

Career Pathways

BUILDING THE WORKFORCE FOR A GREEN ECONOMY



Green | Jobs and the Ohio Economy

Part 1

The Obstacles and Opportunities in Defining Green Pathways



Department of
Job and Family Services

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June 2011

Prepared by the

Bureau of Labor Market Information
Office of Workforce Development
Ohio Department of Job and Family Services

in cooperation with the

U.S. Department of Labor
Employment and Training Administration



This workforce solution was funded by a grant awarded by the U.S. Department of Labor's Employment and Training Administration. The solution was created by the grantee and does not necessarily reflect the official position of the U.S. Department of Labor. The Department of Labor makes no guarantees, warranties, or assurances of any kind, express or implied, with respect to such information, including any information on linked sites and including, but not limited to, accuracy of the information or its completeness, timeliness, usefulness, adequacy, continued availability, or ownership. This solution is copyrighted by the institution that created it. Internal use by an organization and/or personal use by an individual for non-commercial purposes is permissible. All other uses require the prior authorization of the copyright owner.

The Obstacles and Opportunities to Defining Green Pathways

Introduction

The concepts of green jobs and a green economy have gained major momentum in our public discourse, media coverage and public policy development. “Green” is literally hailed to be a pathway for saving us from environmental catastrophe, maintaining middle class jobs, reducing unemployment, and securing future U.S. economic dominance. Unfortunately, green advocacy has generally occurred within a context where little has been done in respect to benchmarking, whether in the form of clear and precise definitions of green, or how we measure workforce and economic aspects of green. Although there may be great merit and justification to the green movement, the academic lexicon and tools of research and measurement lag the public and policy discourse. In workforce and economic development inquiry, we are still at our infancy in establishing a coherent and consistent definition of the green economy and green jobs and are far from agreement on robust measurement practices. We are still looking for the research road to a greener economy. What follows is an attempt to articulate how far we have come and roads yet to be taken in Ohio.

Philosophies behind the Green Movement

There are three broad goals associated with the green movement:

- environmental protection and energy sustainability,
- national security, and
- economic development and job creation.¹

The first goal often comes to mind when the term *green* is used. Concerns about greenhouse gases and other pollution have raised issues with the use of oil and coal for energy.² Oil, the United States’ main source of transportation fuel, and coal, used to generate about half of the electricity in the U.S., are limited resources. The green movement focuses on energy from renewable resources, increased energy efficiency to reduce overall energy needs, and the environmental benefits expected to be realized from these efforts.³

¹ Anderberg, Marc. *Green Collar Workers and Other Mythical Creatures*. Austin, TX: Texas Workforce Commission, August 2008, p.16. http://www.lmci.state.tx.us/shared/PDFs/Green_Collar_Workers2.pdf.

² U.S. Energy Information Administration. *Net Generation by Energy Source by Type of Producer*. <http://www.eia.doe.gov/cneaf/electricity/epa/epat1p1.html>.

³ See the *Digest of Green Reports* at <http://www.labormarketinfo.edd.ca.gov/?pageid=1032> for examples.

The second goal, national security, is concerned with U.S. reliance on imported oil. About two-thirds of the oil consumed in the U.S. is imported.⁴ Worldwide oil demand is increasing, which in turn increases competition for oil.⁵ Countries that produce oil can control its availability and cost, making the U.S. economically vulnerable. The U.S. is also militarily vulnerable; the largest consumer of oil in the U.S. is its military.⁶ Reducing reliance on foreign oil will reduce these vulnerabilities.

The third green goal, economic development and job creation, is a byproduct of the first two goals. Switching to renewable energy and increasing energy efficiency will require new technologies, infrastructures, products, and services, which are expected to produce new jobs. A second way renewable energy and energy efficiency could aid job growth and economic development is by shifting expenses. Money not spent on foreign oil will stay in the U.S.; if energy costs can be reduced, money will be available for other uses.⁷

The adoption of green technologies and processes is not guaranteed and green jobs will not appear until then. Adoption will depend on consumers and employers seeing value in green goods and services.⁸ As demand for green products and services develops, the number of green jobs is expected to increase. What will this mean for workforce development?

Issues and Problems Defining Green

Which industries will have green jobs? What kinds of green jobs will there be? Will there be an adequate supply of workers for green jobs? There are no easy answers because “green” is pervasive in the economy, yet difficult to isolate and measure.⁹

The first step in getting a handle on green employment is deciding what qualifies as green. Much of this discussion is happening at policy-making levels, and certain goals or activities are commonly mentioned. For example, the Federal Energy Independence Act of 2007 (the Green Jobs Act) focused on the energy efficiency and renewable energy industries. The American Recovery and Reinvestment Act of 2009 (ARRA) broadened the green definition to include energy efficiency and weatherization, renewable energy, smart grid power transmission, water quality, and research as green activities. These definitions are broad, however, and lead to questions of interpretation. For example, is nuclear energy production green? It reduces oil and coal consumption, but there are pollution issues with nuclear wastes. Is increasing a vehicle’s

⁴ U.S. Central Intelligence Agency. “United States.” *The World Factbook*. <http://www.cia.gov/library/publications/the-world-factbook/geos/us.html>.

⁵ Pirog, Robert. *World Oil Demand and Its Effect on Oil Prices* [CRS Report for Congress RL32530]. Washington, DC: GPO, 2005.

⁶ U.S. Senate. *Statement of the Honorable Edward C. Aldridge, Under Secretary of Defense, Acquisition, Technology, and Logistics, and Dr. Delores M. Etter, Deputy Director, Defense Research and Engineering, before the Senate Armed Services Committee, Emerging Threats and Capabilities Subcommittee: Defense Wide Research and Development*. Washington, DC: GPO, 2001. <http://armed-services.senate.gov/statemnt/2001/010605aldretter.pdf>.

⁷ Anderberg, p.17.

⁸ *Ibid.*, 15.

⁹ This section draws heavily from *Shades of Green Jobs: Definitions and Issues*, a May 2009 presentation by Rebecca Rust of the Florida Agency for Workforce Innovation, Labor Market Statistics Center. http://www.workforceflorida.com/news/docs/090508_GreenDefinitionsRust.pdf.

fuel mileage by three miles per gallon green or does it take more of an increase? Is simply selling green products a green activity?

From a workforce development perspective, the distinction between green production and practice activities may be important. Production activities are defined as those resulting in the generation of green power or the manufacture of green products. A couple of examples are the generation of electricity from wind and the manufacture of hybrid vehicles. Practice activities are defined as those that use green products or processes to achieve green goals, but that do not produce green power, products or services. Some examples are hotels using energy-efficient lighting and companies operating fleets of hybrid vehicles. From an environmental point of view, both are important. Production activities may be a more important focus for workforce development because the production activities are more likely to be central to an industry's purpose and therefore more likely to affect the industry's workforce needs.

Although many of the questions surrounding the process of defining green activities are out of the hands of the workforce development community, it must use the current definitions of green activities to begin identifying green industries and occupations. This is challenging, however, because of limitations in the identification system and the nature of green activities.

Industries and occupations are classified using schemes called taxonomies. The taxonomies start with broad classifications of industry or occupational activities, and each level of classification becomes more specific and narrow. Unfortunately, neither the industry taxonomy (the North American Industry Classification System or NAICS) nor the occupational taxonomy (the Standard Occupational Classification or SOC) have mechanisms for identifying green industries or occupations. For example, both green and traditional residential building construction firms have the same industry classification (NAICS 2361) based on their primary activity, which is residential building construction. The manner in which green and non-green builders accomplish construction or differences in the end products are not considered in the industry classification system. In the same way, the occupational classification system does not distinguish between green and non-green versions of an occupation. Carpenters (SOC 47-2031) working for green and non-green builders have the same occupational classification based on the primary skills, duties, and knowledge of their occupation, rather than their end-products.

There are probably few industries or occupations that engage in green activities that are exclusively green. In other words, an industry may produce both green and traditional products. For example, the motor vehicle manufacturing industry (NAICS 3361) produces both high-mileage hybrids and less fuel-efficient vehicles. Industrial engineers (SOC 17-2112) employed in vehicle manufacturing might work on either green or non-green vehicles or both. Even businesses dedicated to producing green products will probably have supporting operations and workers, such as accounting and accountants, which have no direct role in green production or services. Instead of trying to classify entire industries and occupations as either green or non-green, it may be more useful to think of them as being on a continuum of 'greenness.' This would require ways of measuring greenness. For example, an industry's greenness might be determined by its percentage of green to non-green output; an occupation's greenness might depend on the share of time spent on green activities. A greenness indicator would most likely

be separate from the existing industry and occupational classification systems, but this approach to identifying green industries and occupations might be more flexible than the existing classification systems.

As the green movement expands, new green industries and occupations will develop, but this presents another challenge. Aside from the difficulties in determining or measuring greenness, new and emerging industries and occupations are not easy to classify, as they generally arise from existing industries and occupations. In order to be classified as a distinct industry or occupation, new industries and occupations must develop in a way that makes them distinguishable from existing industries and occupations. They must grow to a measurable size before they gain a distinct classification. The prohibitive cost of universal measurement requires survey methodologies, where an occupation has to be numerous enough to be adequately captured in the sampling frame. Until they reach a measureable size, new industries and occupations are included in catch-all classifications.¹⁰

Steps Being Taken

Despite problems with defining green jobs and industries, there are a variety of efforts underway to develop working, measurable green industry and occupational definitions and to research the current green jobs situation. Much of the research and discussion can be found on a California green jobs site that has a digest of research and reports

(<http://www.labormarketinfo.edd.ca.gov/?pageid=1032>). Examples of reports include: *Clean Technology: Workforce Challenges and Opportunities*; *Economic Benefits of Investing in Clean Energy*; *Green Careers Resources Guide*; and *Green Jobs: A Pathway to a Strong Middle Class*. The site currently summarizes more than 130 reports.

Because of the limitations of the Standard Occupational Classification system, O*NET, the Occupational Information Network, has developed a unique approach to thinking about green occupations. They identified *increased demand*, *enhanced skill* and *new and emerging* as three groups of occupations based on the effect that green activities are expected to have on demand for the occupations and on the corresponding knowledge, skills, and worker requirements.¹¹

Increased demand green occupations are existing occupations that are expected to see higher demand and some changes in work context, but few changes in occupational tasks or worker requirements. In other words, the occupations will mostly remain the same, but increases in green activities will drive demand for these occupations. Examples of increased demand green occupations are electricians and carpenters. O*NET has identified 68 increased demand green occupations.

The second group, enhanced skills green occupations, will see significant changes in work and worker requirements. The purposes of these jobs will remain the same, but the tasks, skills, and knowledge will change. Demand for these occupations may or may not increase. For example,

¹⁰ See *A Statistical Dilemma: New and Emerging Occupations*, <http://ohiolmi.com/research/2010Emerging.pdf>.

¹¹ Lewis, Phil M. & Rivkin, David R. *O*NET Program Briefing* [PowerPoint presentation], National Center for O*NET Development, February 3, 2009.

heating and air conditioning installers may need to work with new types of heating and air conditioning systems. There are 57 enhanced skills green occupations identified.

Finally, some green activities and technologies will lead to the creation of new and emerging green occupations, with unique work and worker requirements not accounted for under the current occupational classification system. For example, energy auditors might evaluate the energy use of buildings or processes. O*NET has identified 90 candidates for new and emerging occupations, but these occupations must grow and stabilize before they are included in the occupational classification system.

The three types of green occupations have different implications for workforce development. Increased demand green occupations will need more training or education program completers, so training and education programs may need to be expanded. Enhanced skills green occupations will require training and education programs to alter or modify their course objectives or curricula to meet new occupational requirements, and in some cases they may need to be expanded as well. New and emerging green occupations could require new training and education programs to be developed.

Although much of the focus is on future development of green jobs, many industries and occupations currently produce green products and services and so have green jobs. Knowing the current green situation could aid economic and workforce development planning. One way to assess the current situation is to conduct a green jobs survey. There were four states that led the way for conducting green job surveys, other states that followed or are conducting surveys, and the U.S. Bureau of Labor Statistics is designing a long-term national green jobs survey.

California, Michigan, Oregon, and Washington were among the first to produce green jobs surveys. These surveys estimated state distributions of green jobs and industries using the existing industry and occupational classification systems. Although the surveys had similarities, there were also some significant differences among them. All four states included energy efficiency, recycling, and renewable energy in their definitions of green activities, but other green activities differed. For example, Michigan included “clean transportation and fuels” as green activities given Michigan's concentration of vehicle manufacturing industries. Oregon and California included activities such as education, consultation, and policy development. There were other differences as well. Oregon included the public sector in its survey, while the other states focused on the private sector. Michigan chose to survey only selected industry sectors, while the other states surveyed all industries. Despite the methodological differences among the surveys, their results suggest that many states should expect relatively low but significant levels of green jobs.¹² The percentage of jobs in each state that were green ranged from 3.8 percent for California, to 3.7 percent for Oregon, 3.0 percent for Michigan, and 1.6 percent for Washington. Some of the divergence among the states is no doubt due to methodological dissimilarities in the surveys, but some portion of the variance should be attributed to economic or policy differences between the states.

¹² As a point of comparison, the transportation equipment manufacturing industry in Michigan accounted for only 4.0 percent of Michigan total nonfarm employment in 2009.

Other states are conducting or planning green jobs surveys. As an aid, the Workforce Information Council (WIC) produced a report on the measurement of green jobs based on analyses of the California, Michigan, Oregon, and Washington surveys as well as other materials. This document addresses design issues for green jobs surveys and it provides states with a common approach to green jobs measurement (depending how closely states follow the recommendations). The WIC report included a green job definition, identified which green activities to measure, developed measurement methods, and suggested an action plan for future green jobs measurement. The WIC report defined a green job as “one in which the **work is essential** to products or services that improve energy efficiency, expand the use of renewable energy, or support environmental sustainability.”¹³ The emphasis on “work is essential” means the work is important and relevant to the associated green activity and that “without the work, the product or service would not be provided.”¹⁴ The WIC chose these green economic activities for measurement: renewable energy and alternative fuels; energy efficiency and conservation; pollution, waste, and greenhouse gas management, prevention, and reduction; environmental cleanup and remediation and waste clean-up and mitigation; sustainable agriculture and natural resource conservation; and education, regulation, compliance, public awareness, and training and energy trading. This list appears to cover the most commonly mentioned green activities. The report discusses various considerations for conducting green jobs surveys such as the intended uses of the data, industry level of measurement, sector focus, and sampling issues. The action plan section suggests sharing information among the states and federal partners to identify best practices, establishing a process for providing states with technical assistance, and continuing development of definitions and discussion of technical issues.

The U.S. Bureau of Labor Statistics is developing national surveys to collect green jobs information for policy planners and for understanding and monitoring the green jobs labor market. Surveys will count and monitor green jobs trends; determine the industrial, occupational, and geographical distribution of green jobs; and collect green jobs wage data. This project is intended to address many of definitional and measurement issues associated with green jobs. The work will be based on the existing NAICS and SOC systems with the potential to develop more detailed categories where needed.

Two approaches will be used to identify and count green jobs. The *output approach* will identify business establishments that produce green products or services. The *process approach* will identify establishments that use environmentally friendly production processes and practices. Some establishments will be in both categories, others will be in only one. The BLS broadly defined green jobs as “those involved in economic activities that help protect or restore the environment or conserve natural resources.”¹⁵ The green economic activities fall in these categories: renewable energy, energy efficiency, greenhouse gas reduction, pollution reduction

¹³ Workforce Information Council Green Jobs Study Group. *Measurement and Analysis of Employment in the Green Economy*. October 1, 2009. <http://www.workforceinfocouncil.org/Documents/WICGreenJobsStudyGroupReport-2009-10-01t.pdf>.

¹⁴ *Ibid*, p.18.

¹⁵ U.S. Bureau of Labor Statistics Comment Request, *Federal Register*, Vol. 75, No. 50, Tuesday March 16, 2010, pp. 12571-12573.

and cleanup, recycling and waste reduction, agricultural and natural resource conservation, and education, compliance, public awareness, and training. These activities are similar to those listed by the Workforce Information Council.

The output approach and the process approaches will require different measurement systems. For the output approach, the BLS will survey establishments to determine whether their products or services are green. The BLS has defined four types of green products and services. First, direct green goods and services are those specifically produced to protect or restore the environment. Second, indirect green goods and services are those produced for another purpose, but which also have a positive effect on the environment, such as products made from recycled materials. Third, specialized inputs are products and services necessary for the production of direct and indirect green products and services. The fourth type is specialized distribution of green goods including transportation and warehousing, wholesale and retail trade, rental and leasing, and restaurants and food services. The process approach to green jobs measurement will require surveying establishments about their processes and determining whether they employ workers whose primary duties are related to those processes.

Measuring Green in Ohio

There are numerous efforts being pursued by communities, organizations, and educational institutions to collect information about the green economy and to develop meaningful plans and policies for economic and workforce development. Although much of this work is general, some of it focuses on specific areas including Ohio. This section discusses two types of efforts: green jobs estimates and analyses of green education and training opportunities. Groups may make green jobs estimates to establish a baseline for green jobs growth and to make a case for investment or development in particular green industries. These estimates can vary widely. Analyses of green jobs education and training opportunities are concerned with the extent to which they are providing an adequate supply and proper training of workers for green jobs.

Green Job Estimates

A disadvantage of green jobs surveys is that they take time and money. Some groups have chosen to make green jobs estimates and employment projections using existing data sources. Differences in the data sources, definitions, and assumptions used to make the estimates can lead to vastly different estimates.

An analysis for the American Solar Energy Society (ASES) examined current and projected employment in the renewable energy and energy efficiency industries; the analysis included Ohio as a case study.¹⁶ It defined the renewable energy industries as: wind, photovoltaic, solar thermal, hydroelectric, geothermal, biomass, fuel cells, and hydrogen. Energy efficiency industries included all or parts of these industries: insulation; energy service companies; recycling; vehicle manufacturing; household appliances and lighting; windows and doors; computers, copiers, and FAX machines; TV, video, and audio equipment; HVAC systems,

¹⁶ Bezdek, Roger. *Renewable Energy and Energy Efficiency: Economic Drivers for the 21st Century*. American Solar Energy Society, 2007. <http://www.ases.org/images/stories/ASES-JobsReport-Final.pdf>.

industrial and related machinery; miscellaneous durable manufacturing; nondurable goods manufacturing; utilities; and construction. The ASES analysis found that in 2006, the renewable energy industries had created approximately 6,600 direct and indirect jobs in Ohio and the energy efficiency industries had created about 496,000 jobs. Many of the renewable energy jobs were in scientific, technical, professional, and skilled occupations; more than half of the energy efficiency jobs were in manufacturing. There were three forecasts of renewable energy and energy efficiency industry employment for 2030. The base forecast for Ohio predicted an additional 21,000 jobs for renewable energy and 964,000 jobs for energy efficiency, assuming no increases in investment levels and continuation of positive energy policies. The moderate forecast predicted an additional 56,000 jobs for renewable energy and 1,150,000 jobs for energy efficiency. The moderate forecast assumed undefined “moderate” investment, continued positive policies, and continued favorable market conditions. The advanced forecast predicted 174,000 jobs for renewable energy and 2,096,000 jobs for energy efficiency. The advanced forecast assumed aggressive investment and policies for the development of new technologies.

Global Insight estimated the current and future green jobs market for the U.S. Conference of Mayors and the Mayors Climate Protection Center.¹⁷ It defined green activities as “any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuel, manufacturing jobs producing goods used in renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy-efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.”¹⁸ Global Insight specified industries they considered engaged in the green activities, then used commercial databases to identify companies in those industries. They estimated that in 2006 there were more than 750,000 green jobs in the United States. More than half of these were indirect jobs in engineering, legal, research and consulting fields. These jobs were geographically concentrated, with approximately 85 percent of green jobs in metropolitan areas. For the 16 metropolitan areas that include any Ohio counties, Global Insight estimated there were 16,884 green jobs. They also projected that these metro areas could have 133,594 green jobs by 2038 assuming the distribution of green jobs remained constant. However, Global Insight expects the distribution to shift as areas compete for green jobs.

The National Governor’s Association for Best Practices commissioned green economy profiles of each state¹⁹. The report focused on employment in 15 green industry segments, venture capital investments in clean technologies, and patent registrations in green technologies as a way of gauging states’ green economic situation. The study found that Ohio’s three largest green industry segments by employment size were: recycling and waste (approximately 9,000 jobs), air and environment (7,300 jobs), and water & wastewater (6,000 jobs). Ohio was noted to

¹⁷ Global Insight. *U.S. Metro Economies: Current and Potential Green Jobs in the U.S. Economy* [Report to the United States Conference of Mayors]. Lexington, MA: Global Insight, August 2008.
<http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf>.

¹⁸ *Ibid*, p. 8.

¹⁹ National Governors Center for Best Practices, *Ohio: Profile of the Green Economy*.
<http://www.nga.org/Files/pdf/09GREENPROFILEOH.PDF>.

have a strong employment concentration in advanced materials (1,300 jobs), which was nine times more concentrated than the U.S. average. Some segments have been growing in Ohio, including the energy storage and water and wastewater segments, which increased their employment concentrations approximately 50 percent from 1995 to 2007. According to the report, segments with high and increasing levels of employment concentration may be targets for investment in research and development, commercialization, and workforce development. Venture capital investment in clean technologies increased in Ohio to \$46 million in 2008 from less than \$20 million in 2007, but Ohio patent registrations in green technologies declined after peaking in the 2000 to 2002 period.

The Environment Ohio Research and Policy Center found more than 440 businesses in Ohio engaged in renewable energy industries.²⁰ The majority were in wind power (221 businesses), followed by solar (118), fuel cells (115), geothermal (93), and biomass (62). There were also more than 60 companies providing “auxiliary” services to the renewable energy companies. The report makes several policy recommendations to help the renewable energy industry expand in Ohio. The same group found more than 1,130 businesses or organizations in Ohio engaged in energy efficiency efforts.²¹ These included 52 businesses doing energy audits, 78 businesses and organizations doing building weatherizing, 109 manufacturers of energy efficiency products, 215 homebuilders and architectural firms working on design and construction of Energy-Star certified homes, and 680 stores selling energy efficient products and appliances.

The Political Economy Research Institute at the University of Massachusetts Amherst conducted a study to identify job opportunities that might arise from investment in green strategies.²² Ohio was one of 12 states included in the study. The study considered six strategies: building retrofitting for increased energy efficiency, mass transit, energy-efficient automobiles, wind power, solar power, and cellulosic biomass fuels. Ten “representative” occupations were identified for each green strategy. For example, building retrofitting would require electricians, heating/air conditioning installers, carpenters, construction equipment operators, roofers, insulation workers, carpenter helpers, industrial truck drivers, construction managers, and building inspectors. The occupation lists were not meant to be exhaustive. For each green strategy, the study then listed the number of jobs and wages for each representative occupation for each of the 12 states. Continuing our reference to building retrofitting requiring electricians, in May 2007, Ohio had 25,560 electricians with an average hourly wage of \$22.20. The report did not project future demand for occupations affected by green strategies. Instead, the study noted that occupations at different pay levels will be affected, and that investment in green strategies will increase demand for many occupations, which could increase wages.

²⁰ Kruse, Wren & Gomberg, Amy. *Growing Ohio's Green Energy Economy*. Environment Ohio Research & Policy Center, March 2009. <http://cdn.publicinterestnetwork.org/assets/1471BBvB0rEmX2LlIe-q5g/Growing-Ohios-Green-Energy-Economy.pdf>.

²¹ Kaplan, Siena; Wohlschlegel, Kari; & McCourt, Jeff. *Ohio's Green Energy Economy: The Energy Efficiency Industry*. Environment Ohio Research & Policy Center, January 2010. <http://www.environmentohio.org/uploads/08/b8/08b898943ea705582815a2ddbcc4b751/Ohios-Green-Energy-Economy---the-Energy-Efficiency-Industry.pdf>

²² Pollin, Robert & Wicks-Lim, Jeannette. *Job Opportunities for the Green Economy: A State-by-State Picture of Occupations that Gain from Green Investments*, Political Economy Research Institute, University of Massachusetts, Amherst, June 2008. http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/Green_Jobs_PERI.pdf.

These few analyses show how different green estimates can be. The ASES and Global Insight analyses, in particular, are widely disparate. The ASES estimate of Ohio jobs in the combined renewable energy and energy efficiency industries for 2006 was just over 503,000 jobs. For the same year, Global Insight estimated less than 17,000 green jobs. The ASES green jobs estimate was **more than 30 times** Global Insight's estimate. Further, neither of these estimates appears to be in line with what other states have found, as their green jobs surveys indicate less than four percent of the workforce is green. Total annual average employment for Ohio in 2006 was 5,435,800. If the percentage of green jobs in Ohio is about 3.8 percent—the same as the estimate from the California green jobs survey—then there would have been approximately 206,000 green jobs in Ohio in 2006. This is significantly less than the ASES estimate and significantly more than the Global Insight estimate. If the percentage is closer to the Washington state estimate, 1.6 percent, then Ohio would have almost 87,000 green jobs, still above the Global Insight estimate and well below the ASES estimate. Most of the difference between the ASES and Global Insight estimates can probably be attributed to using differing definitions of green jobs and industries and the way in which the definitions were applied to industries. These studies also applied assumptions to secondary data resources as opposed to directly collecting data. The resulting wide differences in estimates make analyses hard to compare. Primary data collection and standardized methodology for conducting green jobs surveys is being developed. Such an approach relies more on empirical measurement and statistical standards that make analysis and comparisons more straightforward and reliable.

Green Jobs Education and Training

An adequate supply of workers will be needed for green industries and activities to expand. According to O*NET, some of these occupations will require modifications to training and education programs, and entirely new programs may need to be developed for some occupations.

The Ohio Board of Regents, the University System of Ohio, and the Ohio Environmental Council produced the *Ohio Green Pathways* catalog of green education and training programs. The initial catalog included programs from 22 community colleges and 11 adult career centers; future editions of the catalog will include university programs as well. Programs were selected for inclusion in the catalog based on their relationship to the green economy, incorporation of sustainable practices, and preparation for a green career. For example, Eastern Gateway Community College has 12 two-year engineering technology programs and four engineering technology certificate programs listed in the catalog.

The Apollo Alliance and Policy Matters Ohio co-authored a paper that identified Ohio training opportunities for green-collar jobs in construction and manufacturing and promoted an integrated green workforce development system for Ohio.²³ The paper argued that the workforce development system favors high-skill jobs, not the middle-skill jobs that are expected to account for more than half of the growth in green jobs. The paper stresses the development of career pathways to move workers from entry-level positions into higher-skill positions.

²³ The Apollo Alliance and Policy Matters Ohio. Mapping Green Career Pathways: Job Training Infrastructure and Opportunities in Ohio. January 2010. <http://www.policymattersohio.org/pdf/MappingGreenCareerPathways2010.pdf>.

Several types of programs exist that address parts of career pathways: job readiness programs, pre-apprenticeship programs, apprenticeship programs, bridge programs, and community and technical college courses and programs. The paper argues that these programs are not integrated, and so do not offer fully realized career pathways and concludes with eight policy recommendations. The first recommendation is to use credible data collection and dissemination methods about green jobs. The second is to integrate environmental, economic, and workforce goals at the federal, state, and local levels. Third is to award grants and contracts for green projects in ways that create linkages to training opportunities. Fourth is to condition training grants and development funds on interagency collaboration and to give priority to partnerships among training providers and stakeholders. The fifth recommendation is to provide funding for the establishment and support of local workforce intermediaries to make connections among stakeholder groups. Sixth is to invest in policies and programs to fill gaps between current programs instead of creating possible unnecessary programs. Seventh is to address barriers to access and persistence in construction and manufacturing trades for less advantaged groups. The final recommendation is to invest in career pathways models that are flexible and that enable workers to easily move in and out of classroom and employment.

Going Forward in Ohio

Economic and workforce development communities in Ohio are engaging in programs to train workers for green jobs:

- Marion's WIA summer youth program provided work experience with an alternative energy company;
- Central Ohio has a privately-funded registered apprenticeship program that provides training in solar photovoltaic installation and maintenance;
- In Green Springs, the Civilian Conservation Corp provides training for green jobs in energy efficiency, housing rehabilitation, and weatherization;
- Troy's WIA program provided on-the-job training in construction with hands-on application of green technologies;
- A program for disadvantaged Appalachian residents and ex-offenders provided green jobs skills;
- In the Toledo area, a WIA-funded program provides training in photovoltaic principles;
- Cuyahoga Community College has a green career pathways program. In addition, it has a veterans education and training program in renewable energy, as well as workforce and technical training on alternative energy applications for a transitioning automotive and manufacturing industry.

As part of the American Recovery and Reinvestment Act (ARRA), Ohio has been awarded several grants aimed at economic workforce development with a green jobs focus. The Ohio Department of Development was awarded a \$6 million State Energy Sector Partnership and Training Grant from the U.S. Department of Labor's Employment and Training Administration. The Energizing Careers Program will develop a pipeline to support original equipment manufacturers in the advanced energy manufacturing sectors of wind, solar, and

biomass, as well Tier One suppliers for those manufacturers. The program supports customized training for improving workers' skills in Ohio's expanding advanced energy manufacturing sector, helping Ohio businesses remain competitive. The program will provide technical and financial assistance directly to employers to train their workers.

Ohio was the sole recipient of one State Labor Market Information Improvement ARRA grant and was a co-recipient on a second grant with Indiana and Michigan. The grant received solely by Ohio is titled *Building the Education, Career Pathways and Labor Exchange Infrastructure within the New Business Paradigm of a Green Economy*. The goal of this project is to develop a statewide infrastructure to support green jobs workforce development, education, and training. The green economy will require workers with unique and specific green knowledge and skill sets. Employer demand for these unique green skills cannot be met without coordination among Ohio's training and education institutions. Coherent, centralized information about educational and training opportunities and potential employers does not exist in Ohio for those interested in joining the green workforce. This project will help Ohio assess knowledge and skills gaps for green jobs in the state's 12 economic development regions by evaluating current green job definitions and measures; identifying green employers for project participation; mapping educational curricula assets; identifying curriculum best practices; developing green jobs curricula; publishing green curricula guidelines; producing an Ohio green jobs training directory; disseminating green career pathways information through One-Stops and WIA-eligible training providers; and developing new green jobs interfaces for the state labor exchange system, OhioMeansJobs.com. The Department of Job and Family Services is partnering with the Ohio Board of Regents on this grant.

The Indiana, Michigan, and Ohio tri-state grant is entitled: *Understanding the Impact of the Auto Industry Transformation in Michigan, Indiana, and Ohio: Identifying New Green Career Pathways for Impacted Workers*. As the auto industry restructures, the three states, which have experienced large employment losses in the auto industry, will coordinate resources, strategic partners, and expertise to analyze this transformation and develop alternative career pathways for dislocated auto workers. This project aims to assist both employers and workers to find success in alternative energy and energy efficient industries. As part of this grant, Ohio is conducting a green jobs survey to estimate the state's distribution of green jobs across the existing industry and occupational classification systems.

Conclusion

Academic tradition generally suggests that the conduct of inquiry—the acquisition of knowledge through methods and measurement—drives social change and social practices. In reality, a more didactic relationship often occurs, where social policy and advocacy can challenge researchers to consider new concepts and ways to look at our human institutions. In this case, workforce and economic inquiry is being challenged to think of the economy from a different perspective, with different concepts and goals. The research challenge is to add rigor to concepts, establish definitions, and apply robust measures and methods of analysis. Only by such means can data be collected to inform workforce and economic development policy that may chart a path to a green economy.

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(06/2011)

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