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# Examining Renewable Energy Transitions: A Tool to Enhance Workforce Development

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As states across the U.S. continue to undergo a vast and seemingly inevitable energy transition (e.g., fossil fuels to renewables), one understudied challenge is ensuring that there is a workforce prepared for this structural shift. This brief investigates one approach to address this challenge through the use of a quantitative mapping tool that facilitates the transition of workers in declining energy occupations to emerging ones. Using secondary data, this brief overviews a technique to better understand the skills gaps and wage gaps associated with energy workforce transitions. Overall, having a higher and more granular comprehension of career pathways into evolving energy jobs can assist practitioners and politicians with program and policy initiatives to strengthen workforce development efforts.

## Background

Traditional electricity generation in the U.S. has relied on large, centralized assets, such as baseload coal-fired power plants, to achieve economies of scale and supply cheap and reliable power to consumers. However, supply-side factors, such as the relative price competitiveness of alternative energy sources, environmental/pollution regulations, and others, have triggered decline in sectors such as the U.S. coal industry, resulting in job losses and other economic hardships in certain communities. Subsequent and rapid investments in new, lower-carbon energy resources have stemmed from state policy mandates and corporate sustainability desires, among other reasons, representing additional demand-side drivers of the contemporary energy transition. For instance, large solar photovoltaic (PV) energy projects are increasingly being deployed throughout the U.S., with roughly 10,000 facilities currently in operation.[1] These large solar energy developments, in addition to the already growing distributed (e.g., rooftop solar) market, have helped create job opportunities, tax revenues, and other positive economic/environmental implications, especially in resource-dependent communities, such as those adversely affected by the hardships of declining coal economies.

1 Solar Energy Industries Association (SEIA). (2020). *Utility-scale solar power.* Retrieved from https://www.seia.org/initiatives/utility-scale-solar-power.

As the workforce attempts to adapt to these shifts in how energy is generated, it has become increasingly important for policymakers and economic developers to understand how the skills and education levels of the existing energy workforce compares to those needed in new energy jobs. Against this background, this brief specifically details a workforce transition mapping tool that contrasts the knowledge, capacities, and work activities of individuals employed in declining energy occupations (i.e., coal) with the skillsets needed for emerging and projected high-growth energy occupations (i.e., solar). Using data from the Occupational Information Network (O*NET) and the U.S. Bureau of Labor Statistics (BLS), this tool uses clustering techniques to compare struggling coal industry occupations with growing solar energy occupations.

## An Example of Coal-to-Solar Workforce Transitions

To illustrate this tool, the researcher mapped coal-fired power plant occupations into solar energy industry occupations, using the State of Ohio as a case study. For a sense of scope, Ohio currently has roughly 1,500 coal industry jobs,[2] which have been declining in recent years, and over 7,000 solar industry jobs,[3] which have been steadily increasing.

**Table 1** displays the results of the mapping employed, using 2018 Ohio-specific wage data from BLS. O*NET data was used to determine how similar the knowledge, capacities, and work activities are for the coal-fired power plant jobs and solar jobs.[4]

While there are solar-related jobs in both the construction and operations & maintenance (O&M) of a facility, for simplicity, the solar occupations in this table are restricted to construction examples. Similarly, not all coal plant occupations were included in the table below, in an effort to display only the ones most directly relevant to core operations (e.g., excluding assistants, accountants, etc.). The goal of these constraints was to focus on the more closely related, and bluer collar, coal-to-solar workforce transitions. By doing this, the table shows the lower education (i.e., associate's or bachelor's degree) level jobs with lower amounts of re-training for potentially displaced coal workers, who likely cannot afford time away from the labor market.

Nevertheless, there are some jobs which are easier, or more palatable to transition to, than others. For instance, a "Coal Power Plant Operator" could fairly easily transition into a "Solar PV Installer," yet face a -$14.70 per hour pay cut in this scenario. Alternatively, the same individual could seek a higher wage and transition into a "Civil Engineer" position, but not without significant upskilling (as indicated by its redder shading).

2 U.S. Bureau of Labor Statistics. (2020). Quarterly Census of Employment and Wages, NAICS 6-digit industries, one area. Retrieved from https://data.bls.gov/cew/apps/data_views/data_views.htm#tab=Tables.

3 The Solar Foundation. (2020). *Solar jobs census* 2019. Retrieved from https://www.solarstates.org/#state/ohio/counties/solar-jobs/2019.

4 For more information, see: Jolley, G. J., Khalaf, C., Michaud, G., Sandler, A. (2019). The economic, fiscal, and workforce impacts of coal-fired power plant closures in Appalachian Ohio. *Regional Science Policy & Practice*, 11(2), 403–422. https://doi.org/10.1111/rsp3.12191.

**Table 1**

Comparing hourly wages and skill requirements in coal-fired power plant and construction-related solar occupations

| | | Solar PV Installers | Electricians | Electronics Engineering Technicians | Electrical Engineers | Solar Energy Systems Engineers | Civil Engineers | Software Developers |
|---|---|---|---|---|---|---|---|---|
| | | $20.52 | $25.08 | $29.59 | $40.28 | $42.97 | $37.68 | $47.51 |
| **Coal Production Workers** | $14.41 | $6.11 | $10.67 | $15.18 | $25.87 | $28.56 | $23.27 | $33.10 |
| **Inspectors, Testers, & Weighers** | $18.51 | $2.01 | $6.57 | $11.08 | $21.77 | $24.46 | $19.17 | $29.00 |
| **Control and Valve Installers/Repairers** | $32.21 | -$11.69 | -$7.13 | -$2.62 | $8.07 | $10.76 | $5.47 | $15.30 |
| **Coal Power Plant Operators** | $35.22 | -$14.70 | -$10.14 | -$5.63 | $5.06 | $7.75 | $2.46 | $12.29 |
| **Electrical and Electronics Repairers** | $35.65 | -$15.13 | -$10.57 | -$6.06 | $4.63 | $7.32 | $2.03 | $11.86 |
| **Electro-Mechanical Technicians** | $27.03 | -$6.51 | -$1.95 | $2.56 | $13.25 | $15.94 | $10.65 | $20.48 |
| **Industrial Production Managers** | $47.96 | -$27.44 | -$22.88 | -$18.37 | -$7.68 | -$4.99 | -$10.28 | -$0.45 |

*Note.* Dollar values in the matrix display hourly wage differences, with positive numbers showing occupations that have higher wages than their transitioning-from occupation; colors note how easy (green) or difficult (red) the transition would be, based on the gap in skills.[5] The non-shaded wages on the periphery represent the median hourly wage rate for each of the respective coal-fired power plant and construction-related solar occupations. Based on Ohio data.

## Conclusion & Policy Recommendations

This example offers a tangible illustration of both the level of difficulty, as well as the wage differentials, associated with an energy-based (in this case, coal-to-solar) workforce transition. The ultimate goal of such a mapping exercise is to help better inform a displaced worker's decision regarding career steps. This tool is not restricted to energy workforce development issues; rather, it can be a useful quantitative mapping method for any declining to emerging occupations in a region. In many cases, these matrices show that there is a skills gap when comparing two industries. In this example, individuals formerly in the coal industry may have a difficult time finding job opportunities with their existing skillset, especially at the same wage rates, in the solar industry. In turn, this suggests a need for upskilling to stimulate regional growth in the face of unemployment caused by energy transitions.

5 This color spectrum was developed using a percentile methodology, with yellow being the 50th percentile. The colors do not represent only the occupations included in the table, but, rather, every occupation that was mapped prior to the trimming of occupations for final display.

Such analysis also has manifold implications for state and local governments, economic development practitioners, energy infrastructure developers, and many others. Though in its relative infancy and not yet adopted by many U.S. states, there exist several opportunities for program development, policy implementation, or other action to incentivize energy workforce training, including:

1. Offering **State Unemployment Benefits Extensions** and/or **Free Workforce Training** for in-demand energy industries, particularly as energy transitions continue to accelerate through the deployment of renewables.

2. Providing **Sales Tax Exemptions** for clean energy firms implementing workforce training programs at high schools, for summer camps/programs, etc. to expedite and ensure an adequate labor supply in emerging energy occupations (e.g., solar and wind).

3. Implementing an **Advanced Energy Workforce Tax Credit** to encourage clean energy and tech firms to hire veterans, individuals with criminal records, and other marginalized populations, train them, and then receive a state tax credit (perhaps akin to federal Work Opportunity Tax Credit (WOTC), yet specific to the energy industry).

4. Proposing and executing **New State K–12 School Curriculum** through the legislature to implement advanced energy courses (such as in the science, technology, engineering, and mathematics (STEM) fields) and/or learning labs (e.g., on-site solar PV arrays) to provide a platform and resources for early and advanced professional development related to clean energy.

This non-exhaustive list is meant to offer a few ideas for future state policy or program strategies as energy transitions become more pointed with higher penetrations of renewable energy projects across the country.

The use of quantitative data can equip policymakers with a better tool to understand the specific intricacies of clean energy workforce transitions, as well as understand which skill gaps and wage gaps may need to be addressed. Such a mapping tool may also help regional officials understand how the job demand created by a specific energy development (e.g., a large solar development in a rural community) compares to regional supply.

Politicians, state agencies, economic developers, institutions of higher education, and many others are seeking ways to ensure well-paying, long-lasting, and diverse careers in the new energy economy. A more detailed look at the workforce-related opportunities and challenges, as this mapping tool demonstrates, may be one strategy to better inform this decision-making process. Moving forward, enhancing education, the use of interactive online tools, and related strategies, may be useful at assisting energy career transitions and long-term policy solutions.

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