



ILLINOIS CLEAN ENERGY JOBS AND TRAINING PROGRAM INVENTORY

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SUMMARY

The Climate and Equitable Jobs Act (Illinois Public Act 102-0662, also known as “CEJA”) establishes the Illinois policy to equitably transition the state to 100 percent clean energy by 2050. As part of this, the Illinois Department of Commerce and Economic Opportunity (DCEO) is responsible for implementing CEJA workforce programs that prepare the Illinois workforce for this clean energy transition. DCEO is also responsible for identifying the career pathways and training curriculum needed, based on comprehensive stakeholder input, so that workers are ready and able to enter clean energy jobs.

This report is intended to inform the design of the Clean Energy Jobs Curriculum that will be used in two of the workforce programs: The Clean Jobs Workforce Network Program and the Returning Residents Clean Jobs Training Program. It assesses existing clean energy training and skills development programs in Illinois. It evaluates industry employment trends to identify in-demand career opportunities for clean energy workforce training participants. Finally, it identifies best practices and programmatic gaps that will need to be addressed to support the industry requirements of in-demand clean energy occupations.

Request for public input

We invite public input on this report and its findings through a [Request for Information](#). This report’s findings and stakeholder input will inform the curriculum development process and workforce program design.

Illinois in-demand clean energy jobs

This report identifies in-demand, entry-level clean energy jobs in Illinois that would be an appropriate focus for the Clean Energy Jobs Curriculum. We evaluated jobs data from existing reports from the Department of Labor (DOL), the Illinois Department of Employment Security (IDES), and other sources. We assessed job titles and industry types based on the following criteria: a) number of annual job openings and total jobs; b) education and training requirements; c) expected growth; d) salary; and d) need for specific clean energy training.

We reviewed Workforce Innovation and Opportunity Act (WIOA) Regional Plans and found very few mentions of clean energy jobs and industries in their assessments of key regional industry sectors. Further, the currently available data for jobs in the solar and wind industries are

lacking or inadequate. When developing clean energy training programs, it will be important to coordinate with employers and regional workforce partners to ensure strong network connections and coherent workforce pathways for the clean energy sector.

Among job titles that are related to clean energy, the jobs in Illinois with the largest number of workers in 2018 were maintenance and repair workers, construction laborers, machinists, automotive service technicians and mechanics, and carpenters. Plumbers, industrial machinery mechanics, electricians, and maintenance & repair workers are expected to see strong job growth. We recommend that the curriculum framework focus on entry-level jobs within the following six career clusters in the table below.

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Table 1: Preliminary list of clean energy career clusters with examples of job titles

Cluster	Examples of Entry-Level Jobs	
Cluster 1: Solar & Wind	Solar photovoltaic (PV) installers Solar sales representatives and assessors	Wind turbine service technicians
Cluster 2: Automotive (EV focus)	Electric vehicle service technicians, mechanics	Bus and truck mechanics
Cluster 3: Electrical	Electrician	Electrical & electronic engineering technicians
Cluster 4: Green building construction	Construction laborers (including weatherization installers) Carpenters	Roofers Construction & building inspectors (including energy auditors)
Cluster 5: Building maintenance	Heating, ventilation, air conditioning and refrigeration (HVAC/R) mechanics & installers Maintenance & repair workers, general	Plumbers, pipefitters, & steamfitters Industrial maintenance mechanics
Cluster 6: Manufacturing clean energy technologies	Sheet metal worker Machinist	Machine tool setters, operators, tenders Welder, cutter, solderer, brazer

Training, skill and knowledge requirements

Next, we identified the general training and education requirements for each of the career clusters on our list. Most typically require a training period of 1-2 years, while some require a training period of 3-12 months. We summarized skills that are required across the different jobs, based on information from the Department of Labor’s O*Net Online (Table 2). We recommend that the curriculum focus on these core skills and knowledge requirements so that students are prepared for multiple jobs in the clean energy industry.

Table 2: Top employability, technical skills, and knowledge requirements

Top employability skills	Top technical skills	Top knowledge requirements
Critical thinking Judgment and decision-making Speaking Active listening Coordination Time management Active learning Reading comprehension	Monitoring Quality control Troubleshooting Operations & control Repairing Complex problem solving Equipment maintenance	Mechanical English language Math Building/construction Customer service Design Administration and management Engineering technology

We also identified common certifications and credentials in these industries, along with technical training gaps. Some of these gaps are described in the table below.

Table 3: Technical skill gaps in clean energy training.

Career cluster	Technical training gaps
Solar/wind	Solar training should include some basic construction training (such as the NCCER curriculum) if students do not already have construction training.
Automotive	Plentiful automobile service technician training programs exist, but very few that address electric vehicles. Need for stackable certificates to teach people to service electric vehicles that includes high voltage electrical safety, AC-DC systems, etc.
Electrical	Electrical training should include more focus on EV Infrastructure training, utility interconnection, installing electric storage devices, and demand response integration technologies.
Green building & construction	Greater focus is needed on whole-building system approaches, energy efficiency generally, making homes and buildings EV ready, and meeting energy code and net zero requirements. In addition, the focus of construction training programs tends to be new construction, rather than retrofits of older buildings, which require special analysis and strategies to improve energy efficiency.
Building maintenance	More training is needed on electrification technologies (such as heat pumps), demand response technologies, air sealing, and weatherization.

Workforce system best practices and gaps

Based on previous research of clean energy workforce systems in Illinois, we identified challenges and best practices, as shown in the table below.

Table 4: Clean energy workforce system challenges and solutions

Challenge	Solutions
Lack of communication & coordination among various parts of the workforce system	<ul style="list-style-type: none"> Improve coordination among employers and training providers Improve coordination among community support providers, training providers, and workforce agencies Coordinate and streamline communication channels to reduce confusion
Lack of awareness and/or negative perceptions of clean energy jobs	<ul style="list-style-type: none"> Promote clean energy literacy in the schools Help students and incumbent workers explore career options through hands-on opportunities Engage in outreach to K-12 schools and community organizations Develop engaging career and job resources
Workforce trainees with inadequate skills for emerging clean energy jobs	<ul style="list-style-type: none"> Support trade programming at high schools Integrate newer clean energy technologies into existing curricula and continuing education Provide work-based learning in clean energy Teach stackable, broad, transferrable skills Provide more job readiness and soft skill training
Failure to reach and support diverse, underserved populations	<ul style="list-style-type: none"> Form diverse stakeholder and advisory groups, including community-based organizations Promote diversity through inclusive training program policies and by collecting and evaluating outcomes. Target underserved populations for training programs and increase outreach to these populations. Make training more accessible and feasible by providing comprehensive support services Make sure training leads to good jobs with livable wages.

Next, we reviewed each of the 10 Illinois WIOA Regional Plans to summarize potential strengths and weaknesses related to growing the clean energy workforce in these regions. The plans mention a need for more communication, coordination, and information sharing between workforce partners. Regions noted that there were too many jobseekers that go through training who do not find jobs, suggesting a lack of coordination among employers, training providers, and support providers. They noted a need for a more cohesive approach for providing basic skills and soft skills training. Finally, most regions noted challenges with availability of wrap-around services, especially transportation and childcare.

Clean energy training program inventory

We collected data on existing clean energy training programs in Illinois that prepare people for the entry-level jobs on our list. The purpose of this inventory was to assess what programs already exist, to explore gaps, and to identify ways the training programs could be enhanced to meet emerging clean energy needs. The main sources of our inventory included Illinois Community College Board reports, DCEO WIOA program reports, US Department of Labor lists of registered apprenticeships, Illinois Works [pre-apprenticeship programs](#) and FEJA solar training programs. We supplemented with web research to build as comprehensive a list of training programs as possible. We identified 1157 training programs for these clean energy-related jobs, and 856 of these are community college programs. The table below breaks down the number of programs identified per cluster.

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Table 5: Number of Illinois training programs in each clean energy cluster

Solar and wind	Automotive	Electrical	Green building & construction	Building maintenance	Manufacturing	Total
69	273	196	110	169	340	1157

For each program, we sought to collect information about training provider type, training outcome, description, location, cost, program length, program format, program pre-requisites and more for most of the programs on our list. In many cases, the information was not available. The greatest amount of data was available for community college programs. We were unable to collect detailed information about most of the apprenticeship programs, in part because many of these programs do not have a strong online presence. We were also unable to acquire a list of non-college programs related to these clean energy jobs; therefore, we suspect that our inventory under-reports private and community-based programs.

Program delivery recommendations

- **Training provider collaboration.** Community-based organizations, community colleges, and organized labor programs should coordinate efforts for clean jobs workforce program delivery that focuses on equity and meets the needs of participating job seekers. These organizations should align their respective strengths and capacities for short-term certification training, longer-term technical programs, community and employer engagement, and wrap-around services.
- **Address data shortage.** DCEO should work with the Illinois Board of Higher Education, the community colleges, and community-based workforce providers to address the shortage of workforce program data for assessment of outcomes and a more comprehensive inventory of training programs in the future.
- **Need better clarity on solar and wind job data.** Traditional sources of employment data do not adequately capture true jobs numbers in the rapidly changing solar and wind industries. DCEO and clean energy workforce training providers should coordinate closely with solar and wind companies to understand hiring needs. Otherwise we face two opposing risks: 1) train too many people who will not find jobs, or 2) fail to deliver an adequate pipeline of qualified workers.
- **Continue to grow partnerships with employers** to provide apprenticeship, internship, and work-based learning opportunities for students, and to ensure that students can connect to job opportunities when their training is complete.
- **Online and social media presence** is important to provide more information and to become better known by more prospective students.
- **More continuing education programs** are needed to help existing professionals develop the skills they need to meet the growing demand for clean energy products and services. Building inspector and energy auditor training programs are especially well suited for existing professionals who are looking for a career change or additional training.

Curriculum framework recommendations

- **Solar job training should be prioritized.** Solar installer training is well suited for stackable certifications that could be added to existing construction or electrical training programs. Solar training should include basic construction training, when students do not already have this training. Given the urgent demand for equity-eligible contractors, this training should be prioritized early on.
- **More electric vehicle (EV) training is needed.** There is no shortage of automotive training programs, but very few of these prepare students to repair and maintain electric vehicles. We recommend stackable electric vehicle certificates to address this need or integrating electric vehicle training into existing automotive certificate programs.
- **More electric vehicle charging infrastructure training is needed.** We recommend that electrician and electrical technician programs offer training to prepare people to install and maintain electric vehicle charging infrastructure. This will be a tremendous need soon and should be aligned with the Illinois Department of Transportation's [Electric Vehicle Infrastructure Deployment Plan](#). This could be a short certificate program added to an existing program or could be included in a larger curriculum.
- **More clean-energy focused multi-craft construction training is needed.** This training should cover a broad range of fields (carpentry, solar, electrical, HVAC, plumbing). There is a strong need to prepare workers for the growing demand for energy efficiency, electrification, and renewable energy services. Students who receive this training will be well-positioned to enter any number of clean energy jobs. Especially in geographic areas where the demand for a single clean energy technology may be limited, educating students broadly can help them transfer their skills from one job to another to meet demand.
- **Focus on quick wins and industry-recognized certifications.** There are several entry-level jobs in the clean energy industry that have relatively short training requirements and can effectively be delivered by community-based organizations. These training programs should focus on quick wins, cross-cutting skills, and industry-recognized certifications, when possible.
- **Focus on energy efficiency and electrification in construction, carpentry, or building maintenance training programs.** Training programs could, for instance, utilize BPI's Building Science Fundamentals course to teach these skills.

CLEAN ENERGY JOBS ANALYSIS

To identify a list of clean energy jobs for analysis, we first turned to the definition of clean energy jobs in the CEJA legislation. The Climate and Equitable Jobs Act section 5-25 on Clean Energy Jobs Curriculum defines clean energy jobs as jobs “in the solar energy, wind energy, energy efficiency, energy storage, solar thermal, green hydrogen, geothermal, electric vehicle industries, other renewable energy industries, industries achieving emission reductions, and other related sectors.” Other related sectors include “related industries involved in the manufacture, development, build, maintenance, or provision of ancillary services to renewable energy resources or energy efficiency products or services. These can also include the manufacture and installation of healthier building materials that contain fewer hazardous chemicals.” Further, clean energy jobs include “administrative, sales, other support functions within these industries and other related sector industries.”

We began by identifying a wide range of entry-level clean energy jobs that fit this definition. We reviewed several key clean energy jobs reports, including NREL’s [State-Level Employment Projections](#), the Department of Energy’s [U.S. Energy & Employment Jobs Report \(USEER\)](#) 2022, the

Brookings Institute’s [Clean Energy Jobs Report](#), the Interstate Renewable Energy Council’s [Clean Energy Career Maps](#), and the [New York Clean Energy Industry Report](#) 2021. Job titles and classifications are different across these sources. Ultimately, we decided to use the job titles associated with Department of Labor Standard Occupational Classification (SOC) system so that we could collect Department of Labor jobs data and training program information about these jobs.

We included jobs that were solely clean energy jobs (such as solar PV installer and wind energy service technician), as well as “green enabled jobs,” jobs that are primarily separate to the green economy but increasingly require green skills (e.g. an automobile mechanic with EV expertise), as defined in Working Nation’s [Green Jobs Now](#). We also considered “Green Enabling Jobs” that aren’t associated with green tech, but that support the green economy (such as a truck driver who distributes clean energy products). Finally, we only included entry-level jobs to address the requirements of the training programs in the legislation.

Jobs were grouped into the following career clusters, based on our review of clean energy fields.

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Table 6: Initial Clean Energy Jobs for Analysis

Cluster	Jobs
Solar and wind	Solar photovoltaic installers Solar sales representative and assessors Solar thermal installers & technicians Solar energy installation managers Wind energy operations managers Wind turbine service technicians
Automotive	Automotive service technicians & mechanics Mechanical engineering technologists and technicians Bus and truck mechanics and diesel engine specialists
Electrical	Electricians Helpers—Electricians Electrical & electronic engineering technologists and technicians Electrical power-line installers and repairers
Green building & construction	Construction laborers Carpenters Roofers Weatherization installers & technicians Construction & building inspectors Energy auditors
Building maintenance	HVAC/R mechanics and installers Stationary engineers and boiler operators Maintenance and repair workers (general) Plumbers, pipefitters, and steamfitters Industrial maintenance mechanics
Manufacturing	Sheet metal worker Machinist Machine tool setters, operators, tenders, metal & plastic Welder, cutter, solderer, and brazer Electromechanical equipment assemblers
Distribution	Laborers and freight, stock, and material movers, hand Transportation worker, all other Stockers & order fillers
Professional services, other	Dispatchers, except police, fire, and ambulance Bookkeeping, accounting, and auditing clerks
Water & wastewater	Water & wastewater treatment plant and system operators
Fuel cell technology	Chemical technicians, mechanical engineering technologists & technicians Electrical & electronic engineering technologists and technicians

To create a shorter list of jobs for deeper analysis, we established criteria for narrowing. To qualify, jobs needed to meet all or most of these criteria:

- **Typical education and training levels, based on surveys of workers, are less than 2 years** and do NOT require a bachelor's degree (data from Department of Labor [O*NET OnLine](#))
- **At least 300 job openings annually in Illinois or 3,000 total jobs.** To identify annual job openings and total jobs, we reviewed data from [O*NET OnLine](#), [Lightcast Green Jobs Now: Illinois](#), Department of Energy [US Energy Employment Report 2022](#), and [IDES Long-Term Occupational Projections 2020-2030](#). We noted significant disparities between the IDES projections and ONET data from the same year (2020). In general, we prioritized the IDES data for our analysis, though IDES did not have data for solar and wind jobs. Because data from IDES, Lightcast, and ONET was either unavailable or inconclusive about the solar and wind jobs on our list, we turned to the USEER report, which included numbers for solar and wind “construction” and “professional services” jobs in Illinois in 2021. We assume that the

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entry-level jobs on our list make up about half of these jobs. We assume that the annual openings make up 10% of total jobs, based on results from the other jobs.

- **Expected growth over the next 10 years above 2%** (data from Bureau of Labor Statistics, Lightcast, and IDES projections). We noted significant disparities between the IDES projections and ONET data. In general, we used IDES data, though IDES did not have data available for solar and wind jobs.
- **Salary at or above near living wage for one adult + one child in Illinois:** \$29.50/hour or \$50,000/yr after taxes¹. (Data from [O*NET OnLine](#))
- **Need for specific clean energy training.** Training that is focused on basic principles of clean energy and/or specific skills needed for renewable energy production, energy efficient construction or maintenance, or reduced emissions. For instance, commercial drivers are needed to transport and distribute clean energy products, but no specific clean energy training is required for this position.

It's important to note that the employment projections used for this analysis do not consider the mandates and incentives included in the Illinois CEJA legislation, the Illinois Power Agency Act, or the National Inflation Reduction Act. These mandates and incentives will increase the demand for clean energy production, energy efficiency upgrades and retrofits, and electric vehicles. Meeting this increased demand will require additional workers, especially equity-eligible workers. Thus, the job openings and employment growth figures used in this document likely underestimate the actual future workforce needs, especially in the solar and wind industries.

Results

We narrowed our list to 19 jobs in six job clusters that met all or most of these criteria, as shown below. Blue highlights indicate areas where the focused jobs do not fully meet criteria.

¹ See MIT's [Living Wage Calculator](#)

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Table 7: Narrowed List of Clean Energy Clusters and Jobs

Job title	Training required (ONET)	Total jobs in 2020 (IDES, unless otherwise indicated)	Annual Openings IL in 2020 (IDES, unless otherwise indicated)	% growth 2020-30 (IDES, unless otherwise indicated)	Average Salary 2021 (ONET)	Clean energy training focus
Solar and Wind						
Wind turbine service technicians	1-2 years	1,643 (USEER)	164 (USEER)	45.7% (Lightcast)	\$66,823	Yes
Solar photovoltaic installer	3-12 months	1,582 (USEER)	158 (USEER)	22.9% (Lightcast)	\$52,344	Yes
Solar sales reps & assessors	1-2 years	487 (USEER)	49 (USEER)	22.9% (Lightcast)	\$107,005	Yes
Automotive						
Automotive service techs and mechanics	1-2 years	28,408	2,909	3.25%	\$48,313	Yes—specialty in EV
Bus and truck mechanics	1-2 years	11,528	1,204	9.49%	\$58,150	Yes—specialty in EV, hybrid, biodiesel
Electrical						
Electrician	1-2 years	24,704	3,006	12.73%	\$80,718	Yes—specialty in renewables, EV
Electrical & electronic engineering tech	1-2 years	2,985	280	1.71%	\$68,498	Yes—specialty in renewables, EV
Green building and construction						
Construction laborers (including weatherization)	3-12 months	39,508	4,444	10.37%	\$41,510	Yes—specialty in energy efficient construction
Carpenters	3-12 months	31,602	3,091	4.28%	\$60,340	Yes—specialty in energy efficient construction
Roofers	3-12 months	3,908	421	9.06%	\$60,850	Yes—specialty in energy efficiency, solar
Construction & building inspectors (including energy auditors)	1-2 years	2,105	227	-4.42%	\$66,280	Yes—specialty in green buildings & energy code, energy efficiency
Building Maintenance						
HVAC/R Mechanics & Installers	1-2 years	8,968	967	9.52%	\$56,643	Yes—specialty in energy efficiency
Maintenance & repair workers, general	1-2 years	64,626	6,994	9.98%	\$49,204	Yes—specialty in energy efficiency, electrification
Plumbers, pipefitters & steamfitters	1-2 years	17,649	2,038	9.56%	\$95,090	Yes—specialty in energy efficiency
Industrial maintenance mechanics	1-2 years	13,611	1,680	27.21%	\$63,575	Yes—specialty in energy efficiency
Manufacturing						
Sheet metal worker	3-12 months	5,388	559	8.22%	\$64,860	Maybe
Machinist	1-2 years	28,493	3,280	9.06%	\$49,083	Maybe
Machine tool setters, operators, tenders	3-12 months	11,539	1,325	9.74%	\$42,369	Maybe
Welder, cutter, solderer, brazer	3-12 months	14,597	1,765	10.31%	\$45,994	Maybe

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Solar and wind: It is difficult to get conclusive numbers on the jobs available in the solar and wind industry. Using estimates from the USEER Illinois report, the numbers of jobs available in the solar and wind cluster are still not high enough to meet our criteria (at least 300 annual openings). We recommend that the state collect better solar and wind jobs data to get a more accurate understanding of the scope of the industry in Illinois and the need for more jobs.

However, all job projections in this industry expect very high growth, due to funding available at the federal and state level for solar and wind energy. Rapid expansion of the solar and wind workforce will be needed.

Furthermore, solar and wind training will need to be a major focus of the curriculum because of upcoming equity requirements. The Illinois Power Agency Act requires that certain portions of work on renewable projects be done by equity-eligible persons and contractors. There are few equity-eligible contractors currently in Illinois. Employers will need to be able to hire people from the CEJA training programs to meet these equity requirements.

Automotive: While the salary for automobile mechanics and service technicians is lower than living wage, we still recommend including these jobs because of the great need for technicians with EV training. This additional training is likely to increase salary potential as well.

Electrical: There is a large demand for electricians and technologists with expertise in renewable interconnection, electric vehicle charging station infrastructure, and more. Though the number of jobs for electrical and electronic engineering

technicians is slightly low, we still recommend including these jobs because of the great need for technicians with experience in interconnection or EV charging station installation.

Green building and construction: The salary for construction laborers is low, but there is a great need for construction laborers with expertise in energy efficiency and renewable installation. These added skills are likely to increase their salary potential. There are relatively smaller numbers of weatherization professionals, energy auditors, and building inspectors, but these jobs are in high demand and are currently difficult to fill. We suggest including them in the training program inventory as add-on specialty training for those already in the construction industry.

Building maintenance: HVAC/R mechanics are expected to see high growth, and there is a need for mechanics who can install and maintain heat pump technologies to aid with the electrification of our heating systems. Likewise, there is a huge need for more industrial maintenance mechanics, especially those with specialty in energy efficiency. This field is expected to grow 27.21% in the next 10 years. Maintenance workers have a lower-than-living-wage salary. However, learning energy efficiency and electrification skills will increase these workers' salary potential as well.

Manufacturing: Most of the jobs in the manufacturing sector have a lower-than-living-wage salary. In addition, it is not clear how much this training would require a clean-energy focused curriculum. However, because of the great need for more energy efficiency and renewable energy technologies and products, we recommend further analysis of this cluster.

REGIONAL JOBS ANALYSIS

To identify the clean energy jobs and focus areas, we reviewed [WIOA Regional Plans](#), as well as long-term [Occupational and Industry projections](#) (2020-2030). Below we summarize the targeted industries mentioned in the most recent WIOA regional, noting any mentions of the clean energy industry.

Regionally targeted industries with in-demand occupations

Table 8: Regionally targeted industries with in-demand occupations.

Illinois Economic Development Region	Targeted Industries	Mention of Energy or Clean Energy?	
Central Economic Development Region 1	Healthcare & Social Assistance Manufacturing Professional & Business Services Construction	Financial Activities Leisure & Hospitality Transportation/Warehousing Information Technology	No
East Central Economic Development Region 2	Manufacturing Transportation & Warehousing Healthcare Business Services	Information Technology Agribusiness Construction	Mentions the Green / Energy sector, energy efficiency workforce collaboration
North Central Economic Development Region 3	Healthcare & Social Assistance Manufacturing Transportation & Warehousing	Construction Professional & Business Services	Mentions a solar training program
Northeast Economic Development Region 4	Healthcare & Social Assistance Manufacturing	Transportation & Warehousing Information Technology	No
Northern Stateline Economic Development Region 5	Transportation & Warehousing Health Care & Social Assistance Agricultural Production Utilities Leisure & Hospitality	Natural Resources & Mining Retail Trade Government Educational Services Information Technology	No
Northwest Economic Development Region 6	Manufacturing Transportation/Logistics Agriculture Health	Professional & Business Services Construction Information Technology Leisure/Hospitality	Mentions solar, wind, and nuclear jobs; energy industry connection to information technology
Southeast Economic Development Region 7	Manufacturing Logistics Healthcare (including childcare)	Construction Education	No
Southern Economic Development Region 8	Healthcare Advanced Manufacturing	Transportation	Mentions energy (fossil and renewable)
Southwestern Economic Development Region 9	Transportation & Warehousing Health Care & Social Assistance	Utilities Manufacturing	Mentions oil and ethanol refining; power industry
West Central Economic Development Region 10	Transportation/Distribution Health Care & Social Assistance Manufacturing Utilities	Agricultural Production Wholesale Trade Construction	Mentions renewable energy courses; power industry

“Clean energy” is a new industry category for most regional workforce systems. As shown in the table above, “clean energy” is not mentioned as a specific targeted industry in any of the regional development plans, though renewable energy or energy efficiency are mentioned in three of the plans. However, construction and

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manufacturing are targeted industries in most of plans, leaving room for energy efficient new construction and retrofits as well the manufacturing and installation of energy efficiency and renewable technologies.

When selecting clean energy training areas for these regions, it will be important to coordinate with employers and regional workforce partners in to ensure strong network connections and coherent workforce pathways for the clean energy sector. Most regions report apprenticeships and work-based learning programs, primarily associated with targeted industries. There is a gap in organized apprenticeships and work-based learning programs for clean energy sectors.

We also used the IDES Economic Development Region Occupation Projections 2018-2028 to identify the clean energy jobs that are projected to see strong growth or that have a strong number of jobs available, as shown in the tables below. Note that no regional jobs data were available for the solar and wind jobs on our list.

Table 9: Economic Development Regions 1-5 Long-term Occupation Projections 2018-2028 for Clean Energy Jobs

		EDR 1				EDR 2				EDR 3				EDR 4				EDR 5			
		2018	2028	New jobs	% change	2018	2028	New jobs	% change	2018	2028	New jobs	% change	2018	2028	New Jobs	% Change	2018	2028	New jobs	% change
17-3023	Electrical and Electronic Engineering Technologists	117	118	1	0	71	71	0	0.00	158	158	0	0.00	2,316	2,296	-20	-1	143	142	-1	-0.70
47-2031	Carpenters	1,462	1,491	29	2.0	931	935	4	0	1,695	1,693	-2	-0.12	23,738	23,779	41	0	1,136	1,138	2	0
47-2061	Construction Laborers	1,833	1,900	67	4	1,006	1,036	30	2.98	2,078	2,137	59	3	28,381	29,081	700	2	1,376	1,398	22	1.60
47-2111	Electricians	889	932	43	4.84	631	643	12	1.90	1,242	1,264	22	2	17,808	18,381	573	3.22	1,060	1,091	31	2.92
47-2131	Insulation Workers, Floor, Ceiling, and Wall	35	35	0		20	19	-1	-5	47	46	-1	-2.13	693	664	-29	-4.18	32	30	-2	-6
47-2152	Plumbers, Pipefitters, and Steamfitters	608	654	46	7.57	403	425	22	5.46	819	864	45	5.49	11,604	12,341	737	6.35	624	652	28	4.49
47-2181	Roofers	182	191	9	4.95	111	117	6	5.41	253	263	10	3.95	3,696	3,830	134	3.63	190	195	5	2.63
47-2211	Sheet Metal Workers	178	182	4	2.25	119	120	1	0.84	262	264	2	0.76	3,691	3,772	81	2.19	214	215	1	0.47
47-4011	Construction and Building Inspectors	99	105	6	6.06	57	58	1	2	88	89	1	1	1,822	1,852	30	1.65	61	63	2	3.28
49-3023	Automotive Service Technicians and Mechanics	1,474	1,343	-131	-9	696	680	-16	-2.30	1,942	1,942	0	0.00	19,887	19,320	-567	-2.85	1,035	995	-40	-3.86
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	396	396	0	0.00	220	220	0	0	460	485	25	5.43	7,369	7,638	269	3.65	320	325	5	1.56
49-9021	HVAC Mechanics and Installers	295	313	18	6.10	188	197	9	4.79	409	431	22	5.38	5,979	6,290	311	5.20	294	309	15	5.10
49-9041	Industrial Machinery Mechanics	639	669	30	5	306	335	29	9	678	746	68	10.03	9,424	9,858	434	4.61	605	651	46	7.60
49-9051	Electrical Power-Line Installers and Repairers	195	208	13	6.67	69	72	3	4	230	239	9	4	1,981	2,081	100	5.05	175	182	7	4.00
49-9071	Maintenance and Repair Workers, General	2,371	2,407	36	1.52	2,000	2,012	12	0.60	2,993	3,020	27	0.90	46,536	47,349	813	1.75	2,081	2,137	56	2.69
51-4041	Machinists	1,128	1,168	40	3.55	674	705	31	4.60	2,090	2,159	69	3.30	20,835	21,414	579	2.78	2,183	2,240	57	2.61
51-4081	Multiple Machine Tool Setters, Operators and Tenders	358	364	6	1.68	327	342	15	4.59	629	642	13	2.07	8,375	8,513	138	1.65	1,117	1,141	24	2.15
51-4021	Welders, Cutters, Solderers, and Brazers	468	480	12	2.56	276	283	7	2.54	918	938	20	2.18	915	839	-76	-8.31	1,114	1,126	12	1.08
		EDR 6				EDR 7				EDR 8				EDR 9				EDR 10			
		2018	2028	New jobs	% change	2018	2028	New jobs	% change	2018	2028	New jobs	% change	2018	2028	New jobs	% change	2018	2028	New jobs	% change
17-3023	Electrical and Electronic Engineering Technologists	130	134	4	3.08	75	78	3	4.00	76	73	-3	-3.95	125	128	3	2	42	40	-2	-4.76
47-2031	Carpenters	1,199	1,228	29	2.42	699	729	30	4.29	737	713	-24	-3	1,882	1,918	36	1.91	477	472	-5	-1
47-2061	Construction Laborers	1,877	1,952	75	4.00	948	990	42	4.43	1,029	1,033	4	0	2,568	2,671	103	4.01	607	614	7	1
47-2111	Electricians	921	960	39	4.23	526	551	25	5	596	572	-24	-4	1,264	1,338	74	5.85	310	317	7	2
47-2131	Insulation Workers, Floor, Ceiling, and Wall	30	29	-1	-3.33	15	15	0	0.00	18	16	-2	-11.11	48	47	-1	-2	11	10	-1	-9.09
47-2152	Plumbers, Pipefitters, and Steamfitters	580	619	39	6.72	288	315	27	9.38	367	357	-10	-2.72	803	882	79	9.84	191	197	6	3.14
47-2181	Roofers	174	182	8	5	82	87	5	6.10	107	101	-6	-5.61	255	273	18	7.06	54	54	0	0.00
47-2211	Sheet Metal Workers	189	195	6	3.17	86	90	4	4.65	96	90	-6	-6.25	232	245	13	6	61	63	2	3.28
47-4011	Construction and Building Inspectors	86	89	3	3	36	37	1	2.78	49	50	1	2.04	117	122	5	4.27	31	31	0	0.00
49-3023	Automotive Service Technicians and Mechanics	1,375	1,343	-32	-2.33	813	783	-30	-3.69	909	872	-37	-4.07	1,905	1,809	-96	-5	580	574	-6	-1.03
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	499	520	21	4.21	226	235	9	3.98	250	253	3	1.20	557	575	18	3.23	190	199	9	4.74
49-9021	HVAC Mechanics and Installers	279	299	20	7	137	147	10	7	170	168	-2	-1.18	384	418	34	8.85	93	92	-1	-1.08
49-9041	Industrial Machinery Mechanics	658	701	43	6.53	386	413	27	6.99	412	455	43	10.44	715	753	38	5	59	63	4	7
49-9051	Electrical Power-Line Installers and Repairers	235	254	19	8.09	83	90	7	8.43	108	115	7	6.48	235	252	17	7.23	46	47	1	2.17
49-9071	Maintenance and Repair Workers, General	2,232	2,271	39	1.75	1,338	1,398	60	4.48	1,563	1,577	14	0.90	2,719	2,804	85	3.13	1,017	1,031	14	1.38
51-4041	Machinists	1,536	1,607	71	4.62	791	821	30	3.79	646	659	13	2.01	1,171	1,202	31	2.65	566	586	20	3.53
51-4081	Multiple Machine Tool Setters, Operators and Tenders	522	529	7	1.34	516	547	31	6.01	385	387	2	0.52	424	440	16	3.77	223	237	14	6.28
51-4021	Welders, Cutters, Solderers, and Brazers	674	695	21	3.12	421	441	20	4.75	259	257	-2	-0.77	521	529	8	1.54	261	265	4	1.53

Across all regions, the jobs with the largest number of workers in 2018 were maintenance and repair workers, construction laborers, machinists, automotive service technicians and mechanics, and carpenters.

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The jobs that anticipated the highest percentage growth by 2028 varied by region, as shown in the table below. In general, the plumbing industry and industrial machinery mechanics are expected to grow across the region. HVAC mechanics and installers were high-growth jobs for most regions.

Table 10: Top 5 jobs by percentage growth from 2018-2028 by Economic Development Region

Region	Top 5 jobs by percentage growth by 2028
Region 1	Plumbers, Electrical power-line installers & repairers, Construction & building inspectors, Industrial machinery mechanics, and roofers
Region 2	Industrial machinery mechanics, Plumbers, Roofers, HVAC mechanics & installers, Machinists
Region 3	Industrial machinery mechanics, Plumbers, Bus and truck mechanics, HVAC mechanics & installers, Roofers
Region 4	Plumbers, HVAC mechanics & installers, Electrical power-line installers & repairers, Industrial machinery mechanics, Bus and truck mechanics
Region 5	Industrial machinery mechanics, HVAC mechanics & installers, Plumbers, Electrical power-line installers & repairers, Construction & building inspectors
Region 6	Electrical power-line installers & repairers, Plumbers, HVAC mechanics & installers, Industrial machinery mechanics, Machinists
Region 7	Plumbers, Electrical power line installers, Industrial maintenance mechanics, Roofers, Multiple machine tool setters
Region 8	Industrial maintenance mechanics, Electrical power-line installers & repairers, Construction & building inspectors
Region 9	HVAC Mechanics & Installers, Electrical power-line installers & repairers, Roofers, Construction & building inspectors, Multiple machine tool setters
Region 10	Industrial machinery mechanics, Multiple machine tool setters, Bus & truck mechanics & diesel engine specialists, Machinists, Sheet metal workers

The jobs that anticipated the highest number of new jobs also varied by region, as shown in the table below.

Table 11: Top 5 jobs by number of anticipated new jobs by 2028 from 2018-2028

Region	Top 5 jobs by number of anticipated new jobs by 2028
Region 1	Construction laborers, plumbers, electricians, machinists, and maintenance workers.
Region 2	Machinists, construction laborers, industrial machinery mechanics, and plumbers.
Region 3	Machinists, Industrial maintenance mechanics, Construction laborers, Plumbers, Maintenance & repair workers
Region 4	Maintenance and repair workers, Plumbers, Construction workers, Electricians, Machinists
Region 5	Machinists, Maintenance & repair workers, Industrial maintenance mechanics, Electricians, Plumbers
Region 6	Construction laborers, Machinists, Industrial maintenance mechanics, Electricians, Plumbers
Region 7	Maintenance & repair workers, Construction laborers, Multiple machine tool setters, Machinists, Carpenters
Region 8	Industrial maintenance mechanics, Maintenance & repair worker, Machinists, Electrical power-line installers
Region 9	Construction laborers, Maintenance & repair workers, Plumbers, Electricians, Industrial machinery mechanics
Region 10	Machinist, Multiple machine tool setters, Maintenance & repair worker, Bus & truck mechanics

WORKFORCE SYSTEM REVIEW

This section summarizes clean energy workforce system challenges and best practices, based on the WIOA regional plans and prior research on workforce systems in general and workforce specifically related to clean energy jobs. Clean energy jobs have been growing in Illinois, but current training programs are not delivering an adequate number of qualified employees. Employers indicate that they find it difficult to hire people for clean energy jobs. In addition, the clean energy workforce is lacking in racial and gender diversity.

From our preliminary research, we find four main challenges to clean energy workforce development. We describe best practices to address those challenges, summarized below.

Challenge: Lack of connections among various parts of the workforce system. In the clean energy workforce system, there is not enough coordination among employers and training providers to ensure that the training programs are meeting the emerging needs of the clean energy workforce. There is also a need for greater coordination among community support providers, training providers (community colleges, community-based organizations, K-12 schools), and workforce agencies to support the needs of a diverse workforce. Multiple communication channels can lead to confusion and duplication of efforts. Best practices to address the lack of connections include the following:

- Streamline communications among workforce groups to reduce confusion and avoid duplication of efforts.

- The Clean Jobs Network Hubs should bring together training providers, support providers, workforce agencies, community-based organizations to offer different options and support training program participants, rather than having the different entities compete against each other for resources.
- In the workforce hubs, foster strong internal communication channels, assessments, and hand-off procedures to better serve participants.
- Strengthen advisory committees and stakeholder gatherings to provide feedback on training programs and how to help students succeed.

Challenge: Lack of awareness/negative perceptions of clean energy jobs. The sector has a growing demand for workers, and not enough students are pursuing training or careers in these industries. Among construction and trade programs, there is limited awareness of clean energy jobs, training programs, and skillsets. Many parents or school counselors have the misperception that trade programs are only suitable for low-performing students, so they tend to steer students away from this path. There is also a lack of awareness about the benefits of apprenticeship and vocational programs, which train a substantial portion of the clean energy workforce, so many students and trainees do not pursue these programs.

Best practices to raise awareness of clean energy opportunities include:

- Promote clean energy literacy.

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- Help students & incumbent workers explore career options.
- Engage in outreach to K-12 schools and community organizations.
- Develop coherent and clear descriptions and definitions of clean energy jobs and career paths.
- Develop engaging promotional resources to draw a diverse workforce to the industry.

Challenge: Lack of qualified workers for clean energy jobs. There is a high demand for *skilled* workers with the technical, academic, workplace and personal effectiveness skills needed. Some focused programs (such as solar or weatherization) do not cover the construction basics that people need. In addition, many programs do not address newer clean energy technologies (such as heat pumps, demand-responsive technologies and EV technologies) and the most up-to-date energy efficiency practices. There is also a need for whole-building approaches that address the building as a system, rather than considering its individual parts. In some areas, there are not enough qualified trainers who can teach these newer clean energy technologies and strategies.

Many employers note that the skills that are most often missing are not the technical skills, but skills such as basic math, time management, communication, reading comprehension, and more.

Best practices to help increase the number of qualified workers to meet the needs of an evolving clean energy industry include:

- Support trade programming at high schools.
- Form employer curriculum advisory committees to make sure that new clean energy technologies and services are integrated into existing and new training programs.

- Provide work-based learning and continuing education in clean energy.
- Teach stackable, broad, transferrable skills that are applicable across many clean energy jobs.

Challenge: Failure to reach and support diverse, underserved populations. Another major issue and source of untapped potential for the clean energy sector is a lack of participation from diverse, underserved populations. Many clean energy jobs are predominantly older, male, and lacking in racial diversity. Rural populations and underserved communities also struggle to train, attract and retain clean energy workers. Reasons for the lack of diversity are complex and include non-inclusive policies, a lack of support services, less access to opportunities, and few diverse voices in decision-making bodies. Below are a few best practices to reach and support diverse, underserved populations.

- Promote diverse hires through inclusive policies and mandates.
- Offer diversity training to employers and training programs.
- Target underserved populations for training programs through more inclusive advertising and recruitment.
- Form diverse stakeholder groups; partner with CBOs and CAAs. Involve these groups in decision-making processes.
- Make training feasible and accessible by providing comprehensive support (transportation, childcare, stipends, scholarships, access to technology, mental health services, etc.).
- Connect training to good jobs with livable wages and benefits.

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The above challenges are described in the WIOA regional plans, as shown below.

Table 12: Selected workforce system weaknesses, self-identified in the WIOA Illinois Regional Plans

IL Economic Development Region	Weaknesses in regional workforce systems
Central Economic Development Region 1	Need better communication/coordination/information sharing between workforce partners Awareness - need better communication of available services to jobseekers Not enough qualified instructors available
East Central Economic Development Region 2	Need better communication/coordination/information sharing between workforce partners Limited transportation services for jobseekers especially in rural areas
North Central Economic Development Region 3	Need better communication/coordination/information sharing between workforce partners Technology challenges in rural areas
Northeast Economic Development Region 4	Awareness - need better communication of available services to jobseekers Limited transportation services for jobseekers especially in rural areas Technology challenges in rural areas Need better communication/coordination/information sharing between workforce partners
Northern Stateline Economic Development Region 5	Need better communication/coordination/information sharing between workforce partners Employers over-surveyed and confused by requests from multiple workforce partners Too many jobseekers that go through training are not finding jobs Need more cohesive approach for providing basic skills and soft skills training Limited transportation services for jobseekers Limited childcare services for jobseekers Negative perceptions of manufacturing jobs by jobseekers
Northwest Economic Development Region 6	Need better communication/coordination/information sharing between workforce partners Limited transportation services for jobseekers Not enough qualified instructors available
Southeast Economic Development Region 7	Limited transportation services for jobseekers Awareness - need better communication of available services to jobseekers Limited childcare services for jobseekers Limited availability of mental health assistance services
Southern Economic Development Region 8	Need better communication/coordination/information sharing between workforce partners
Southwestern Economic Development Region 9	Need to develop career pathways and strategies to address skills gaps
West Central Economic Development Region 10	Need better communication/coordination between workforce partners Limited success establishing apprenticeship programs Technology challenges in rural areas

A few weaknesses stand out across multiple economic development regions. First and foremost, the plans mention a need to for more communication, coordination, and information sharing between workforce partners. Illinois EDR Region 5 provides examples of this. Employers indicated that they were over-surveyed and confused by requests from multiple workforce partners. They also noted that there were too many jobseekers that go through training who do not find jobs, suggesting a lack of coordination among employers, training providers, and support providers. Finally, they noted a need for a more cohesive approach for providing basic skills and soft skills training.

Many economic development regions noted a need to raise awareness of jobs, training, and services to jobseekers. There was a need to better communicate opportunities to job seekers.

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Finally, several economic development regions identified gaps in training opportunities. For instance, EDR Region 9 reported a need to develop career pathways and strategies to address skills gaps. EDR Region 10 reported limited success establishing apprenticeship programs, while other regions did report active programs for apprenticeships, pre-apprenticeships, and youth apprenticeships. Some, but not all, regions had apprenticeship navigators, US DOL Registered Apprenticeships, and other work-based learning programs. This suggests that there are regional gaps in work-based learning opportunities.

Several regions noted barriers that make it difficult for people to access training and jobs, including limited childcare and limited transportation support services for jobseekers lacking vehicles, especially in rural areas. There were also technology challenges in rural areas. To address these barriers, economic development plans indicated the availability of wrap-around services in their regions. Below we summarize this availability.

Regional availability of supportive wrap-around services

Table 13: Summary of available supportive services identified in the WIOA Illinois Regional Plans (2020-2024)

EDR Region	Social services referral support	Childcare	Work clothing, tools	Developmental services	Healthcare	Housing	Mental health	Substance use	Transportation
Central EDR 1	✓	✓	✓		✓	✓		✓	✓
East Central EDR 2	✓	✓	✓	✓	✓	✓	✓	✓	Yes, some gaps
North EDR 3	✓	✓	✓	✓	✓	✓	✓	✓	✓
Northeast EDR 4	✓	✓	✓	✓	✓	✓	✓	✓	Yes, some gaps
Northern Stateline EDR 5	✓	Yes, some gaps	✓	✓	✓	✓	✓	✓	Yes, some gaps
Northwest EDR 6	✓	✓	✓	✓	✓	✓	✓	✓	Yes, some gaps
Southeast EDR 7	✓	Yes, some gaps	✓	✓	✓	✓	✓	✓	Yes, some gaps
Southern EDR 8	✓	✓	✓	✓	✓	✓	✓	✓	✓
Southwestern EDR 9	✓	✓	✓	✓	✓	✓	✓	✓	✓
West Central EDR 10	✓	✓	✓	✓	✓	✓	✓	✓	Yes, some gaps

We note that all economic development regions report a similar availability of supportive services for participants. Transportation assistance was noted as the most important challenge. While all provide transportation assistance, participants that do not own a vehicle struggle with transit to education, training, work, and social service appointments. This is especially true, although not exclusively, for rural areas. Limited childcare availability in rural areas was also noted as a challenge for participants. The economic development regions did not discuss supportive services for mental health and substance abuse as much as they reported on other services. This might indicate a gap that needs to be addressed.

TRAINING, SKILL AND KNOWLEDGE REQUIREMENTS

For the shorter list of jobs identified above, we used Department of Labor’s O*NET Online to get a sense for the skills and knowledge required in these jobs. DOL’s job descriptions of knowledge, skill, and training requirements are based on surveys of employers in the industry and represent the typical training, skills, and knowledge required for these jobs. 12 of the 19 jobs typically required medium-length training (1-2 years preparation), as shown in table 7 above. For these programs, most required a career-focused training program with on-the-job experience. An apprenticeship or associate degree may be required, and previous work-related skills, knowledge, and experience are usually required.

Seven of the 19 clean energy-focused jobs typically required a shorter period of training (3-12 months preparation). For these jobs, a high school diploma was usually required for entry, and some previous work skills or experience was usually needed. On the job training or career-focused training was often required.

To identify skills and knowledge requirements for these jobs, we first consider the skills and knowledge requirements that were broadly applicable across all clean energy jobs. We identified the general knowledge and skill requirements of all 24 jobs, based on [O*NET Online](#) data from the US Department of Labor. To dive deeper into skill and knowledge requirements, we reviewed the Department of Labor’s Competency Model Clearinghouse, which identifies personal effectiveness competencies, academic competencies, workplace competencies, industry-wide competencies, and industry-sector technical competencies for several of the clean energy job clusters. We also reviewed the State of Illinois Model Programs of Study Guides for related clean energy jobs. The top employability skills, technical skills and knowledge requirements across all jobs in our inventory are described in the table below.

Table 14: Top employability and technical skills and knowledge requirements.

Top employability skills	Top technical skills	Top knowledge requirements
Critical thinking (15/19 jobs)	Monitoring (18/19)	Mechanical (16/19)
Judgment and decision-making (14/19)	Quality control (13/19)	English language (16/19)
Speaking (14/19)	Troubleshooting (12/19)	Math (15/19)
Active listening (14/19)	Operations & control (10/19)	Building/construction (13/19)
Coordination (13/19)	Repairing (7/19)	Customer service (12/19)
Time management (12/19)	Complex problem solving (7/19)	Design (12/19)
Active learning (12/19)	Equipment maintenance (6/19)	Administration and management (12/19)
Reading comprehension (11/19)		Engineering technology (11/19)

DCEO’s [Recommended Technical and Essential Employability Competencies for College and Career Pathway Endorsements](#) presents another way to consider the core competencies required for the clean energy jobs on our list.

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The report identifies the following top ten cross-sector essential employability competencies:

- Teamwork & conflict resolution
- Communication
- Problem solving
- Decision making
- Critical thinking
- Adaptability & flexibility
- Initiative & self-drive
- Reliability & accountability
- Cultural competence
- Planning & organizing.

The report also identifies the top 10 technical competencies for advanced manufacturing, engineering, technology and trades:

- Equipment safety
- Manufacturing environment
- Personal health & safety
- Spatial reasoning
- Process, design, & development
- Installation
- Customer focus
- Quality assurance & continuous improvement
- Digital manufacturing
- Supply chain logistics

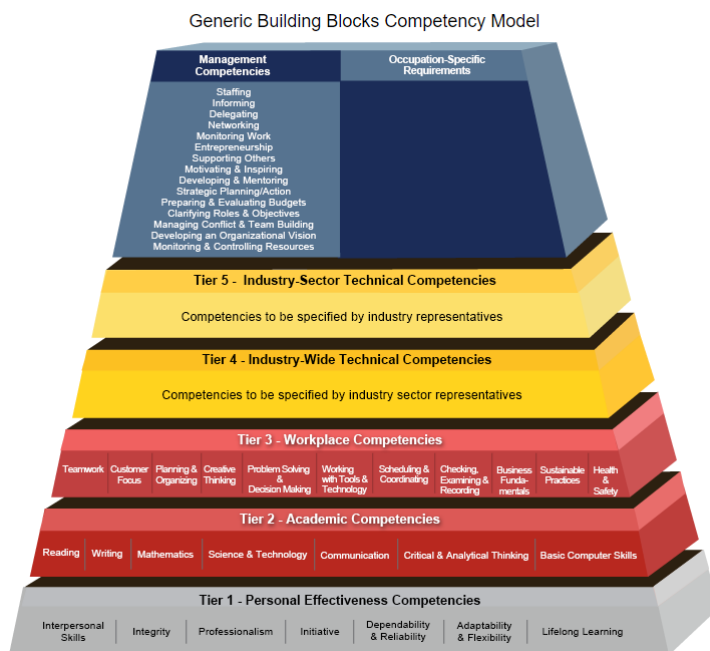


Figure 1: Generic Building Blocks Competency Model

In addition to considering skills and knowledge areas, we identified core competencies for clean energy jobs using competency models from the Department of Labor’s [Competency Model Clearinghouse](#), for industries related to clean energy: renewable energy; energy generation, transmission and distribution; residential construction; commercial and industrial construction; and advanced manufacturing. The Generic Building Blocks Competency Model, shown on the left. For Tier 1 (Personal Effectiveness Competencies), Tier 2 (Academic Competencies), and Tier 3 (Workplace Competencies), competencies are nearly identical across these clean energy-related industries and are reflected in the Generic Building Blocks Competency Model, shown on the left. The competencies taught in

these three tiers should be addressed in curriculum through job readiness training, remedial training (as needed) and connection to adult education programs. Assessments, especially for academic competencies, will help to identify needs for additional training.

Industry-wide technical competencies were somewhat similar across the different clean-energy industries. All industries required competencies in quality assurance and continuous improvement, as well as personal health and safety. Most also required knowledge of policies, laws, and regulations. Residential and commercial

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construction shared the most overlap, with shared competencies in building and construction design; material resources; and operations, installation, and repair. Training programs should make sure to cover these shared competencies to train people for a variety of different jobs.

For each industry, the Department of Labor’s competency models provide detailed worksheets and spreadsheets for assessing curriculum and credentialing and can be used to identify the broad range of skills needed in each general cluster.

For industry-sector and occupation specific technical competencies, we recommend reviewing government or industry-created job task analyses or competency and task lists. These documents can be used to guide a curriculum framework for specific jobs. We identify a few task analyses for newer clean energy jobs in the table below.

Table 15: Sample job task analyses for clean energy jobs

Job cluster	Job task analyses
Solar and wind cluster	NABCEP: PV Installation Professional Job Task Analysis NABCEP: Objectives and Task Analysis for a Professional Small Wind Energy System Installer NABCEP: PV Technical Sales Job Task Analysis
Automotive	ASE: Light Duty Hybrid/Electric Vehicle Task List (p. 5-12).
Green building construction	NREL: Single-family Energy Auditor Job Task Analysis NREL: Multifamily Energy Auditor Job/Task Analysis and Report BPI: Energy Auditor Job Task Analysis
Green building maintenance	ESCO Group: HVAC Excellence Competency and Task List (with emphasis on newer clean energy technologies) NREL: Job/Task Analysis for a Facility Manager (with emphasis on newer energy efficiency technologies)

Certifications

We also researched certifications that are common in the industry to standardize training across programs and ensure that training is meeting industry requirements. We list a few of the most common in the table below.

Table 16: Common certifications

Career cluster	A Sample of common certifications or licenses
Solar/wind	NABCEP PV Associate (entry level) and professional certifications; ETA: PV Certifications; NABCEP and ETA: Small wind certification.
Automotive EV certificates	ETA International: Electrical Vehicle Technician; NIASE: Light duty hybrid/electric vehicle specialist
Electrical	ETT Certified technician certifications; ETA International Industrial electronics, state and municipal licenses; EVITP: EV Infrastructure Certification
Green building & construction	NCCER: Carpentry, Weatherization, etc. BPI: Building Science Principles, Air Leakage Control Installer, Quality Control Inspector, Envelope Professional, etc.; ICC: Electrical plans examiner, Commercial building inspector, etc.; LEED (Leadership in Energy and Environmental Design) Green Associate.
Building maintenance	EPA 608 technician certificates; NATE: Ready to Work certificate, HVAC Support Technician, etc.; BPI: Retrofit Installer Technician, Infiltration & duct leakage; ESCO: Geothermal Heat Pump Certification; NABCEP: Solar Heating Associate.
Manufacturing	NIMS: Machining Level 1; AWS: Certified Welder

Curriculum gaps

In preparation for creating a curriculum framework, we have begun reviewing existing curriculum and note a few gaps that need to be filled, as shown in the table below.

Table 17: Curriculum gaps

Career cluster	Technical training gaps
Solar/wind	Training that prepares people for NABCEP Associate Exam should include some basic construction training (such as the NCCER curriculum) if students do not already have construction training. Need training on rooftops.
Automotive	Plentiful automobile service technician training programs, but very few that address electric vehicles. Need for stackable certificates to teach people to service electric vehicles that includes high voltage electrical safety, AC-DC systems, etc.
Electrical	EV Infrastructure training, Utility interconnection policies & requirements, installing electric storage devices, demand response integration technologies.
Green building & construction	Greater focus on whole-building system approach, more focus on energy efficiency and meeting energy code requirements.
Building maintenance	Need for more training on heat pump technology, electrification, demand response and demand control systems, etc.

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CLEAN ENERGY TRAINING PROGRAM INVENTORY

Methods

To begin to collect data on clean energy training programs in Illinois, the Standard Occupational Classification (SOC) job codes and names were matched with similar jobs in the Classification of Instructional Programs (CIP) codes used by the US Department of Education. For some jobs, the SOC codes (job name) and CIP Code (training program name) aligned perfectly. For others, there were multiple CIP codes for a single job, or multiple SOC codes for a single CIP code. Identifying CIP codes allowed us to collect data from DCEO and the Illinois Community College Board about specific training programs.

We then began to inventory the training programs that were associated with these jobs. The main sources of our inventory included:

- **Illinois Community College Board:** They identified all community college programs with the target CIP codes. Each separate certificate or associate degree program was included, meaning that if a college had stackable certificates or programs, multiple entries were listed. Information provided included credit hours, program type (certificate or AAS), college name, and program title.
- **WIOA Programs:** Northern Illinois University provided us with a spreadsheet of all DCEO WIOA programs for the target CIP and ONET codes. This was by far the most comprehensive dataset available, and included training program URL, program format, entity type, program prerequisites, program length, and even outcome data (though only about 10% of entries had outcome data, and even this data was incomplete). Each separate certificate or associate degree program was included, meaning that if a college had stackable certificates or programs, multiple entries were listed.
- **Registered Apprenticeship Programs:** DCEO also provided a list of registered apprenticeship and Preapprenticeship programs. Information provided included location, employer name, program sponsor name, program type, and occupation title.
- **FEJA solar training programs:** We manually researched and entered information on each of the solar training programs through FEJA.

We collected the following data about each program, to the extent that data was available.

- CIP codes and SOC codes
- Training program provider type
- Training program length
- Program prerequisites and format
- Cost of training program
- Location of training program
- Type of outcome (industry recognized certificate, associate degree, etc.)

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We sought to collect outcome data (number of participants served, number of participants who completed the program, etc.) from these training programs but were only able to collect outcome data from a very small number of programs. We have therefore not included this in our analysis.

Below, we present summaries of each of the clean energy career cluster inventories.

Solar and wind

Cluster 1 includes the following four jobs:

- Wind turbine service technicians
- Wind energy operations and development managers
- Solar photovoltaic installers
- Solar sales representatives and assessors

We identified related CIP training program names for these four jobs and then added up the number of Illinois training programs in our inventory with these codes.

- Wind Energy Technology/Technician (2 programs)
- Energy Systems Technology/Technician (31 programs)
- Energy System Installation and Repair Technology (4 programs)
- Solar Energy Technology/Technician (5 programs)
- Solar Energy System Installation and Repair Technology/Technician (25 programs)

In total, we identified 69 programs in this cluster. The table below describes some of the main findings in our inventory regarding training provider type, training program outcome, program length, and location.

Table 18: Summary of Solar and Wind Training Program Inventory

	Training provider type	Training program outcome	Program length	Location
Solar training	Split between private programs (non-profit or for-profit), and community college programs	Mostly industry recognized certifications, some associate degree or IHE certificate of completion	Installer programs mostly short (under 25 weeks). Technologist programs 1-2 years.	Most in northeast IL, with a few in other scattered regions.
Wind training	Mostly community college programs	Mostly associate degrees and certificates	Most programs 1-2 years	Most in northeast and central IL, with a few in other scattered regions.

In general, we found that the wind technician programs were located at community colleges and were largely associated with energy systems technology programs. Many were associate degree programs, with some stackable certifications. Wind energy and energy systems technology programs were clustered around the central part of the state, where wind turbines are most appropriate, though some programs were in the Northeast region as well.

Solar training programs were split between private programs and community colleges, with private programs providing the bulk of the solar installer training. These programs mostly prepared students for the NABCEP PV Associate exam, though some programs did not provide industry-recognized certifications but instead led to

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“measurable skill gain.” Some energy systems technology programs at community colleges offered both wind and solar training (including training to prepare for the NABCEP PV Associate exam). We did not find any programs that specifically trained people for solar sales representative and assessor jobs.

Recommendation

Climate and Equitable Jobs Act Training programs should focus on offering more training for all jobs in this cluster. Solar Photovoltaic Installer training is particularly well suited for delivery by community-based organizations because it is short in duration and can help prepare people to receive industry-recognized credentials. There are many public and private providers who can provide this training. Solar training can also easily be integrated into construction trades, as an add-on specialty curriculum in apprenticeship or pre-apprenticeship programs.

We also see a need for more community college training programs in both wind and solar, especially outside of Chicago. We recommend developing an add-on certificate to train people to be solar assessor and sales representative, as it appears that this training is not regularly offered in Illinois.

Automotive

Cluster 2 includes the following two jobs:

- Automotive Service Technicians and Mechanics
- Bus and Truck Mechanics and Diesel Engine Specialists

Related CIP coded training programs include the following:

- Vehicle Maintenance and Repair Technology; Automobile/Automotive Mechanics Technology/Technician (229 programs in Illinois)
- Diesel Mechanics Technology/Technician (32 programs in Illinois)
- Alternative Fuel Vehicle Technology/Technician (12 programs in Illinois)

In total, we identified 273 automobile technician and repair technology training programs in Illinois. The table below describes some of the main findings from our inventory. We identified 13 programs that had a specific EV or alternative fuel focus.

Table 19: Automotive Training Program Inventory Summary

	Training provider type	Training program outcome	Program length	Location
Automotive training	Almost all taught at community colleges	Mostly stackable certificates leading up to associate degrees	Many short-term certificate programs (under 25 weeks), with a range of offerings ranging from a few months to 2 years	Decent geographic distribution throughout the state, with fewer programs in the west central region.
EV-focused programs	All taught at community colleges	EV training is usually offered as a certificate (or set of certificates) in a larger automotive program	Most programs 1-2 years	Very sparse distribution of EV-focused training

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Most of the automotive industry trainings (255) available in the state are classified as community college programs. 18 additional programs were listed as “other.” Most (198) are classified as certificate programs that are either industry recognized, or students receive a certificate of completion. 51 programs were associate degree programs. Training duration for automotive technology jobs is varied. 117 programs provide under 25 weeks of training. 80 programs provide 25 weeks to 50 weeks of training. 60 programs provide 51-75 weeks of training. 11 programs provide 76 – 100 weeks of training. Five programs provided more than 101 weeks of training.

Recommendation

Illinois shows a growth trajectory in automotive and truck mechanic industries. Illinois is working to position itself as a leader in electric vehicles. The Climate and Equitable Jobs Act sets a goal for 1 million electric vehicles on the road in Illinois by the end of 2029. The automotive technology training programs will need to adapt to equip workers with electric vehicle maintenance and repair experience as EV vehicles and EV charging stations expand across the U.S. As an early adopter, Heartland Community College has opened an electric vehicle training with five separate program certificates in partnership with [Rivian Automotive LLC](#) in Normal, IL. While there is no shortage of vehicle maintenance and repair technology programs, only a few of these programs offer EV-focused training. There is tremendous opportunity for existing community colleges to step up and offer this training.

It should also be noted that there is a great need for more Automotive Service Technicians and Mechanics, and Bus and Truck Mechanics and Diesel Engine Specialists, and these technicians will also need EV and alternative fuel training. We note that Bus and Truck Mechanics are expected to see higher growth, and there are fewer training programs, compared to the number of workers.

Electrical

Cluster 3 includes the following three jobs in the electrical and power distribution sector:

- Electricians
- Electrical and Electronic Engineering Technologists and Technicians
- Electrical Power-Line Installers and Repairers

We identified 6 CIP training program codes related to these positions. Below we describe the number of training programs in our inventory for each of these 6 CIP programs. In total, we identified 196 electrical training programs in Illinois.

- Electrical, Electronic, and Communications Engineering Technology/Technician (69)
- Electrician (65)
- Industrial Electronics Technology/Technician (48)
- Electrical/Electronics Equipment Installation and Repair, General (7)
- Lineworker (2)
- Electrical and Power Transmission Installation/Installer (2)

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All electricians and electrical & electronic engineering technologies technicians require a medium amount of preparation including vocational school training, on-the-job training and experience, an associate degree, 1-2 years of experience, and/or an apprenticeship for union trades. Electrical Power-Line Installers and Repairers require a minimum of a high-school diploma or general equivalency degree, along with on-the-job training and experience, and apprenticeships.

Table 20: Summary of Electrical Training Program Inventory Summary

Training provider type	Training program outcome	Program length	Location
Split between community colleges (140), Apprenticeships (104), and private providers (16)	Industry or IHE certificates (110) Apprenticeship completion (39), License (7), Associate degree (58), Measurable skill gain (62)	Range of programs and certificate offerings. 42 programs 0-25 weeks; 46 programs 26-50 weeks; 54 programs 51-75 weeks; 16 programs over 100 weeks.	Decent geographic distribution throughout the state, with 108 in the Northeast region.

Most of the electrical industry training listed in our inventory is available through IL community colleges or through trade unions. There are 37 community college programs for electrician training, 81 community college programs for electrical and electronic engineering technologists and technicians, and 3 community college programs for electrical power-line installers and repairers. We identified 13 apprenticeships for electricians, 11 apprenticeships for electrical/electronic engineering techs, and 3 apprenticeships for power-line workers. Most of the programs provide certificates; a few have licensed apprenticeships, and a few programs lead to an associate degree. Of the programs listed, about half are 25-50 weeks, and half are 51-75 weeks. Apprentice programs for electricians take about 4 years – 8,000 hours of on-the-job experience. Most programs are in-person, a couple online and a few hybrid-training programs exist.

Recommendation

The electrical industry in Illinois shows signs of growth in some areas and signs of contraction in others. The steady growth rate is for line workers and electricians with skills that cross several clean-energy technology areas including commercial/industrial/residential solar and industrial wind turbine installation; electric charging stations; and general grid expansion and maintenance. The skills are transferable across sectors and across state-lines. Linemen travel across the state as needed by the utility they work for and can be deployed to disaster areas after extreme weather events like hurricanes, tornadoes, extremely high-winds, and ice-storms, to repair the electric grid. As the effects of storms worsen due to climate change, the need for workers in this field grows.

Programs that provide base-level CEJA workforce development trainings should include some electrical systems training. Specific electrician training programs and apprenticeships should include a certificate, track or other training designed to train electricians specifically about solar installation and provide hands on experience. The expanding solar industry in Illinois needs electricians with solar experience and high-voltage expertise. General electricians with no solar experience take more time to learn on the job – which increases project costs. Power-line workers and installers should be recognized by CEJA as a clean-energy job path; however, specialized training for line-workers is not something that the CEJA Clean Jobs Curriculum should focus on.

Green building and construction

Cluster 4 includes jobs in the green building and construction sector which includes O*NET job titles for construction laborers (including weatherization installers), carpenters, roofers, and construction and building inspectors (including energy auditors). Related CIP coded jobs included five related positions:

- Construction Trades, General (46 programs)
- Carpentry/Carpenter (25 programs)
- Construction Site Management/Manager (22 programs)
- Roofer (8 programs)
- Building/Home/Construction Inspection/Inspector (including energy auditor) (9 programs)

Some of the jobs in this cluster require more training than others do. Construction laborers, carpenters, and roofers typically require some high school education and some experience (3 months to 1-year), according to the Department of Labor’s O*Net Online. Weatherization technicians require a little more training, proof of a high school diploma, some training, and job experience. Construction and Building Inspectors and Energy Auditors require a medium level of preparation. A high school diploma, vocational school training, on-the-job experience, and additional training up to an associate degree may be required.

Table 21: Training program inventory summary

Training program	Training provider type	Training program outcome	Program length
General construction	Split between community colleges (9), apprenticeships (8), private non-profit or for-profit providers (18)	Some industry recognized or IHE certificates (7), completion of apprenticeship or pre-apprenticeship (8). A few associate degrees (4).	Most under 25 weeks.
Construction management	Split between community colleges, apprenticeships, and private providers	Associate degree programs or completion of apprenticeship program	Not enough data.
Carpentry	Split between community college and apprenticeship	Mix between industry recognized certificates (10), completion of apprenticeship (6), associate degree (5).	Apprenticeships longer (multiple years); community college programs mostly under 50 weeks.
Building inspection and energy auditor	Mostly private programs	Most lead to industry-recognized certificates.	Split between 0-25 weeks, 26-50 weeks, and more (5).

Construction, construction management, and carpentry programs were split somewhat evenly between community colleges and union trade programs. There were also several general construction programs provided by private non-profit training programs. As is consistent with the training requirements, many of the programs are short-term, though there are some longer apprenticeships as well.

Building inspection and energy auditor training is usually offered by a private provider as an add-on curriculum for existing professionals in the construction industry. BPI certifications are common for jobs in the residential energy efficiency retrofit field.

Recommendation

Annual openings indicate that the construction trades industry needs a steady flow of qualified workers. Workers with diversified skills, problem solving ability, and knowledge of building science and general

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construction can have upward mobility into higher paying career jobs. As Illinois adopts more advanced energy efficiency and building codes, construction-related and remodeling/retrofit workers will need additional training.

Clean-energy focus of construction methods applies to a wide range green-building practices and varied building certifications. Existing construction programs should incorporate green-building design and construction principles into the basics to overcome the ideas that somehow green building is a separate topic, “different,” “more difficult,” “more expensive,” and therefore “not desirable” for construction. Programs that normalize green building practices, improve energy efficiency, and focus on long-term operating costs of buildings will help move Illinois closer to carbon reduction goals. Workers with diversified skills, problem solving ability, and knowledge of building science, general construction, and green building practices can have considerable upward mobility into higher paying career jobs. Also, we recommend cross training roofers with solar panel installation training to prepare them for in-demand solar installation work.

Building maintenance

Cluster 5 includes the following four jobs:

- HVAC Mechanics & Installers
- Industrial Machinery Mechanics
- Maintenance & Repair Workers, General
- Plumbers, Pipefitters, and Steamfitters

We identified related CIP training programs for these jobs. Below we list the number of training programs we identified that are associated with each CIP training program:

- HVAC/R Maintenance Technology/Technician (114)
- HVAC/R Engineering Technology/Technician (8)
- Industrial Mechanics and Maintenance Technology (13)
- Building/Property Maintenance and Management (9)
- Plumbing Technology/Plumber (25)

Table 22: Building Maintenance Training Program Inventory Summary

Training provider type	Training program outcome	Program length	Location
Mostly community colleges, with a few private and apprenticeship programs	Mostly industry-recognized certificates or IHE completion certificates (75). 23 associate degrees, and a handful of apprenticeship certificates. Lots of stackable certificates	Half of the programs were between 26-50 weeks. Others split between short-term (0-25 weeks) and longer programs (51-75 weeks).	Decent geographic distribution throughout the state, though no programs were identified in the West Central and Southeast regions.

Most jobs in this category require medium preparation: vocational school training and on the job experience, an associate degree of 1 – 2 years. Industrial Maintenance Mechanic training may include an apprenticeship. The most training programs (114) were found associated with the HVAC mechanic and installer job. Lightcast reports

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9 programs for building/property maintenance, 25 programs for plumbing trades, and 13 programs for industrial mechanics and maintenance technology.

Training programs for jobs in this cluster are most frequently part of community college programs (110 programs). There were 38 apprenticeship providers listed, 7 for-profit training programs, and 13 programs that fell into an “other” category. Of these, 66 programs provided industry-recognized certifications, 22 IHE certificates of completion. 31 offer apprenticeships, 14 provide licenses (for plumbing primarily). Most training programs were between 26 and 50 weeks (65). 52 training programs were 51-75 weeks of training. 27 programs were considered short programs under 25 weeks. 7 programs were more than 101 weeks of training – indicating completion of an apprenticeship program.

Recommendation

Lightcast estimates the highest growth in this cluster at 18.8% for industrial maintenance mechanics. Growth projects are flat for HVAC and General Maintenance and Repair Workers. 3% growth is expected in the plumbers and pipefitters field. IDES data projects industrial maintenance mechanics to grow by 27% and growth of 9 – 10% for HVAC mechanics and installers, maintenance and repair workers, and plumbers and pipefitters. Stationery engineers and boiler operator jobs are projected 7.66%. This data was published before the passage of the 2022 Inflation Reduction Act, which provides rebates, credits, and other incentives for high energy efficiency appliances and renewable energy projects. The Inflation Reduction Act addresses affordability of high-efficiency HVAC systems for low and moderate-income individuals by providing credits at the time of purchase. Families putting off the purchase of energy systems that reduce energy bills will have more financial resources beginning in 2023 to upgrade furnaces and boilers. As high-efficiency appliances are incentivized, the market for these products will increase. HVAC technicians will need to learn new skills for installing high efficiency equipment such as high efficiency air-source heat pumps; geothermal or ground source heat pumps; hybrid hot water systems; heat-pump water heaters and more. Companies that begin to sell and repair these technologies early on will be at an advantage over companies that are only interested in sticking with the status quo.

Climate and Equitable Jobs Act Training programs should focus on HVAC and Industrial Maintenance Mechanics programs in this cluster. Create training for energy efficiency, controls, and heat pump expertise.

Manufacturing

The manufacturing cluster includes the following jobs:

- Sheet Metal Worker
- Machinist
- Machine Tool Setters, Operators, Tenders, Metal & Plastic
- Welder, Cutter, Solderer, and Brazer.

For these four jobs, we identified a diverse set of CIP training programs. Below we describe the number of programs we identified for each training program type.

- Welding technology/welder (221 programs)

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- Welding Engineering Technology/Technician (2)
- Machine Tool Technology/Machinist (65)
- Machine Shop Technology/Assistant (13)
- Manufacturing Engineering Technology/Technician (12)
- Sheet Metal Technology/Sheet working (6)
- Sheet Metal Worker (7)
- Precision Systems Maintenance and Repair Technologies/Technician (2)
- Precision Production, Other (3)
- Computer Numerically Controlled (CNC) Machinist Technology (2)

In total, we identified 340 training programs related to manufacturing. Most jobs in this category require some preparation, some experience, and 3 months to 1 year of training. A machinist job may require a medium level preparation with vocational school training, on-the-job experience, or 1–2-year associate degree.

The table below summarizes some of the main findings from our inventory of this cluster.

Table 23: Manufacturing Training Program Inventory Summary

Training provider type	Training program outcome	Program length	Location
Most programs we identified were based at community colleges (259), with a few private providers (34) or other providers (41).	Most programs led to industry-recognized certificates or IHE certificates of completion (275). There were a few Associate degree programs (44)	Over half of the programs in this inventory were under 25 weeks, while 30% were between 26-50 weeks, and 15% were between 51-75 weeks.	Geographic distribution is somewhat representative of population levels, with the Northeast region having the largest number of training programs. The North Central and Southern regions have a disproportionately high number of training programs per population.

Recommendation

As our inventory shows, there are ample training programs in the manufacturing sector, many job openings, and high anticipated growth. We also note that three of the four jobs in this cluster are below living wage.

It is unclear how much specialized clean-energy curriculum is required for this industry. The technical skills taught in existing programs are likely similar to the technical skill needs for clean-energy focused manufacturing (manufacturing solar panels, for instance). However, students may benefit from a “core” clean energy curriculum that broadens their career options to other clean energy career pathways. In regions where manufacturing is expected to grow, there may be a need for additional training, especially training delivered by community-based organizations that is more accessible to target populations.

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