The Workforce Readiness Index: A Local and Regional Assessment Tool for Energy Sector Preparedness

Brinn McDowell, Haijing Liu, Jeremy Stefek, and Bailey Pons

National Renewable Energy Laboratory

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List of Acronyms

EPA	U.S. Environmental Protection Agency
IPEDS	Integrated Postsecondary Education Data System
LFPR	labor force participation rate
LQ	location quotient
MSA	Metropolitan Statistical Area
NCES	National Center for Education Statistics
NREL	National Renewable Energy Laboratory
RAPIDS	Registered Apprenticeship Partners Information Database System
SOC	Standard Occupational Classification

Executive Summary

Building up a workforce that is properly trained and adequately sized is essential to the deployment of energy generation sources for the United States to meet future energy demand. Workforce development to support supply chain or large infrastructure investments typically occurs at a local level. However, there is a critical gap in understanding where and to what extent regional workforces are equipped to meet the needs of an energy industry. The Workforce Readiness Index ("the index") was developed to assess and compare energy sector workforce readiness across the United States at the county level to provide granular information to various stakeholders such as industry members, state decision makers, and training program developers. Workforce readiness is defined as the ability to recruit from the general labor market, transition workers with comparable skill sets, and train a workforce using scalable or existing training programs near a specific location. Therefore, the index evaluates readiness levels based on the likelihood that a county possesses the workforce development infrastructure needed to support the occupations required by an energy-related industry or sector. Furthermore, the index offers a standardized yet flexible approach that captures regional variations and highlights local strengths and challenges.

Both internally developed datasets and publicly available data were leveraged to calculate the index. In conjunction with other metrics and qualitative information, the results of the index are intended to provide insights for key stakeholders to support more informed decisions about energy development. To develop and use the index, the following five replicable steps can be followed:

- Step 1: Create internal datasets—e.g., an Occupation Map (see example in Appendix A.1) and Education and Training Database (see example in Appendix A.2)—for the target energy industry or deployment phase.
- Step 2: Collect the county-level workforce and economic data for all indicators (Section 2.1).
- Step 3: Perform calculation process (Section 2.2).
- Step 4 (optional): Upload data into ArcGIS or similar mapping software.
- Step 5: Interpret results (Section 3).

Building on the methodology of the Economic Development Capacity Index developed by Argonne National Laboratory in collaboration with the U.S. Economic Development Agency, the Workforce Readiness Index is composed of four main sub-indices: workforce availability, transportation access, program availability, and transferrable skills. Each sub-index is assessed using several indicators, which are collected at the county level or Metropolitan Statistical Area level from either publicly available datasets, such as the U.S. Census Bureau, or internal data collection efforts. The results of the index across the four sub-indices are then grouped into five different categories based on the level of readiness.

As a result, the index can be leveraged to compare regional workforce readiness across different phases of development—highlighting variations in occupational capacity—and at different geographic levels of comparison. The geographic levels of comparison include counties compared to the national average, counties compared to their state average, and selected regions of counties compared to one another. It can also overlay these occupational patterns with

resource data to assess whether regions with strong resource potential are also well prepared in terms of workforce. The index also helps visualize both alignment and gaps across regions; it identifies counties that are lagging and explores potential causes, such as training availability, existing industry structures, or labor market constraints, and offers insights into how these regions can improve preparedness for energy deployment.

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1 Introduction

As the United States approaches unprecedented growth in energy consumption, there is an immediate need to support a domestic energy supply chain to deploy generation sources to meet the demand and to develop a workforce to manufacture, construct, and operate these energy generation systems. In a recently released study, the National Electrical Manufacturers Association (2025) calculated a 50% increase in electricity demand by 2050 in the United States. Meeting this electricity demand will require not only technological and infrastructure investments but also a skilled and adequately sized workforce aligned with accelerated deployment. However, there is a critical gap in understanding where and to what extent regional workforces are equipped to meet the needs of an energy industry. Workforce development efforts are typically localized, leading to significant variation in workforce development initiatives across regions. In response, industry stakeholders have expressed the need for more detailed, region-specific analyses that can better inform planning and resource allocation for recruiting, training, and hiring workers.

For this purpose, the Workforce Readiness Index ("the index") was developed as a national tool to assess and compare energy sector workforce readiness.[1] Unlike existing tools, the index offers a standardized yet flexible approach that captures regional variations and highlights local strengths and challenges. Its structure allows users to explore specific workforce readiness indicators across multiple geographies, enabling industry leaders, federal and state governments, and other stakeholders to make better-informed decisions. This assessment methodology can also be applied across different energy industries or phases of deployment by analyzing specific occupations or occupational groupings. Overall, the index presented in this report offers a novel approach to addressing the urgent workforce needs of the energy sector by providing a data-driven, localized view of workforce capacity across the United States.

This report documents the methodology leveraged for the creation of the Workforce Readiness Index. The objectives of the index are twofold: (1) to provide data-driven insights that inform the development of targeted local workforce initiatives and (2) to promote a community-based approach in the infrastructure planning and site selection processes. Apart from informing supply chain and infrastructure decisions, the methodology standardizes an analytical approach to compare local and regional workforce readiness for energy industries from a workforce perspective. The results of the index could be valuable for a variety of audiences, including industry (e.g. developers, manufacturers, operators), local economic and workforce development boards, federal and state government decision makers, training organizations, and other researchers. Ultimately, the index intends to inform large capital investments such as the siting of manufacturing facilities or power plants.

The report is organized as follows: the next section details the structure and indicators used in the index, followed by data sources and aggregation methods. Subsequent sections provide example applications of the tool and a discussion of key findings, limitations, and future directions.

[1] Workforce readiness is defined in Section 2.1 of this report.

2 Methodology

The index methodology provides a standardized process to assess the workforce readiness level of a county with respect to the nation or a particular state.[2] A county-level granularity was chosen, driven by the input data. Through the creation of internal datasets, the index results can be customized to assess the unique workforce development needs of various energy industries or phases of deployment. The following five replicable steps can be followed to use the method:

- Step 1: Create internal datasets—e.g., an Occupation Map (see example in Appendix A.1) and Education and Training Database (see example in Appendix A.2)—for the target energy industry or specific deployment phase.
- Step 2: Collect both publicly available and internally developed datasets for all indicators (Section 2.1).
- Step 3: Perform calculation process (Section 2.2).
- Step 4 (optional): Upload data into ArcGIS or similar mapping software.
- Step 5: Interpret results (Section 3).

The following sections detail the indicator data, describe how the calculation process is conducted, and explain how to interpret the results of the index.

2.1 An Approach to Calculating Metrics: Index, Sub-Index, Pillars, and Indicators

Workforce readiness is defined as the ability to recruit from the general labor market, transition workers with comparable skill sets, and train a workforce using scalable or existing training programs near a specific location. The calculator evaluates readiness levels based on the likelihood that a county possesses the workforce development infrastructure needed to support the occupations required by an energy industry.

The Workforce Readiness Index is composed of four main sub-indices: workforce availability, transportation access, program availability, and transferrable skills based on previous research by the National Renewable Energy Laboratory (NREL) (Pons et al. forthcoming). Each sub-index is assessed using several indicators, which are collected at the county level or Metropolitan Statistical Area (MSA) level from publicly available datasets, such as the U.S. Census Bureau, or through internal data collection efforts.

The results of the Workforce Readiness Index are grouped into five different categories based on the level of readiness across the four sub-indices: very low, low, moderate, high and very high readiness. The index provides a way to compare the ability of various areas to support the development of an energy industry at a singular point in time and helps inform decision-making. However, it is important to note that the index is intended to be used with other metrics and is not based on workforce magnitude, which is the number of workers needed for each occupation to meet demand.

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[2] Additionally, because the calculation methodology is comparative, it can also be used to understand the workforce readiness level of a county with respect to the state or selected region; however, those results are not displayed on the visualization tool.

The following subsections introduce the indicators for the workforce availability, transportation access, transferrable skills, and program availability sub-indices (Figure 1). The workforce availability and transportation access sub-indices are technology-agnostic and are based primarily on socioeconomic data, whereas the transferrable skills and program availability sub-indices are specific to the target industry sector and therefore require the creation or utilization of specific databases.

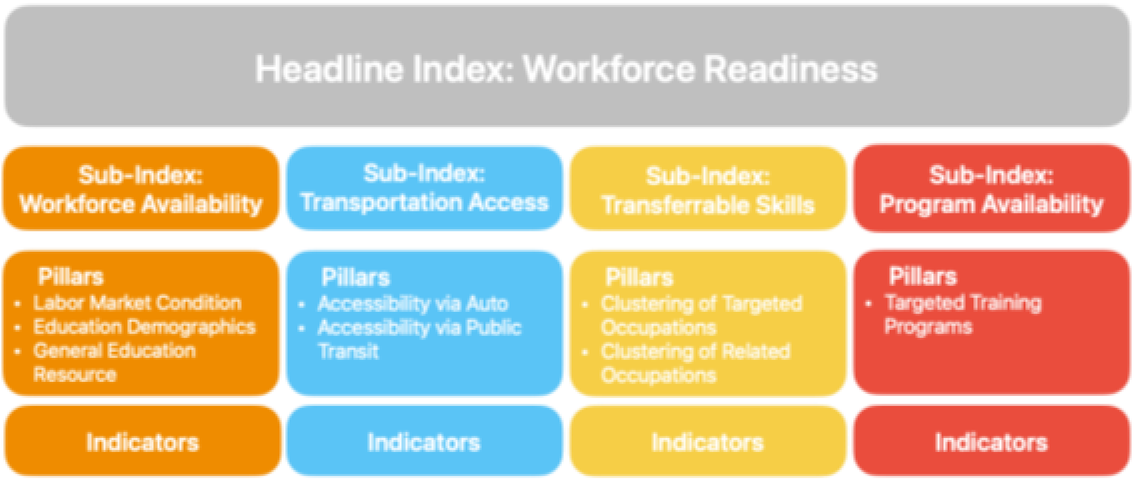

Figure 1. Index, sub-index, pillars, and indicators for the Workforce Readiness Index

2.1.1 Workforce Availability

The workforce availability sub-index assesses the extent to which the general workforce is employed or seeking employment and the education attainment level of the current and future workforce. It aims to understand the labor market foundation of an area and is not technology specific. The sub-index for workforce availability is composed of three pillars (Figure 1) and multiple associated indicators (Table 1). The three pillars include labor market conditions, education demographics, and general education program availability.

2.1.1.1 Labor Market Conditions

The labor market condition pillar provides an overview of the demographic structure and economic dynamics in a county.

Labor force participation rate (LFPR) measures the percentage of the working-age population that is either employed or actively looking for work. A high LFPR means a large proportion of people are engaged in or seeking employment, signaling a robust pool of potential workers. Therefore, LFPR can be understood as an indicator of the overall capacity of the local labor force (International Labour Office 2016). A higher LFPR implies a higher workforce availability and thus a higher workforce readiness level.

Younger population percentage denotes the proportion of the total population that is under 15 years of age. A higher younger population percentage represents the long-term workforce availability of the local market and therefore a higher workforce supply readiness in future years.

Unemployment rate measures the proportion of the labor force that is unemployed and actively seeking employment. This indicator is widely leveraged as a key indicator of local economic conditions. A higher unemployment rate signals an economic downturn (International Labour Office 2016). However, with respect to the index, a higher unemployment rate means that more individuals are actively seeking job opportunities, which could create a larger available workforce for energy projects. This increased labor supply may make it easier for firms to find qualified or trainable workers, potentially reducing labor costs and accelerating project implementation. As a result, the local government might view energy development as a strategic opportunity to address unemployment while also advancing energy goals. A higher unemployment rate in this case represents a higher workforce availability and higher workforce readiness level in a county.

2.1.1.2 Education Demographics

The education demographic pillar considers the human capital perspective of the general labor market conditions (International Labour Office 2016). The pillar is composed of three variables: percentage of population 25 years and over that has a high school degree or GED, percentage of population 25 years and over that has a bachelor's degree or above, and percentage of population 25 years and over that has an associate's degree or some college education.

The percentage of the population that holds a bachelor's degree is often used as a key indicator of human capital, reflecting the skill level and economic potential of a region. Higher concentrations of college-educated individuals are associated with increased productivity, innovation, and wage growth, contributing to regional economic development (Glaeser and Maré 2001). However, it does not fully capture other skill sets, such as those gained through vocational training, which also play a crucial role in the manufacturing, construction, and operation of energy infrastructure. Therefore, the percentage of the population that holds a high school or associate's degree is included to provide a more comprehensive measure of the workforce readiness level. This approach aligns with previous research emphasizing the need for a varied talent pipeline that includes both traditional college graduates and those with vocational training (Muro et al. 2019). A higher percentage of the population with an education of high school degree or higher indicates a higher workforce readiness.

2.1.1.3 General Education Programs

The general education program pillar represents the potential talent supply within a county. It includes three indicators: university student enrollment, community college or technical school enrollment, and the number of individuals completing apprenticeships.

The student enrollment data are sourced from the Integrated Postsecondary Education Data System (IPEDS)[3] using total 12-month enrollment figures categorized by institution type within each county, while the apprentice data are sourced from the Registered Apprenticeship Partners Information Database System (RAPIDS).[4] Although the data align with the concept of measuring educational attainment (such as the percentage of the population with a high school diploma, associate's degree, or bachelor's degree), the focus is different. Rather than reflecting

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[3] IPEDS 12-month enrollment data can be found at https://nces.ed.gov/IPEDS.
[4] RAPIDS data can be found at https://www.apprenticeship.gov/data-and-statistics.

the existing educational attainment of the population, the general education program pillar provides insight into the future local workforce supply, offering a near-term, forward-looking perspective on talent availability in the labor market. A higher student enrollment number indicates a higher workforce readiness for the area.

Table 1. Workforce Availability Sub-Index Composition

Pillars	Indicators	Description	Data Source
Labor Market Conditions	Labor force participation rate	Percentage of the working-age population that is either employed or actively seeking employment	ACS 2023 5-year[5]
	Unemployment rate	Percentage of the total labor force that is unemployed and actively seeking employment	ACS 2023 5-year
	Younger population percentage (<14 years)	Proportion of the total population that is under the age of 15	ACS 2023 5-year
Education Demographics	% High school degree	Percentage of population 25 years and over that has high school degree or GED	ACS 2023 5-year
	% Bachelor's degree	Percentage of population 25 years and over that has a bachelor's degree or above	ACS 2023 5-year
	% Associate's degree	Percentage of population 25 years and over that has an associate's degree or some college education	ACS 2023 5-year
General Education Program	University enrollment	Total 12-month enrollment number for the institutions with a bachelor's degree as the highest offering	IPEDS 2023[6]
	Community college + tech school enrollment	Total 12-month enrollment number for the institutions with lower than bachelor's degree as the highest offering	IPEDS 2023
	Completer apprentices	Total completed apprentices in the last year	RAPIDS 2024[7]

2.1.2 Transportation Access

Transportation access is a crucial factor when siting an energy project, factory, or related facilities, as efficient commuting options enable a reliable local workforce to meet the project's job needs. Prioritizing local hiring further strengthens local benefits, ensuring that those most impacted by the projects also get their fair share in economic opportunities through wage earnings, benefits, and career pathways. Higher transportation access means higher workforce readiness.

[5] ACS 2023 5-year data can be located at https://www.census.gov/programs-surveys/acs/news/data-releases.2023.html#list-tab-1133175109.
[6] IPEDS 2023 enrollment data can be located at https://nces.ed.gov/ipeds.
[7] RAPIDS 2024 data can be located at https://www.apprenticeship.gov/data-and-statistics.

To measure the accessibility of a county, we evaluate how easily potential employees can reach a workplace location. Following the National Cooperative Highway Research Program report (National Academies of Sciences, Engineering, and Medicine 2022), we define the objective of this measure as determining how accessible the proposed job location is to potential workers. Given this goal, we identify the access-to-opportunity measure as the most suitable approach. The data were sourced from the Environmental Protection Agency's (EPA's) Smart Location Database,[8] where we used Destination Accessibility (D5) to evaluate how easily jobs and working-age populations (18–64 years) can be reached within a set commute time, weighted by proximity, to reflect local accessibility effectively.

Therefore, the transportation access sub-index assesses the extent to which the workforce in an area can reach a place of work through personal vehicles or public transportation (Table 2). The reason for considering both transportation modes is that although car travel is the primary mode of transportation, focusing solely on it would exclude transit-dependent, low-income populations who rely on public transit for commuting. Including public transit in our analysis provides a more complete understanding of accessibility, capturing the full range of potential employees. This approach ensures that job opportunities are reachable for the broader population.

2.1.2.1 Auto Accessibility

The auto accessibility pillar uses the Automobile Accessibility (D5ae) measure from EPA's Smart Location Database, where it estimates the working age population within a 45-minute drive at peak morning travel times (8 a.m. on a typical weekday). The analysis uses the TravelTime Application Programming Interface (API) to determine reachable census block groups within this time window, employing a travel-time decay formula from the "Travel Estimation Techniques for Urban Planning" (Transportation Research Board and National Academies of Sciences 2022). This formula assigns greater weight to closer destinations, sharply decreasing in weight beyond 10 minutes of travel time. Intrazonal travel—travel occurring within the same census block group—is accounted for by estimating internal travel speeds based on activity density classifications (urban, suburban, or rural).

The data at the block group level are aggregated to the county level to represent transportation accessibility by automobile. This aggregated value is then normalized by dividing it by the total population of the county. A higher auto accessibility score indicates a higher level of workforce readiness due to an increased ability for a population to commute to a job site using an automobile.

2.1.2.2 Public Transit Accessibility

The public transit accessibility pillar uses EPA's Transit Accessibility (D5be) measure from the Smart Location Database, evaluating accessibility during evening peak commuting periods. It estimates the total working-age population via various forms of public transit, including buses, trains, and subways, as well as associated walking, waiting, and transfer times. Transit trips can last up to 90 minutes, but in-vehicle travel is limited to 45 minutes, with walking segments capped at 15 minutes and transfer waits limited to 10 minutes. Accessibility calculations

[8] EPA Smart Location Database: https://epa.maps.arcgis.com/home/webmap/viewer.html?webmap=137d4e512249480c980e00807562da10.

primarily use the TravelTime API, supplemented by static general transit feed specification data to correct for service reductions during COVID-19. Areas without public transit are assigned neutral accessibility values (0) rather than being negatively penalized. A distinct transit-specific decay function, derived from the 2017 National Household Travel Survey, emphasizes shorter, more convenient trips.

Similar to auto accessibility, the data at the block group level are aggregated to the county level and then normalized by dividing by the total population of the county. Higher public transit accessibility indicates a higher workforce readiness level because of increased accessibility by the transit-dependent portion of the population.

Table 2. Transportation Access Sub-Index Composition

Pillars	Indicators	Description	Data Source
Auto Accessibility	Working-age population within 45-minute auto travel	Working-age population within 45-minute auto travel time, time-decay (network travel time) weighted	EPA Smart Location Database 2021
Public Transit Accessibility	Working-age population within 45-minute transit	Working-age population within 45-minute transit commute, time decay (walk network travel time, general transit feed specification schedules) weighted	EPA Smart Location Database 2021

2.1.3 Transferrable Skills

The transferrable skills sub-index assesses the extent to which the existing workforce in each area possesses skill sets that align with those required for various energy industries or phases of deployment. The sub-index is composed of two indicators: the average targeted occupational location quotient (LQ) and the average related occupational LQ (Table 3).

The location quotient is calculated as:

$$LQ_i = \left(\frac{e_i}{e}\right) / \left(\frac{E_i}{E}\right)$$

Where e_i is the local employment in industry i, e is the total local employment, E_i is the national employment in industry i, and E is the total national employment.

The calculation of these indicators is dependent on internally developed occupation lists (see an example in Appendix A.1) that are based on mapping job titles aligned to codes in the U.S. Bureau of Labor Statistics' Standard Occupational Classification (SOC) system. SOC codes provide access to employment data published at the MSA level by the Bureau of Labor Statistics. By creating custom occupational lists based on SOC codes, jobs can be aligned with the requirements of specific technologies or deployment phases, enabling targeted analysis of workforce readiness across industries or sectors.

2.1.3.1 Average Targeted Occupational Location Quotient

By leveraging an occupation list created for the technology or deployment phase, an LQ is determined for each of the targeted occupations by matching the occupational name, aligned with the SOC code, with an LQ statistic. An LQ measures an occupation's concentration in the local workforce relative to the nation. Once the LQs are compiled, the average LQ across all listed occupations is computed, which provides a single value that reflects the workforce's overall alignment with an energy industry's needs. This average is calculated at the MSA geographic level because of data availability. However, when completing the overall index, counties that fall within an MSA will be assigned the value corresponding to the MSA for this sub-index. This process involves identifying the MSA to which each county belongs and then using the sub-index value for that specific MSA.

2.1.3.2 Average Related Occupational Location Quotient

The average related occupational LQ measures the concentration of occupations with skills and expertise that are transferable to the targeted occupations. The O*NET Related Occupations database,[9] which identifies a list of 20 related occupations with similar knowledge, skills, and abilities for each eight-digit SOC code, is used to determine the related occupations.

From this list, the five most closely related occupations are selected. If any of the related occupations are already part of the targeted occupation list, they are excluded from the analysis. Finally, the average LQ of the remaining related occupations is calculated, offering insight into the broader workforce's potential to transition into energy industry roles. However, to give it a smaller weight to the transferrable skills sub-index, it is multiplied by 0.5.

The final transferable skills sub-index is calculated as the average of the targeted occupational LQ and a less weighted average of the related occupational LQ. Higher composite LQ values indicate greater workforce readiness levels.

Table 3. Transferrable Skills Sub-Index Composition

Pillars	Indicators	Description	Data Source
Clustering of Targeted Occupations	Average targeted occupational LQ	Average LQ of all relevant occupations	Occupational Map, OEWS 2023[10]
Clustering of Related Occupations	Average related occupational LQ x 0.5	Average LQ of five top related occupations	Occupational Map, O*NET 2023

2.1.4 Program Availability

The program availability sub-index assesses the feasibility of training the required workforce for an industry through a scalable or existing training program in the area. The sub-index is composed of three pillars: applicable university programs, applicable community college and technical programs, and applicable apprenticeship programs (Table 4).

There are two options to calculate these pillars. A more general approach is based on the list of occupations and their associated SOC codes from the occupation map, coupled with IPEDS

[9] O*NET Related Occupations database: https://www.onetcenter.org/dictionary/26.3/excel/related_occupations.html.
[10] OEWS 2023 data can be located at https://www.bls.gov/oes/.

data[11] that maps each occupation with a series of program codes offered by educational institutions. Another option that requires more time and effort uses an internally developed education and training database (see an example in Appendix A.2), which includes university, community college and technical programs, and apprenticeship programs that train for the chosen energy industry.

Unlike other sub-indices, program availability does not depend on workforce size or concentration. Instead, it functions as a binary measure, assigning a value of 0 or 1 to indicate the absence or presence of relevant training programs in the region, respectively. Higher program availability means higher workforce readiness level in the area.

[11] IPEDS 2023 enrollment data can be located at https://nces.ed.gov/ipeds.

Table 4. Program Availability Sub-Index Composition

Pillars	Indicators	Description	Data Source
Targeted Training Program	University program	Availability of wind or renewable energy programs at the university level	NREL internal database (Appendix A)
	Community college and technical program	Availability of wind or renewable energy programs at a community college and technical school level	NREL internal database
	Apprenticeship program	Availability of wind or renewable energy programs at the apprenticeship program level	NREL internal database

2.2 Calculation Methodology

The calculation of the index and sub-index workforce readiness levels employs a method derived from the Economic Development Capacity Index,[12] developed by Argonne National Laboratory in collaboration with the U.S. Economic Development Agency.

The process begins with collecting data for relevant indicators, organized under thematic pillars, followed by compiling corresponding raw data at either the county or MSA level. Each indicator is standardized by converting its raw value into a z-score, representing its distance from the average in terms of standard deviations—either relative to the national or the state average, depending on the chosen frame of comparison. Indicators based on LQ are excluded from this step, as LQ is already a standardized measure. The resulting z-scores are then transformed into percentiles using a cumulative normal distribution, again allowing for comparison either of counties across states or the nation or within the state.

After transforming all indicators into percentiles, the values are grouped into thematic pillars. For each pillar, an average percentile score is computed by taking the mean of the percentiles of its constituent indicators. Next, these pillar-level scores are grouped into broader sub-indices. Each sub-index score is calculated by taking the average of the pillar scores it contains. Most sub-indices apply a simple unweighted average, unless a specific weighting scheme is justified (e.g., based on policy relevance or statistical importance). Finally, the headline index—Workforce Readiness Index—is calculated as the average of the sub-index scores, providing a single composite measure of regional readiness or performance. This final score is also expressed as a percentile to maintain consistency and comparability.[13] In most cases, a simple average is applied, except for education-related pillars, which follow a different aggregation method.

The level of education required to work varies depending on the phase of deployment for the energy industry being evaluated. For example, the design and development phase might require

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[12] Economic Development Capacity Index: https://www.anl.gov/dis/economic-development-capacity-index.

[13] Note: Each level of aggregation (pillar, sub-index, headline) applies its own average independently, based on the data grouped under it. In other words, the headline index is not a direct average of all raw indicators but rather a tiered aggregation of previously averaged values.

more workers with bachelor's degrees than the installation and maintenance stage, where skilled trades occupations are more essential. For that purpose, the indicators in all education-related pillars—such as education demographics, general education programs, and targeted training programs—reflect different levels of educational attainment. In these cases, weights are applied to each indicator based on their relative importance to energy workforce development, determined by the projected proportional demand for workers at different education levels, such as high school diplomas or bachelor's degrees, within this industry or phase of deployment. These weights are informed by prior research and expert judgment, reflecting the typical distribution of education levels required across occupations in the target industry.

To assess energy workforce needs by education level, we apply weights to occupations based on two key factors:

- The proportion of each occupation within the industry
- The distribution of education levels typically required for that occupation.

For each occupation, we multiply its share of the energy workforce by the percentage of workers in that occupation who hold a given education level. This produces a weighted contribution of that occupation to each education category.

For example, if engineers make up 12% of the energy workforce, and 54% of engineers hold a bachelor's degree, then engineers contribute 6.48% (0.12 × 0.54) to the overall demand for bachelor's-level workers in the industry.

This calculation is repeated for all occupations and education levels. The resulting values are summed across occupations to estimate the total demand distribution across education levels (e.g., high school diploma, associate's, bachelor's, master's, etc.). This method ensures that the overall profile reflects both the relative size of each occupation, and the educational qualifications most commonly associated with it, providing a nuanced view of workforce development needs in the energy sector.

Finally, each county's readiness score is classified into five categories based on percentile thresholds (Table 5). This categorization enables clear comparisons across counties and helps identify regions that may require targeted policy interventions or workforce investment.

Table 5. Percentile Groupings of Readiness

Percentile	Category – Workforce Readiness Level (WRL)
0%–20%	WRL 1
20%–40%	WRL 2
40%–60%	WRL 3
60%–80%	WRL 4
80%–100%	WRL 5

3 Interpretation of Calculator Results

To understand the results of the calculator, it is important to correctly interpret both the sub-indices and the total Workforce Readiness Index overall score. The index total score is an average of the sub-index scores; therefore, a higher index score can be achieved by increasing the sub-index scores through actions that positively impact the indicators that influence the separate sub-indices. Furthermore, a high index does not necessarily indicate that all the sub-indices are strengths within that county. It is important to look at the specific sub-indices and indicators that are influencing the average to better interpret the index score.

For the sub-indices, workforce availability assesses the extent to which the general workforce is employed or seeking employment, meaning if the readiness is considered high, more of the area's workforce is currently seeking employment. This indicates the labor pool is relatively available to be trained and hired if an industry decided to develop an energy project or manufacturing facility in the area for an energy project. For transportation access, the sub-index assesses how easily the workforce can commute to a place of work through personal vehicles or public transportation. If the readiness score is high, the area is more easily accessible for a workforce by car or public transit, indicating there may be fewer barriers for a workforce to reach a place of work if there was an energy industry facility placed in the area. Transferrable skills assess the extent to which the existing workforce in each area possesses skill sets that align with those required for a specific phase of energy development. Therefore, if the readiness score is high, the existing workforce possesses skills that are applicable to the roles necessary for an applicable facility in the area. The remaining sub-index, program availability, assesses if a workforce could be trained by scalable or existing training programs in the area. If the readiness score is high, there are relevant training programs in the area to upskill and train workers for the work needed by energy industry development. The interpretation of the sub-indices is displayed in Table 6.

Table 6. Interpretation of Calculator Results for the Sub-Indices

Sub-Index	The readiness is considered low if…	The readiness is considered high if…
Workforce Availability	The area's workforce is not seeking employment and does not have the minimum education required.	The area's workforce is seeking employment and has the education necessary.
Transportation Access	The area is difficult to access for a workforce by car and public transit.	The area is easily accessible for a workforce by car and public transit.
Transferrable Skills	There is a low concentration of workers in the area with skill sets that align with the industry being assessed.	There is a high concentration of workers in the area with skill sets that align with the industry being assessed.
Program Availability	There is a limited number of relevant training programs in an area for the selected industry.	There are relevant training programs in an area for the selected industry.

3.1 State Interpretation

Similar to the national-level Workforce Readiness Index results, the counties can also be compared to each other on the state level. While the interpretation of the results remains the same, the scope of comparison would be within the geographic limits of the state. Therefore, a county with optimal readiness at the state level may not have that same rating when compared to the counties of the entire nation. Selected regions of counties can also be compared to one another using this method, but that comparison is not displayed on the mapping tool.

4 Limitations

Some of the limitations of the Workforce Readiness Index and sub-indices include:

- **The exclusion of qualitative factors.** This method focuses primarily on the compilation and evaluation of quantitative datasets, which may overlook qualitative factors, such as worker perception and awareness of an industry, that can contribute to an increased workforce risk or readiness for a county.
- **Arbitrarily assigned weights.** Weights assigned to each indicator are arbitrarily determined by the researcher, with equal weighting such as simple averages being the most common approach. This calculation method can introduce subjectivity into the data and may not reflect each indicator in an objective manner.
- **Potential for misinterpretation of statistical measures**. Statistical tools such as percentiles and z-scores may lead to misinterpretation by the user based on their knowledge of these mathematical concepts. Therefore, to mitigate these limitations, it is suggested to pair the results of this analysis with qualitative interviews of key stakeholder groups and assessments of local economic and workforce policy for a more comprehensive understanding of the results of the calculator.
- **Limited ability to show future workforce readiness projections**. This index provides a way to compare the ability of various areas to support the development of an energy industry at a singular point in time, using the most current data published. It does not include many indicators to signal how the workforce readiness level of an area may change in the future.
- **Sensitivity of results for transferrable skills sub-index is influenced by the specific list of occupation being analyzed**. When analyzing large amounts of occupations simultaneously, the results become less sensitive because they are calculated using a simple average, which can dilute variations.
- **The analysis is subject to data limitations** regarding availability, quality, and abstraction caused by spatial aggregation and disaggregation.

5 Conclusion

This report provides the basis for evaluating the comparative workforce readiness level for an area utilizing a community-based approach. Leveraging multiple economic and education-focused indicators, the Workforce Readiness Index works to determine a county's ability to recruit from the general labor market, transition workers with comparable skill sets, and train a workforce using scalable or existing training programs near a specific location. In conjunction with other metrics and qualitative information, the results of the index are intended to provide insights for stakeholders to support more informed decisions about energy development. This index could help inform topics related to:

- Placement of a supply chain facility
- Transitions to energy-related career paths
- Regional connectivity to enhance workforce development initiatives.

There are a few scenarios where this tool has proven useful in real-world applications. The Communities-LEAP initiative, led by the U.S. Department of Energy, supports locally driven efforts to explore economic development opportunities related to renewable energy. In several of these projects, this tool has provided a starting point for workforce analysis and strategic planning. By integrating local demographic and economic data, it has helped us develop an initial understanding of the community context—including factors such as the size and characteristics of the labor pool, prevalent industries, and education levels. This "first cut" can help ground conversations with stakeholders and guiding more detailed assessments.

Two components of the tool allow comparison of multiple energy deployment options and assessment of their feasibility and cost effectiveness: the transferable skills sub-index and the program availability sub-index. The transferable skills sub-index evaluates the extent to which workers in existing local occupations have skills that can be redeployed in energy sectors. Meanwhile, the program availability sub-index provides a snapshot of local or regional education and training infrastructure relevant to energy occupations.

In essence, these indices help identify "low-hanging fruit"—technologies or projects that align well with existing worker skills and training pipelines, which would face fewer workforce readiness barriers to implementation.

Areas for expansion of the calculator functionality and applications could include:

- Workforce gaps within a certain area based on the workforce demand and supply
- Increased insight into barriers to job access for community members
- Policy evaluation.

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Appendix A. Development of Internal Databases

The Workforce Readiness Index relies on technology-specific foundational datasets that detail occupational roles and skills, education and training credentials, and locations where workers can obtain industry-specific training. These databases include occupational maps, which identify key occupations within a specific industry or phase of deployment and provide comprehensive details on job roles and required qualifications. Occupation titles can be tied to codes in the Standard Occupational Classification (SOC) system, which enables the compilation of data from publicly available sources. The education and training database lists education and training programs related to occupations of interest. The following sections provide an overview for each database, along with an explanation of the data sources and the methodology used in their development.

A.1 Occupational Maps

Occupational maps can be supplied to the calculator in numerous ways, including industry-derived customized lists or premade NREL occupation or career maps. However, to unlock datasets, all occupations must be matched to their most closely associated SOC code.

NREL's occupation maps were created to establish a standardized framework of job titles across various phases of development for multiple energy technologies. As a publicly accessible resource, these datasets are intended to support organizations in workforce development, tool creation, and labor market analysis. These occupational maps serve as living documents and are periodically updated to reflect industry changes and new data insights. A comprehensive methodology and example are available at the occupation map website.

A.2 Education and Training Database

Education and training databases are used for the program availability sub-index and inform the targeted training programs for an industry, indicating the feasibility of training the required workforce by leveraging existing programs in an area. The programs considered in the calculator are university, community college and technical, and apprenticeship programs.

NREL's education and training databases are created by compiling institutions with majors, specializations, or programs related to an industry. The data came from a variety of publicly available data sources. For two-year and four-year certificate and degree programs, the data are sourced from the College Navigator Tool from the National Center for Education Statistics (NCES), which is the primary federal entity for collecting and analyzing data related to education. The process to build the database from the occupational maps, through a crosswalk compiled by NCES, was used to translate SOC codes to the associated Classification of Instructional Programs codes.[14] The list of programs/major names are also supplemented by subject matter experts to create the most comprehensive list of programs for the specific database being leveraged. For registered apprenticeship programs, the Registered Apprenticeship Partners Information Database System (RAPIDS) from ApprenticeshipUSA by the U.S. Department of Labor was used. NREL researchers determined which programs to include based on the occupational maps for an energy industry. The programs are then aligned through an SOC and

[14] The SOC code to Classification of Instructional Programs code crosswalk developed by NCES can be found at https://nces.ed.gov/ipeds/cipcode/post3.aspx?y=56.

RAPIDS code crosswalk that provides associated RAPIDS codes given occupational titles. More broad programs are also covered within the database. Institution types include universities, community colleges, technical schools, and third-party training providers.