Alignment Between Community College Credentials and Middle-Skill Jobs in Advanced Infrastructure and Energy

By Cameron Sublett, Maria Cormier, and Susan Bickerstaff

In an economic climate where many high-value, high-demand jobs require less than a bachelor's degree, community colleges play a critical role in preparing workers for emerging occupations. In 2023, CCRC launched the Building a Sustainable Future initiative to examine how community colleges are recruiting and training students for the "green economy" (CCRC, n.d.). Through dialogue with colleges, we learned that they were seeking to meet the demand for new skills driven by historic federal investments, such as the Infrastructure Investment and Jobs Act (2021) and the Inflation Reduction Act (2022). And colleges sought to identify which credentials would best prepare students for the shifting labor market.

To address this question, we conducted a national landscape study to assess the alignment between occupational demand (as measured by job postings) and worker supply (as measured by community college credentials awarded) (Cormier, 2025). However, as our research progressed, it became clear that a traditional definition of green jobs did not capture the full scope of the emerging landscape. We found that the green economy relies on many occupations that, while not narrowly defined as green, require similar technical competencies and are equally central to the future workforce.

In this brief, we introduce an inventory of what we call advanced infrastructure, energy, and agriculture (AIREA) jobs. This classification encompasses traditional green roles—such as wind turbine technicians, solar photovoltaic installers, and environmental engineering technicians—as well as adjacent occupations shaped by changing energy and infrastructure demands, such as electrical line workers, construction managers, precision agriculture technicians, and industrial machinery mechanics. Driven by major public and private investments, the need for workers in AIREA fields is expected to rise (Di Battista et al., 2025). Importantly, community colleges have long been the dominant education providers for these occupations, which frequently require less than a bachelor's degree.

We begin by explaining how we identified AIREA jobs and credentials. We then present findings on AIREA job postings and community college credentials awarded between 2010 and 2023. Using commuting zones as our regional unit of analysis, we identify areas where AIREA job availability and credential production appear to be well aligned. Overall, demand for AIREA workers grew significantly between 2010 and 2023. These fields support diverse credentialing

pathways, and many commuting zones show strong alignment between graduate supply and workforce demand. Insights from the study can help federal and state policymakers identify high-growth sectors and regions while supporting community and technical colleges in developing, modifying, and expanding programs in industries where trained workers are most needed.

Identifying AIREA Jobs and Credentials

To identify and define AIREA jobs and credentials, we analyzed job postings data from Lightcast and community college award data from the Integrated Postsecondary Data System (IPEDS). Through a multistep refinement process, we selected 235 occupational codes and 429 distinct degree and certificate programs for the AIREA inventory. We linked the credential programs to occupations using a crosswalk established by the National Center for Education Statistics (see Wang et al., 2025, for details). Overall, between 2010 and 2023, AIREA roles accounted for 27% of all postings, while approximately 17% of all community college credential completions were in AIREA fields of study.

Community colleges award AIREA credentials across a broad range of program areas, including welding, automotive technology, and wastewater treatment. Table 1 illustrates the relationship between these program areas and their corresponding career pathways through several examples, noting the typical education level required for occupational entry.[1] (The complete list of AIREA occupations and corresponding programs of study may be downloaded from the data tool.) These examples demonstrate that AIREA jobs vary in their entry requirements, ranging from high school diplomas to associate degrees. Higher-level jobs in these program areas as well as entry-level jobs in other program areas require bachelor's degrees. This highlights the dual importance of community colleges' workforce training and transfer functions.

Research Methods and Online Data Explorer

For methodological details about this study, visit the **AIREA Data Explorer**, an interactive data tool developed by a team of researchers at the Foundation for California Community Colleges and the University of Tennessee, Knoxville (Wang et al., 2025). The tool allows users to explore AIREA hiring trends by commuting zone and the number and type of AIREA credentials awarded by community colleges.

Table 1.

Examples of AIREA Credentials and Jobs

Program area	Common community college award level	Aligned occupations	Entry education level	Industry
Automobile/automotive mechanics technology/technician	Short-term certificate	Electrical and electronics installers and repairers, transportation equipment technician	Associate degree or some college	Energy
Marine science/merchant marine officer	Short-term certificate	Ship engineers	Associate degree or some college	Infrastructure
Water quality and wastewater treatment management and recycling technology/technician	Associate degree	Environmental science and protection technicians, including health technicians	Associate degree or some college	Agriculture
Welding technology/welder	Short-term certificate	Welders, cutters, solderers, and brazers	High school diploma or equivalent	Infrastructure

Note. Short-term certificates are less than one academic year in duration.

AIREA Jobs and Their Characteristics

Overview of AIREA Job Postings

The most common AIREA jobs are heavily concentrated in the infrastructure and energy industries. Many of these roles, including truck drivers and automotive service technicians, prioritize technical skill and practical experience and therefore require a subbaccalaureate credential, such as a short-term credential, an industry-recognized certificate, or a high school diploma. While some engineering and management roles in the AIREA landscape require a bachelor's degree, these positions appear in significantly lower volumes (see Table 2). For example, there were nearly 10 million unique job postings for truck drivers compared with fewer than 1.5 million for civil engineers.
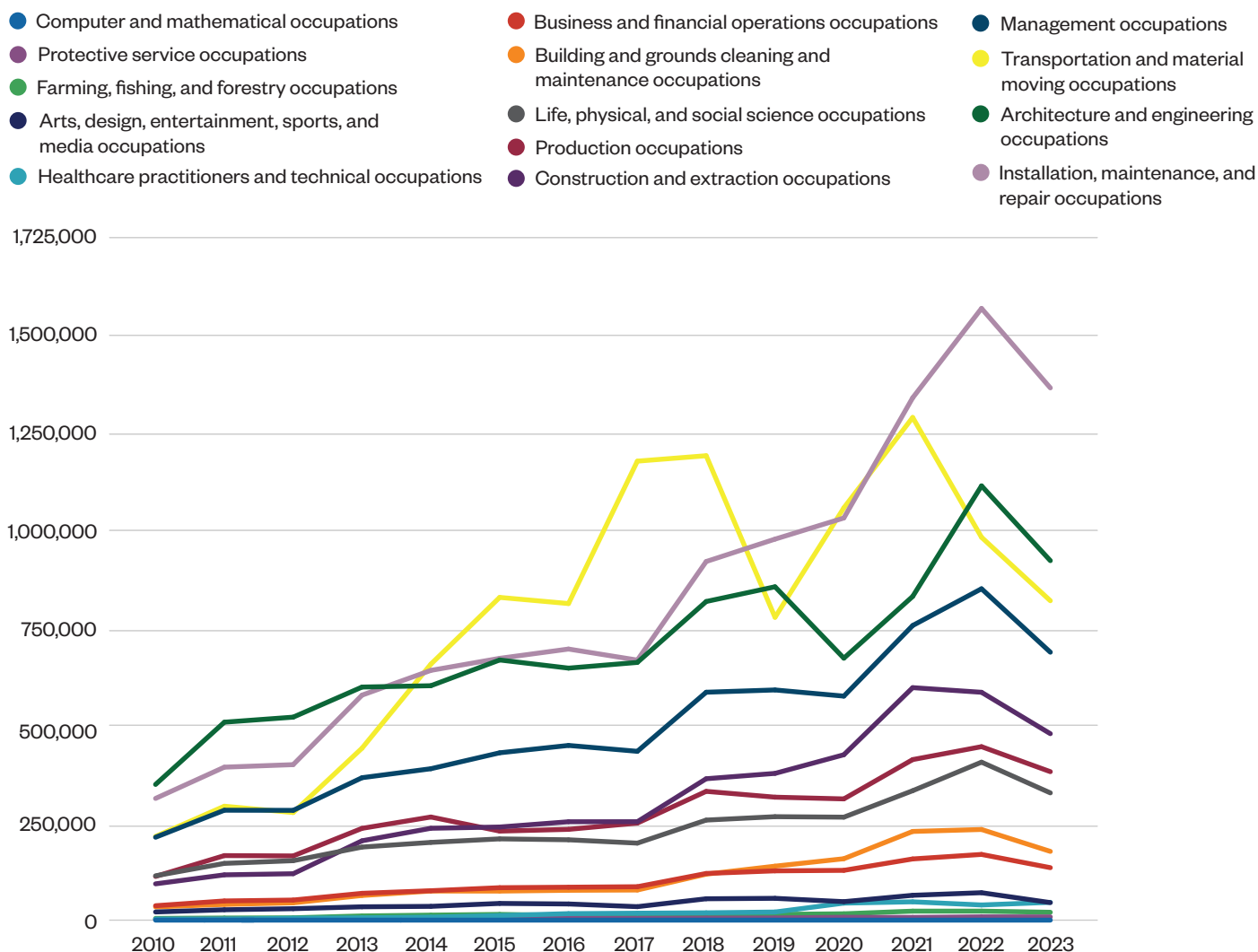
Table 2.

Top 10 AIREA Jobs, 2010–2023

Occupation	Unique job postings	Entry education level	Industry
Heavy and tractor-trailer truck drivers	9,984,462	Associate degree, certificate, or some college	Infrastructure, energy
Maintenance and repair workers, general	3,950,770	High school diploma or equivalent	Infrastructure
Automotive service technicians and mechanics	2,178,514	Associate degree, certificate, or some college	Infrastructure, energy
Industrial engineers	2,039,480	Bachelor's degree or higher	Infrastructure, energy
Transportation, storage, and distribution managers	1,903,721	High school diploma or equivalent	Infrastructure
First-line supervisors of mechanics, installers, and repairers	1,630,732	High school diploma or equivalent	Infrastructure, energy
Inspectors, testers, sorters, samplers, and weighers	1,580,235	High school diploma or equivalent	Infrastructure
Industrial production managers	1,523,929	Bachelor's degree or higher	Infrastructure, energy
Mechanical engineers	1,520,180	Bachelor's degree or higher	Infrastructure, energy
Civil engineers	1,461,964	Bachelor's degree or higher	Infrastructure

General Trends in Demand

The demand for jobs in AIREA fields has increased over the past decade. As Figure 1 shows, transportation and material-moving occupations and installation, maintenance, and repair occupations experienced the most dramatic increases in job postings, especially from 2019 through 2022. The decline after 2022 suggests the surge may have been driven in part by pandemic-related labor demand and supply chain constraints, followed by a cooldown.

Figure 1.

AIREA Job Postings, 2010–2023

- Computer and mathematical occupations
- Protective service occupations
- Farming, fishing, and forestry occupations
- Arts, design, entertainment, sports, and media occupations
- Healthcare practitioners and technical occupations
- Business and financial operations occupations
- Building and grounds cleaning and maintenance occupations
- Life, physical, and social science occupations
- Production occupations
- Construction and extraction occupations
- Management occupations
- Transportation and material moving occupations
- Architecture and engineering occupations
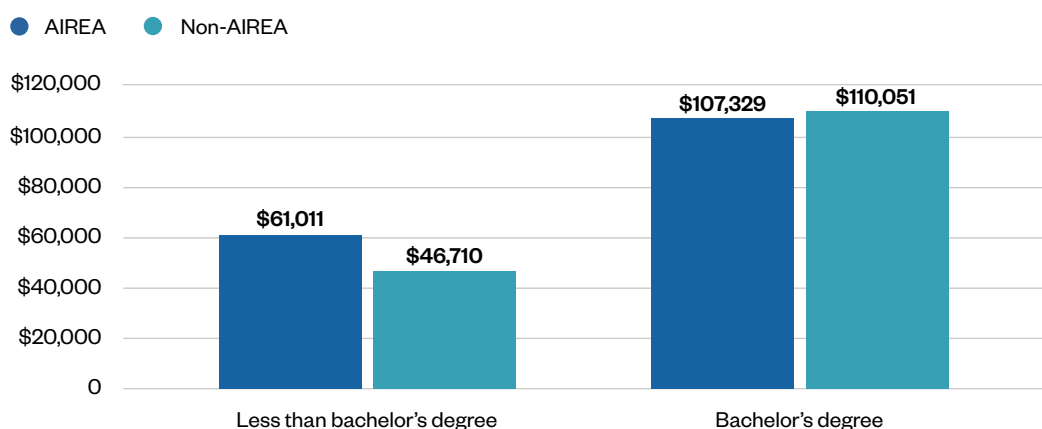- Installation, maintenance, and repair occupations

Several occupational categories, particularly construction and extraction, experienced steady or accelerated growth in job postings over the decade. This trend reflects sustained demand for hands-on, infrastructure-adjacent roles, many of which are likely supported by public sector investments in energy and transportation.

Wage Statistics

Analysis of 2024 occupational wage data from the Bureau of Labor Statistics' (BLS) Occupation, Employment and Wage Statistics (OEWS) program indicates that middle-skilled workers[2] in AIREA jobs earn about 31% more annually than equivalently skilled workers in non-AIREA roles.[3] Figure 2 shows that for jobs that do not require a bachelor's degree, the average wage is higher in AIREA roles ($61,011) than in non-AIREA roles ($46,710). At the bachelor's degree level, wages are about equal: $107,329 in AIREA versus $110,051 in non-AIREA jobs. These findings underscore the viability of AIREA-related professions as "good jobs," demonstrating that they offer compensation competitive with other fields for candidates with or without a bachelor's degree.

Figure 2.

Annual Wages for AIREA and Non-AIREA Jobs, 2024

Community College AIREA Credentials

Overview of AIREA Awards

Although 17% of community college awards nationally are in AIREA program areas, this proportion varies substantially across colleges. While a few institutions award large shares of their credentials in AIREA programs (above 60%), most colleges award between 10% and 20% of their credentials in such programs, suggesting that many community colleges fall below the national mean. The most AIREA-intensive institution, South Central Louisiana Technical College, reported 90% of awards completed in AIREA programs, while others recorded rates as low as 0%. These extremes point to pronounced regional and institutional specialization, likely reflecting differing state priorities and labor market contexts.

While non-AIREA programs still account for the majority of credentials conferred by community colleges, the number of AIREA awards has grown more rapidly in recent years. From 2010 to 2023, AIREA completions grew by 69% (rising from 142,312 to 240,610), outpacing the 55% increase in non-AIREA fields. This upward trajectory signals sustained institutional and student interest in AIREA programs, ongoing demand for AIREA jobs, and the potential impact of stable public investments in applied fields.

Characteristics of AIREA Programs and Credential Pathways

Ten AIREA program areas account for 52% of AIREA credentials across all award levels, indicating a concentration in key fields. These program areas include welding technology/welder; biological and physical sciences; automobile/automotive mechanics technology/technician; heating, ventilation, air conditioning, and refrigeration maintenance technology (HVAC/R); electrician; truck and bus driver/commercial vehicle operator and instructor; biology/biological sciences; general; diesel mechanics technology/technician; and industrial mechanics and maintenance technology/technician.

As Figure 3 illustrates, AIREA programs are most prominent at the certificate level. Between 2010 and 2023, AIREA fields accounted for 26% of all short-term (less than one year) certificates and 20% of long-term (one year or more) certificates awarded by community colleges. In contrast, they represented a much smaller share of degree awards, comprising 10% of associate degrees and just 4% of bachelor's degrees conferred by community colleges.[4] This distribution has remained remarkably stable over time. Despite small changes in award trends, such as a gradual rise in community college bachelor's completions and a minor decrease in short-term certificate completions, the fundamental dominance of certificate-level training in AIREA fields at community colleges has held steady.

Figure 3.
Distribution of Community College AIREA Credentials by Award Level, 2010–2023
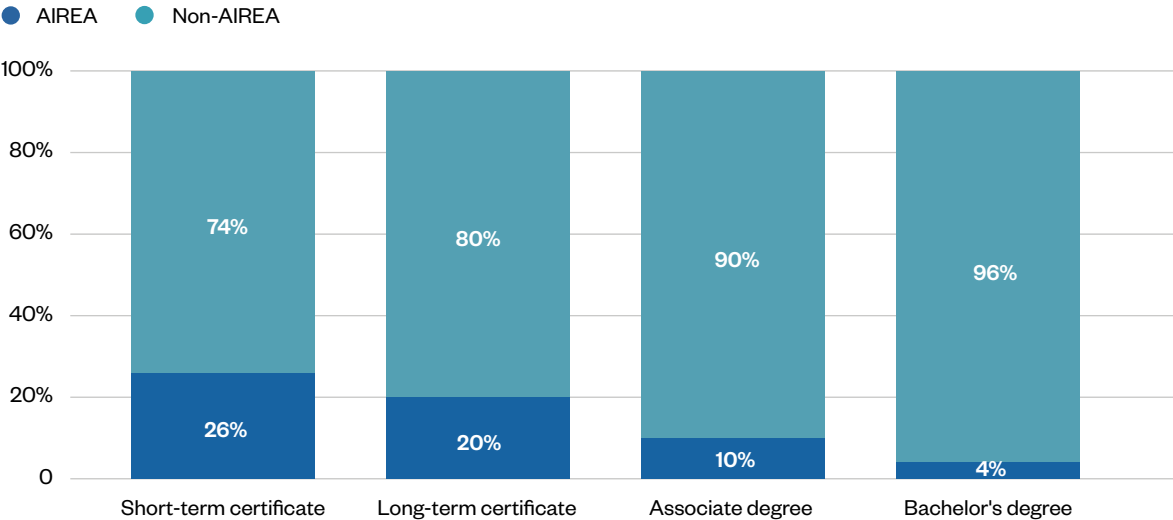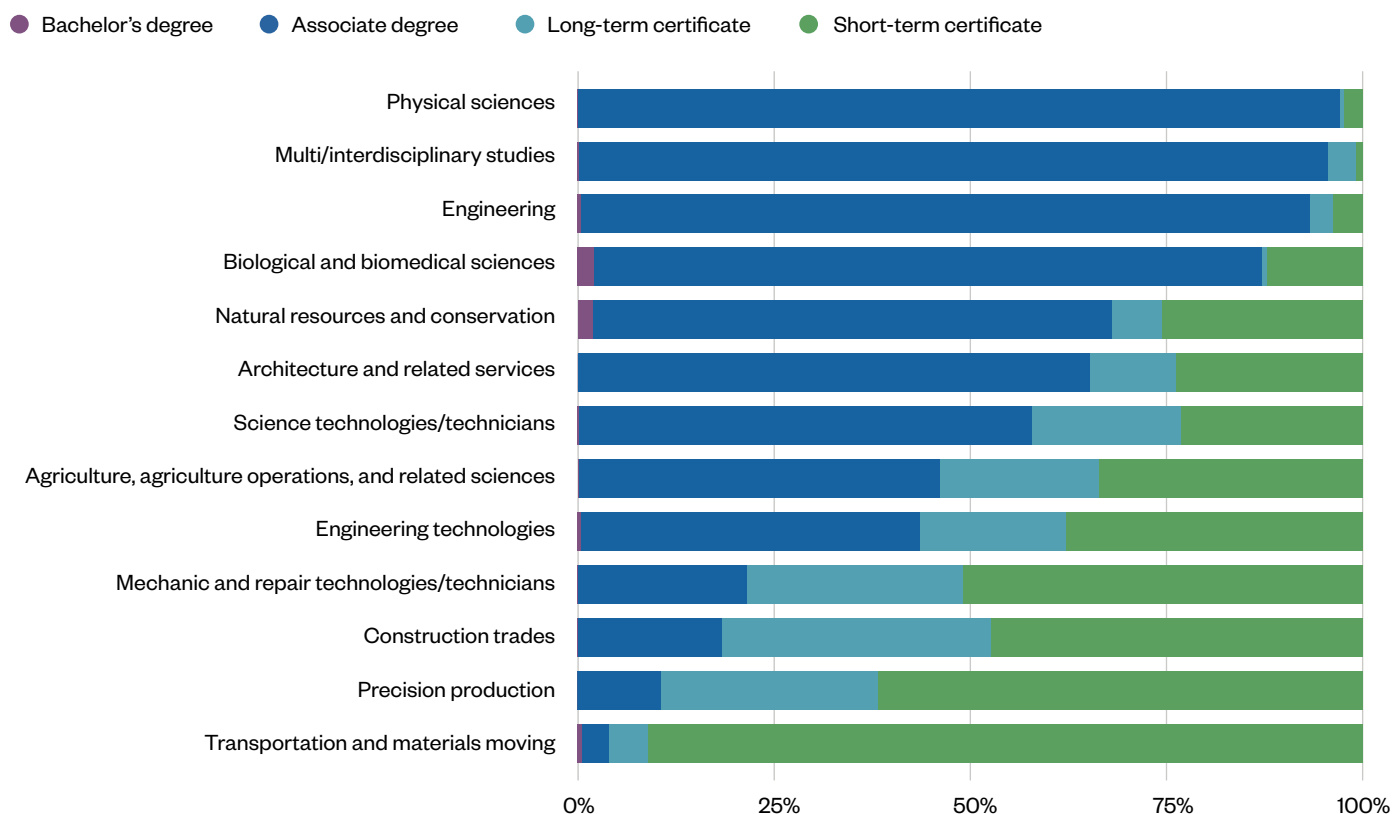

Figure 4 disaggregates AIREA credentials by their two-digit Classification of Instructional Programs (CIP) codes, which indicate their respective field (comprising multiple program areas). Analyzing the data at this level reveals distinct variations in the mix of awards across fields. Notably, hands-on technical sectors such as transportation and materials moving, precision production, and construction trades are dominated by short- and long-term certificates, with relatively few associate degrees. This structure supports fast, skills-forward pathways for roles like welders, electricians, and HVAC installers. The data suggest these sectors are optimized for rapid workforce entry, leveraging community colleges for focused technical training.

Figure 4.

Distribution of Community College AIREA Credentials by Field and Award Level, 2010–2023

● Bachelor's degree　● Associate degree　● Long-term certificate　● Short-term certificate

Meanwhile, the largest number of AIREA program completions at the associate level are in the applied science, technology, engineering, and mathematics (STEM) foundations and engineering technologies programs, such as biological and physical sciences, drafting/design technology, and engineering. In fields such as physical sciences, engineering, and multi/interdisciplinary studies, associate degrees account for the majority of awards, suggesting these areas require more foundational coursework or are commonly linked to transfer pipelines to four-year institutions. Among community college bachelor's degree completions in AIREA fields, nearly all were in applied science and technical specializations.

Regional Alignment Between AIREA Job Postings and Credentials

Here we examine the supply–demand balance, or alignment, within commuting zones. Defined by the U.S. Department of Agriculture, commuting zones represent functional local labor markets based on the flow of commuters across county lines. To measure alignment, we aggregate credential completions for every community college within a zone and compare them with local job postings. For instance, Colorado Northwestern Community College is located in the Steamboat Springs, Colorado, commuting zone. Between 2010 and 2023, the college awarded 3,403 credentials, roughly 18% of which were in AIREA fields. Over the same period, 18% of the 59,635 unique job postings in the commuting zone were for AIREA roles.
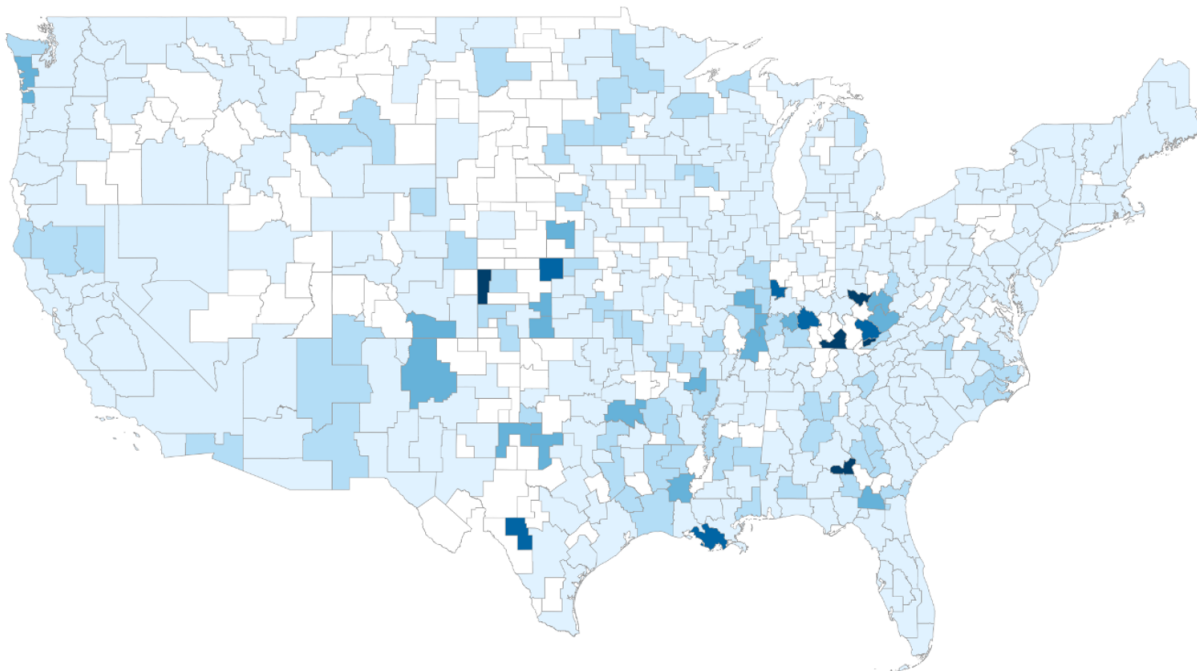
This suggests that while the absolute volume of demand is high, the college's program mix is proportionally well tuned to the local economy.

Figure 5 shows the ratio of community college credential supply to workforce demand. A value of 1.0 represents nominal equilibrium, with one community college AIREA credential produced for every AIREA job posted. The dominant trend is a pervasive national undersupply, particularly in major metropolitan hubs. The vast majority of the map has a supply–demand ratio of 0.00–0.43,[5] indicating that job postings significantly outstrip the production of related degrees and certificates. In the lowest-tier regions, more than six job openings were available for each credential awarded.

Figure 5.

AIREA Supply–Demand Ratio, 2010–2023

- 0.00 – 0.17: Extreme undersupply
- 0.18 – 0.43: High demand/low supply
- 0.43 – 0.93: Approaching alignment
- 0.94 – 1.58: Balanced market
- 1.59 – 3.23: Supply exceeds demand
- N/A – commuting zone without community colleges

However, the map also reveals pockets of high alignment or potential oversupply, with ratios of 1.59–3.23. Notably absent from major coastal population centers, these commuting zones are primarily concentrated in rural and micropolitan regions within the Great Plains, Rust Belt, and parts of the South. This likely reflects a dynamic where lower absolute job volumes make it easier for colleges to meet demand, or where specialized training infrastructures simply outpace local labor markets. The result is a sharp geographic divergence: While some rural areas occasionally achieve equilibrium or surplus, the nation's largest metropolitan labor markets face a deepening green skills gap.

Discussion and Conclusion

This brief examines national patterns in AIREA credential production at community colleges and labor market demand over a 13-year period. Our findings offer insights for policymakers, community college leaders, and practitioners seeking to continue strengthening the workforce for the emerging green economy:

Community colleges are central to infrastructure and energy workforce preparation. Demand for AIREA jobs has risen steadily over the past decade. The most common roles are concentrated in the infrastructure and energy sectors and typically require subbaccalaureate credentials, such as short- and long-term certificates. Our analysis confirms that the majority of AIREA job postings require less than a bachelor's degree, reinforcing the essential role community colleges play in preparing the middle-skill workforce.

AIREA careers offer strong returns. With AIREA workers earning approximately 31% more than similarly skilled workers in non-AIREA fields in jobs that do not require a bachelor's degree, expanding access to AIREA programs offers a powerful lever for economic mobility. This is particularly vital for students from underserved or rural communities, where these high-wage, middle-skill pathways can drive regional prosperity.

Flexible, stackable education pathways are critical. Between 2010 and 2023, 17% of all community college credentials were in AIREA fields. While completions are concentrated at the certificate level, especially in hands-on technical trades, associate degrees remain common in applied STEM and engineering disciplines, such as biological and physical sciences and drafting/design. This variation underscores the need for stackable credentials that allow students to prioritize immediate job entry while retaining clear options for longer-term academic and career advancement.

Regional specialization drives workforce alignment. While national data show a general undersupply of AIREA credentials, some smaller commuting zones demonstrate strong alignment between graduate supply and local demand. These regions, which often produce a high number of AIREA graduates relative to their size, serve as successful models for aligning education with economic development. Their example suggests that workforce development strategies are most effective when tailored to specific regional contexts rather than applied broadly.

Endnotes

1. While our inventory includes quintessential green jobs, it also captures certain occupations not traditionally labeled as such. For example, while not strictly green, automotive mechanics and technicians will be instrumental in advancing the nation's energy and infrastructure economies.

2. The BLS defines middle-skill jobs as those requiring more education and training than a high school diploma but less than a bachelor's degree.

3. Average OEWS annual wage figures for AIREA and non-AIREA occupations were weighted by the number of workers within each occupation to reduce bias from differences in occupational size.

4. About 200 community colleges in 24 states confer relatively small numbers of bachelor's degrees (Bragg et al., 2024).

5. Supply–demand ratios were grouped using the Jenks natural breaks method, which partitions values into five classes by minimizing within-class variance and maximizing between-class differences to better represent the underlying distribution of AIREA alignment values.

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