.
Include industry recognized certifications in the training.	Post-secondary education and RA are not mutually exclusive goals; both may be encouraged and incentivized in pre-apprenticeship programs.

Direct entry agreements with RAPs are critical, however they are constituted: direct acceptance, guaranteed interviews, classroom training credit, etc. And it is important to be intentional about DEIA goals in the recruitment and placement of pre-apprentices (YouthBuild San Joaquin is an excellent example).

### Launching a High-Quality Pre-Apprenticeship Program in Clean Energy

All successful employment training programs exist in the context of local employer needs, and apprenticeship programs begin with and focus on employers. Likewise, pre-apprenticeship programs that are to be successful in preparing participants for apprenticeship should begin with addressing employer needs in their local context. Following these steps in creating a pre-apprenticeship will yield a high probability of success in training and placing participants into clean energy jobs:

1. **Identify local employer needs.** Consult local employers in energy, construction, and utilities to identify their workforce needs and gaps. Determine hiring trends to identify in-demand occupations. Connect with local RAPs in clean energy businesses that would be candidates for formal articulation agreements. Industry organizations with local chapters are a good place to start. Begin building an advisory board of employers with hiring needs who would benefit from better-qualified entrants into apprenticeships.
2. **Develop the operational plan.** Create an operational plan for the pre-apprenticeship that will clearly outline the entry and success requirements for the pre-apprenticeship, the scope of hard and soft skills training, credentials to be offered, target population demographics, participant

<sup>23</sup> <https://www.dir.ca.gov/das/BP-Pre-Apprenticeship.pdf>



prerequisites, legal and insurance requirements, and employer partners. All clean energy pre-apprenticeship programs should include safety training. Demographics should include minimum age and DEIA considerations. Prerequisites should include academics, licensing, and for many clean energy occupations, physical capabilities and accommodations. Legal and insurance considerations are particularly important for programs that cater to youth participants.

3. **Consult state requirements and resources.** Many states support pre-apprenticeship programs through recognition or formal registration.<sup>24</sup> Registration or recognition by a state apprenticeship body benefits the program by assuring potential participants and employers that the pre-apprenticeship program is high-quality and meets state standards for apprentice preparation. Many states also promote pre-apprenticeship programs so potential applicants can more easily find programs in their area of interest. Some states require or encourage remuneration for pre-apprentice job-site work and support services; some states provide grants to offset these costs. Alternately, some states prohibit pre-apprentices from being paid for work that apprentices or journey workers can do; it's important to know the local legal context. Consult the state apprenticeship agency to determine what requirements and resources are available and pursue state recognition or registration if available.
4. **Develop or choose curriculum.** It is critical that the pre-apprenticeship program teaches participants what local employers need them to know. Aligning curriculum with industry needs is always done in consultation with employers. An advisory board can be quite helpful. Several examples have been given of curriculum used by high-quality pre-apprenticeship programs; all began with employer needs and included remediation for basic math, communication, and employability skills.
5. **Develop a plan for hands-on, job-site training.** Pre-apprenticeship participants are not yet apprentices. While hands-on training is an essential part of high-quality pre-apprenticeship programs, employers can experience a drop in productivity if hands-on experience is conducted on an actual job site; strong employer partnerships are essential. Youth participants present additional challenges regarding job safety, worker insurance, and child labor laws; investigate these issues thoroughly with employer partners.
6. **Execute formal agreements with RA partners.** These agreements can take many forms but are essential to fulfil the mission of a pre-apprenticeship program preparing participants for entry into RA. Participants may be guaranteed direct entry into an apprenticeship or be guaranteed interviews. Credit may be given for classroom and/or job site hours. DEIA considerations may be built into entry agreements. Formal agreements make clear to participants, employers, and the training organization what the responsibilities and expectations are for all parties.
7. **Recruit.** Begin recruiting participants into the pre-apprenticeship program. Build DEIA into recruitment intentionally to encourage better DEIA outcomes at placement. Determine the needs of participants to be able to enroll and complete the pre-apprenticeship training; determine what resources are required to meet those needs, which could include transportation, meals, and child care. Enlist employer support in recruitment activities so participants know there are jobs at the end of the training.

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<sup>24</sup> [https://cyai2024.org/sites/default/files/2023-03/CYAI%20-%20Govt%20Support%20for%20Apprenticeship\\_March.%202023\\_508C.pdf](https://cyai2024.org/sites/default/files/2023-03/CYAI%20-%20Govt%20Support%20for%20Apprenticeship_March.%202023_508C.pdf)



Launching a high-quality pre-apprenticeship program begins and ends with employers. Knowing and meeting employer needs will greatly increase the probability of a pre-apprenticeship program's success in placing graduates.

## CONCLUSION

New and emerging clean energy jobs, and conventional trades jobs with an impact on the generation, distribution, and use of energy are critical to reducing the atmospheric carbon that is contributing to climate change, which has a disproportionate effect on disadvantaged communities who could benefit the most from these jobs. There are huge gaps in the supply and demand for workers to fill these jobs in an aging workforce. RA is an acknowledged best practice to give workers the skills needed to master these trades, and high-quality pre-apprenticeship programs are an excellent means of helping prepare potential workforce entrants to be successful in apprenticeships. Pre-apprenticeships do not have to convey all the hard skills necessary to master a given trade; that will happen in the apprenticeship itself. High-quality pre-apprenticeships should instead focus on things like tool use, safety, basic literacy and numeracy, and employability skills, exposing participants to a variety of related trades so participants can discover their own aptitudes for particular trades.

Diversity, equity, inclusion, and accessibility strengthen and broaden an organization's ability to meet its workforce needs and gaps. However, DEIA does not just happen; it must be strategically planned for in the earliest stages of workforce development. Building DEIA into pre-apprenticeship recruitment and placement strategies ensures a strong pipeline of qualified candidates to fill apprenticeship positions. This study has shown some innovative examples of DEIA strategies and identified best practices for pre-apprenticeship programs wishing to ensure success for their graduates as they enter RA and join the clean energy workforce.





## APPENDIX A: SELECTED CLEAN ENERGY AND ENERGY EFFICIENCY-RELATED OCCUPATIONS<sup>25</sup>

While this table is not exhaustive, each of these occupations represents an apprenticeship opportunity that high qualify pre-apprenticeship programs can take advantage of for their participants.

O*NET-SOC Code	Occupation Title	Skills Transferability	U.S. Median Hourly Wage (2021)	U.S. Total Employment (2021)	U.S. Annual Openings (2021-2023)
47-2061.00	Construction Laborers	Refocus	\$18.16	1,358,400	143,200
47-2131.00	Insulation Workers, Floor, Ceiling, and Wall	Direct	\$19.17	33,700	3,100
49-9071.00	Maintenance and Repair Workers, General	Refocus	\$20.76	1,539,100	160,100
47-2181.00	Roofers	Refocus	\$22.65	158,800	15,000
47-2231.00	Solar Photovoltaic Installers	Direct	\$22.92	17,100	2,500
51-9011.00	Chemical Equipment Operators and Tenders	Refocus	\$23.12	110,300	10,600
47-2031.00	Carpenters	Refocus	\$23.20	948,500	91,200
49-9021.00	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Refocus	\$23.38	394,100	40,100
19-4031.00	Chemical Technicians	Refocus	\$23.56	60,400	7,800
47-2211.00	Sheet Metal Workers	Refocus	\$25.69	129,100	12,300
49-9081.00	Wind Turbine Service Technicians	Direct	\$27.05	11,100	1,900
49-9041.00	Industrial Machinery Mechanics	Refocus	\$28.77	384,800	42,500
47-2152.00	Plumbers, Pipefitters, and Steamfitters	Refocus	\$28.79	469,000	48,600
47-2111.00	Electricians	Refocus	\$28.87	711,200	79,900
17-3026.00	Industrial Engineering Technicians	Refocus	\$28.95	64,200	6,600
47-4011.00	Construction and Building Inspectors	Refocus	\$29.63	129,200	14,800
49-2094.00	Electrical and Electronics Repairers, Commercial and Industrial Equipment	Refocus	\$29.68	52,800	5,000
51-8021.00	Stationary Engineers and Boiler Operators	Refocus	\$30.53	32,500	4,200

<sup>25</sup> <https://www.onetonline.org>



O*NET-SOC Code	Occupation Title	Skills Transferability	U.S. Median Hourly Wage (2021)	U.S. Total Employment (2021)	U.S. Annual Openings (2021-2023)
51-8091.00	Chemical Plant and System Operators	Refocus	\$33.75	22,400	2,300
49-9051.00	Electrical Power-Line Installers and Repairers	Refocus	\$37.65	126,600	11,100
51-8013.00	Power Plant Operators	Refocus	\$38.87	29,200	2,100



## APPENDIX B: USEFUL LINKS

- ▶ Apprenticeship.gov, Explore Pre-Apprenticeship:  
<https://www.apprenticeship.gov/employers/explore-pre-apprenticeship>
- ▶ Apprenticeship.gov, Apprenticeships in the Energy Industry:  
<https://www.apprenticeship.gov/apprenticeship-industries/energy>
- ▶ Apprenticeship.gov Apprenticeship Finder: <https://www.apprenticeship.gov/apprenticeship-job-finder>
- ▶ Apprenticeship.gov, Scaling Diversity Equity Inclusion Accessibility (DEIA) in Registered Apprenticeship:  
[https://www.apprenticeship.gov/sites/default/files/DOL\\_DEIAFactsheet\\_v2.pdf](https://www.apprenticeship.gov/sites/default/files/DOL_DEIAFactsheet_v2.pdf)
- ▶ Pre-Apprenticeships – Building Strong Apprentices:  
<https://apprenticeshipusa.workforcegps.org/resources/2017/04/10/11/56/Pre-Apprenticeships-Building-Strong-Apprentices>
- ▶ Department of Energy, The Greening of Registered Apprenticeships:  
[https://www.doleta.gov/oa/pdf/greening\\_apprenticeship.pdf](https://www.doleta.gov/oa/pdf/greening_apprenticeship.pdf)
- ▶ Department of Energy, Apprentices Earn While They Learn Building a Clean Energy Future:  
<https://www.energy.gov/articles/apprentices-earn-while-they-learn-build-clean-energy-future>
- ▶ Making Youth Apprenticeships Equitable and Effective: Lessons From North Carolina:  
<https://www.ncjustice.org/publications/making-youth-apprenticeships-equitable-and-effective-lessons-from-north-carolina/>
- ▶ Get Into Energy Jobs Board (includes clean energy apprenticeships): <https://getintoenergy.jobs>
- ▶ Center for Energy Workforce Development, Get Into Energy Apprenticeships:  
<https://getintoenergy.org/apprenticeships/>
- ▶ CareerOneStop.org, What Are Green Careers?  
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