

Vermont Department of Labor, Economic & Labor Market Information Division

Assessing Green Employment

A Review of Relevant Literature

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Introduction

This report provides an overview of previous literature and methods regarding the prevalence and impact of green occupations and employment. It was created as part of a Memorandum of Understanding (MoU) between the Vermont Department of Labor and Vermont Technical College in support of the Vermont Business Sector Analysis Project. The report satisfies Vermont Department of Labor deliverable #3 of the MoU (as revised) signed by both parties on or before May 14th, 2013.

When reviewing most research measuring the impact of the green economy, a few common themes emerge. Broadly, “green” activities are most often defined as those that reduce waste, protect and preserve natural resources or prevent pollution. Beyond these broad outlines, however, the definitions and measurement tools vary widely. Defining and measuring “green” occupations and industries has been attempted by numerous private and public organizations. In the pages that follow, a review of literature by these organizations concerning this topic will be provided. The next section details efforts done by three agencies at the federal level. That is followed by a review of efforts done in three states: Oregon, Idaho and Pennsylvania. Finally, the work of three private-sector organizations is reviewed.

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Federal Efforts

This section begins by reviewing the definitions and methodology of three federal initiatives: The Bureau of Labor Statistics' (BLS) Green surveys, the O*NET Collaborative identification of green occupations and the U.S. Department of Commerce's *Measuring the Green Economy* report. These three efforts form the basis of much of the research done by states, which are reviewed in the second part of this section. While the O*NET program continues, data collection for the BLS Green program was discontinued in 2013 in response to budget reductions. The Department of Commerce's research concluded in 2010.

The Bureau of Labor Statistics

As a state partner to the U.S. Bureau of Labor Statistics, the Economic & Labor Market Information division relies heavily on BLS data for both this green research project and a host of other programs. Much of the data for this project is generated by the BLS. It is appropriate, then, to begin with an understanding of how the BLS defines "green" occupations and industries (Bureau of Labor Statistics, 2013). The BLS defines Green Jobs as:

(1) Jobs in businesses that produce goods or provide services that benefit the environment or conserve natural resources or

(2) Jobs in which workers' duties involve making their establishment's production processes more environmentally friendly or use fewer natural resources.

The first definition is an output approach – it measures the production of green goods or services. Examples include, but are not limited to, energy from renewable resources, energy efficient appliances, pollution reduction and organic agriculture.

The second definition is a process approach. It identifies workers who research, develop or use technologies and practices that lessen environmental impact. These technologies and practices include generating electricity from renewable resources; reducing pollution, greenhouse gases and waste production; and conserving natural resources.

Guided by the two definitions above, the BLS looks at green employment through two lenses: The Green Goods and Services (GGS) survey and the Green Technologies and Practices (GTP) survey. GGS identifies establishments that produce green goods and services. This measure identified 325 six-digit

NAICS (North American Industrial Classification Systems) codes that have green employment, some with 100% green and others with a portion of their revenue derived from green. 222 of those 325 industries are present in Vermont. The measure of green employment is based on the portion of total revenues generated from producing green goods and services. In order to determine if a good or service is green, the BLS turns to federal product ratings or established standards. Examples of federal ratings include the federal designation of organic agriculture and the Energy Star efficiency program. From the private sector, the BLS uses standards such as LEED (Leadership in Energy and Environmental Design) certification.

The output from the GGS survey includes the number of jobs related to production of green goods and services by industry, by ownership (public or private) and by various geographies. An analysis of the state-level data collected under the GGS program can be found in a previous project deliverable, *Analysis of Green Jobs Sector in Vermont*.

The Green Technologies and Practices survey estimates the number of workers spending half or more of their time involved in green technologies or practices. Workers are considered to be involved in green practices if they are:

(1) Researching, developing, maintaining, using, or installing technologies or practices to lessen the environmental impact of their establishment, or

(2) Training the establishment's workers in these green technologies and practices.

The GTP survey identifies three groups of green technologies and practices. These include technology and practices related to energy from renewable resources and energy efficiency; greenhouse gas and pollution reduction; and recycling, reuse and natural resource conservation. The output from the GTP survey includes the total number of jobs in which workers spent more than half of their time involved in green technologies and practices. The results are available in aggregate, by NAICS industry sector and by Census regions. The results also include data related to mean and median wages for green positions.

Limitations in BLS methodology

The Bureau of Labor Statistic's methodology for calculating green jobs creates an important baseline for comparison, but its applicability is limited. Some of the limitations and drawbacks of the data set are discussed below.

The BLS Green Goods and Services survey relies on revenue share as a proxy for measuring green employment related to production of green goods and services. This requires imputing employment levels from revenues. The BLS found that attempts to directly count employment were complicated by the significant number of people whose work responsibilities included the production of both green and traditional goods and services, or administrative tasks associated with such production.

Another identified limitation of BLS methodology is related to the broad definition of “green”. The BLS, for example, includes environmental remediation services as green, despite the fact that such services are simply neutralizing the impact of non-green practices. It also includes a significant portion of steel manufacturers because the majority of steel produced in the US is from recycled materials. The process of making steel, however, is probably not considered “green” by most parties.

Finally, the BLS GGS program is based on North American Industry Classifications (NAICS). These classifications do not have separate sectors for industries such as solar photovoltaics, instead lumping all of these firms into the same category as “Other Energy Producers and Installers.” Firms that install photovoltaics are simply categorized as residential or commercial electrical contractors.

For a more comprehensive discussion of limitations and problems with the BLS Green program methodology, readers are encouraged to read Dr. David Kreutzer’s *The Federal Green Jobs Agenda: What the Job Count Actually Tells Us* (Kreutzer, 2012) and his related work, much of which can be found at The Heritage Foundation (www.heritage.org).

O*NET

The Occupational Information Network (O*NET) is a database of occupational definitions designed by the Employment & Training Administration of the U.S. Department of Labor. In 2009, the National Center for O*NET Development began research to investigate “the impact of green economy activities and technologies on occupational requirements in an effort to determine their impact on current O*NET – SOC occupations and to identify new and emerging occupations.” As part of this research, O*NET created a definition stating that “The green economy encompasses the economic activity related to reducing the use of fossil fuels, decreasing pollution and greenhouse gas emissions, increasing the efficiency of energy usage, recycling materials and developing and adopting renewable sources of energy.” (Dierdorff, Norton, Drewes, & Kroustalis, 2009)

Because the impact of green activities and technologies varies among different occupations, O*NET focuses on how these activities are expected to impact each occupation. Specifically, O*NET sees three potential impacts: (1) some occupations will face increased demand due to the activity or technology; (2) some occupations will face a significant change in the associated work or worker requirements and; (3) new occupations will be created due to unique work and worker requirements generated by these activities and technologies.

O*NET's green economy research was not created in order to measure the current or future supply of green occupations. Because it is created using the Standard Occupational Classification system, however, it can be paired with current Occupational Employment Statistics to estimate the extent of portion of the economy that is greening. The results of applying this analysis to Vermont can be found in a previous project deliverable, *Analysis of Green Jobs Sector in Vermont*.

U.S. Department of Commerce, Economics and Statistics Administration

The first federal agency to attempt to define and measure the green economy was the Economics and Statistics Administration of the U.S. Department of Commerce (ESA). *Measuring the Green Economy* was released in April 2010. ESA researchers identified green products as those whose "predominant function serves one or both of the following goals:

- Conserve energy and other natural resources: This includes products or services that conserve energy to reduce fossil fuel use and promote water, raw material, land, and species and ecosystem conservation; or
- Reduce pollution: This includes products or services that provide clean energy or prevent, treat, reduce, control or measure environmental damage to air, water and soil. The remediation, abatement, removal, transportation or storage of waste and contaminants also are considered to reduce pollution." (U.S. Department of Commerce, Economics and Statistics Administration, 2010)

ESA relied primarily on the 2007 Economic Census of the U.S. Census Bureau which analyzes business activity based on survey responses from almost five million companies. Businesses are classified by six-digit NAICS codes and also by product/service codes. The report only covers the private sector, excluding public utilities, buses, and subway systems. Rail transportation and public education institutions are also excluded. No geographic subsets are analyzed – the data is only available at a national level.

The Economic Census coding framework also does not separately account for items such as alternative fuel vehicles and energy efficient appliances. To address the limitations of the economic census, ESA obtained sales and employment estimates from a variety of sources. This includes supplemental estimates for alternative fuel vehicles, green construction, photovoltaic cells and organic agricultural products.

ESA created both a “broad” and “narrow” definition of green. The narrow definition restricts labeling products and services as “green” to those items for which there is general consensus. This definition included 497 product and services codes. The broad definition includes a range of products and services for which the green status may be more open for discussion. This definition included 732 product and services codes.

Once the list was identified, ESA estimated green employment by calculating the share of each product category that would be considered green, then using that share to measure the share of NAICS-based employment levels.

ESA finds that between 1% and 2% of private sector production is green, with the low estimate using the narrow definition and the higher estimate using the broad. The total number of green jobs ranged from 1.8 million (narrow definition) to 2.4 million (broad definition). Approximately three in every four green jobs is in the service sector, while 13% are in manufacturing. Between 80% and 90% of all green business activities are in energy conservation, resource conservation and pollution control.

State Research

As part of the 2009 American Recovery and Reinvestment Act, several states received Labor Market Information Improvement Grants from the Employment and Training Administration of the US Department of Labor. These grants funded significant research in the current conditions and expected growth in green employment in these states. Below, we review the methodology and results from three of those states: Oregon, Idaho and Pennsylvania.

Oregon

The Oregon Employment Department’s 2012 report *The Greening of Oregon’s Workforce: Jobs, Wages and Training* (Oregon Employment Department, 2012) defines a green job as one with “Essential job

duties related to providing a service or producing a product in any of these categories: Increasing energy efficiency; producing renewable energy; preventing, reducing or mitigating environmental degradation; cleaning up and restoring natural environment; providing education, consulting, policy promotion, accreditation, or other services supporting the above categories.”

The department distributed a survey to 7,793 employers in the state’s Unemployment Insurance program between June and August of 2011. 3,577 (46%) responded to the survey. The sample was divided into 15 industries using the North American Industry Classification System (NAICS). Each firm in the sample received a survey via mail, but firms had the option to respond either via mail or online. Staff members also conducted follow up calls to a random sample of non-respondents.

The survey instrument asked respondents to list the job title and brief description of any position where one of the above green job duties was essential to the job. In addition, it asked for education level and any special requirements or certifications for the position. Finally, it collected information from Occupational Employment Statistics program of the BLS. This included wage range data, total green employment in a firm and projected growth in green employment by the following year. Job titles and descriptions were used to assign a Standard Occupation Code (SOC) to each position. Results of the study were then published by industry (NAICS) and by occupation (SOC).

The report finds that 43,148 jobs in Oregon are green, 3% of total employment. The largest sectors of green employment are in Construction and Natural Resources and Mining. Only 39% of those jobs required postsecondary education. Wages in green jobs were, on average, approximately \$3.24 higher than the average wages of all Oregon jobs.

Idaho

The Idaho Department of Labor produced several reports on the green economy in Idaho. For purposes of this review, we focus on two of those reports: the *Idaho Green Capital Report* (Foster, 2011) and the *Idaho Green Projections and Economic Impact* (Uhlenkott, Townsend, & Scudder, 2011) These reports summarize the findings of a survey of 5,000 Idaho firms on the prevalence of green jobs and project future growth in green employment. The results of both are summarized below, followed by a discussion of the methodology.

The first report, the *Idaho Green Capital Report* generates a gap analysis by investigating the current supply and demand for green labor and the 2008 – 2018 occupational projections. On the demand side,

the report finds that the largest number of green annual openings is expected among Retail Salespersons, followed by Heavy Tractor-Trailer Truck Drivers. The occupations with the most green employment are Construction Laborers followed by Landscaping and Groundskeeping Workers and Hazardous Materials Removal Workers. The green occupations with the highest rate of annualized growth are Architectural and Engineering Managers, Hazardous Materials Removal Workers and Environmental Engineers.

The second report, *Idaho Green Projections and Economic Impact*, uses occupational concentration ratios from the 2010 Idaho Green Jobs Survey. It applies those concentrations to 2008 – 2018 long-term occupational projections of 206 occupations identified as green. It finds that nineteen of the twenty major industry classifications in Idaho include at least some green employment. At the three-digit NAICS level, the industries with the highest level of green concentration (“very green”) are expected to grow 23% between 2008 and 2018, well above the average for the state, and add 20,680 jobs.

Idaho currently has an estimated 17,000 green jobs with average earnings of \$20.50 per hour. The direct contribution to the economy is approximately \$725 million. Idaho Labor Market Information relies on multipliers from Economic Modeling Specialists to estimate that green jobs create another \$404 million in indirect and induced earnings. The total contribution of the green economy is estimated to be “almost \$1.3 billion in earnings, about 5.4% of total state wages and salaries.”

The fastest growing green occupations are projected to be those that require a master’s degree (1.9% average annual growth), those that require only short- or moderate-term on-the-job-training (1.65%) and those requiring doctoral degrees (1.52%). The slowest expected growth is among those jobs requiring long-term on-the-job training.

Pennsylvania

In its January, 2010 *Pennsylvania Green Jobs Report*, the Pennsylvania Department of Labor & Industry seeks to identify green jobs, estimate employment projections and analyze growth in industries where these jobs exist. It also analyzes the impact of state and federal policy on the green economy, but a review of that section is outside the scope of this research.

Pennsylvania defines green jobs as those that “promote energy efficiency, contribute to sustainable use of resources, prevent pollution and reduce harmful emissions or clean up the environment.” (Dedrick & Mukherjee, 2010). It goes on to define three specific types of green occupations: *Emerging Occupations*

are those that require new skills unique to the industry, *Evolving Occupations* are those that require workers to learn new skills associated with changes in processes. *Traditional Occupations* are those that will be affected as green industries grow. The state identified 81 green SOC occupations. The report also identifies five green industry sectors which are closely aligned with those sectors identified by BLS and others: energy efficiency, renewable energy, clean transportation, pollution prevention and agriculture & resource conservation.

The Pennsylvania Department of Labor and Industry identifies 350,000 green jobs in Pennsylvania. Fifty nine percent (205,557) of those jobs are in energy efficiency, divided among 21,827 firms. Pollution prevention is the second largest green employer constituting 63,358 jobs among 2,587 firms. Clean transportation employs the fewest people but has the highest employees per firm at 40.

As of 2006, 40% of green employment in Pennsylvania was in construction. Engineers & Scientists and Agriculture & Forestry each employed 16% of green workers. The remainder were divided among Management & Business Specialists (13%), Production (8%), and Mechanics & Repairers (7%).

Private Sector Research

The section below summarizes the results and methodology of three private sector U.S. reports about the green economy. These include research from Brookings, The Pew Charitable Trust, and the Economic Policy Institute. These three reports were chosen because they offer primary data, use unique methodology and are among the most cited pieces on this topic.

The Brookings Institution

The Brookings Institution's 2011 report *Sizing the Clean Economy: A National and Regional Green Jobs Assessment* defines the green economy as "the sector of the economy that produces goods and services with an environmental benefit." (The Brookings Institution, 2011). Of the numerous private-sector reports published regarding the green/clean sector, it is among the most comprehensive.

Brookings attempts to fill perceived gaps in available data and research. Specifically, it attempts to create and analyze a detailed database of employment statistics nationwide, by large metropolitan area and by state. While Brookings research addresses multiple geographies, most of the information reviewed below is specific to the state of Vermont. This is done both because the broader project

including this review is about Vermont, and because no other available private research provides such detail at the state level for Vermont.

In the methodology supplement to the report, a more specific definition of clean economy is provided. It states that:

“Clean economy is economic activity – measured in terms of establishments and the jobs associated with them – that produces goods and services with an environmental benefit or adds value to such products using skills or technologies that are uniquely applied to those products.”

This definition focuses on production and therefore does not include jobs associated with green *processes* such as energy savings, waste reduction, environmental advocacy or related scientific research. The report also only includes firms who make products unique to the green economy and does not attempt to measure indirect jobs such as suppliers to green producers, green attorneys and advocates. Unlike many other private sector reports, Brookings considers Nuclear Energy production a green / clean energy. When possible, Brookings relies on previously-established standards and definitions such as the aforementioned BLS definition of green jobs. The five main categories of green established by the BLS (renewable energy, energy efficiency, greenhouse gas reduction, environmental management and agriculture & natural resource conservation) are broken down further into 39 industry segments. The clean economy is then mapped using the six-digit North American Industry Classification System (NAICS).

Brookings engaged in a two-step process to determine if an establishment was green. First, they relied on Standard Industrial Classification codes (SIC) to identify industries that were exclusively part of the green economy. 222 SICs were included. Second, Brookings compiled a list of green economy firms that may fall outside these SIC codes by examining numerous green-oriented specialized listings, certification programs and national associations.

Using the data compiled in this two-step process and comparing it with available BLS and Dun & Bradstreet data, Brookings was able to estimate the number of green jobs in a given geography, the intensity or concentration of those jobs relative to all jobs in a region, the expected employment growth rates and estimated annual wages.

Brookings finds that Vermont had 9,425 green jobs in 2010, ranking it 47th of the fifty states in total number. This is due in large part to the state’s small population and workforce. This is equal to 3% of all

jobs in the state, a concentration or intensity that ranks fifth in the nation. Between 2003 and 2010 Vermont added 1,130 green jobs, 1.8% annually. This growth rate ranked Vermont 44th among the fifty states. Annual wages for green jobs in Vermont were \$1,381 higher than the average of all jobs in Vermont.

Both the largest number of green jobs (1,232) and the largest number of green jobs added between 2003 and 2007 (356) were in Public Mass Transit. Organic farming provided 1,222 green jobs in 2010 but this was a slight decline from the 2003 figures. Employment in Conservation, Waste Management and Green Buildings Materials round out the top five largest segments. Biofuels/Biomass was the fastest growing segment, increasing at an annual average rate of 34.6%. This was followed by Solar Photovoltaic at 28.7%, Professional Energy Services (10.3%) and Pollution Reduction (8.3%).

Pew Charitable Trust

While Pew's 2009 Report *The Clean Energy Economy: Repowering Jobs, Businesses and Investments Across America* focuses primarily on energy issues, it provides a very detailed look at the labor market in the clean economy and is an important contribution to green labor literature. The report counts jobs in every state that are "aimed at developing clean, renewable sources of energy, increasing energy efficiency, reducing greenhouse gas emissions that cause global warming and conserving water and other natural resources." (Pew Charitable Trusts, 2009)

Pew's methodology for identifying establishments and employment in the clean energy economy is unique among the studies reviewed here. Pew starts by identifying companies that receive clean technology venture capital. This information stems from data provided by two membership organizations that track investment in clean energy technology, Cleantech Group, LLC and New Energy Finance. They then identify similar companies using the National Establishment Time Series database. From there, firms are sorted into those in SIC codes that are (1) fully part of the clean energy economy, (2) partially green and (3) active in some area of clean energy but categorized under a much broader SIC code. Individual research was done on all firms under the latter two categories to determine if they were involved in clean economy activities. Trends in business growth were then tracked via the National Establishment Time Series dataset. The results include total number of firms and total employment in each clean energy sector as well as average annual growth rates of employment (1998 – 2007)

As with Brookings above, Pew produces data for all fifty states. This review primarily focuses on the results for Vermont. Pew finds that Vermont had 2,161 clean jobs in 2007 and an average annual

growth rate of 1.7% between 1998 and 2007. While the total number of clean jobs leaves Vermont 45th out of the fifty states, the state's very small labor force is the largest factor in that ranking. As a percent of all employment, Vermont's concentration of .59% is the seventh highest in the nation. Oregon leads the nation with 1.02% (1,902,294) clean jobs.

Economic Policy Institute

The Economic Policy Institute's 2012 report *Counting Up to Green* (Pollock, 2012) finds that Vermont has the most green jobs per capita and the greenest workforce in the United States. EPI uses data from The Green Goods and Services survey of the Bureau of Labor Statistics as well as other sources to arrive at the findings discussed below. While the report offers significant interpretation and analysis of BLS and other federal agency data, it does not collect or analyze any primary data.

According to Pollack's analysis, 73% of green jobs in the US in 2012 were in the private sector while 27% were public. They further find that the federal government has the highest concentration of green jobs at 5.3% compared to 2.1% in the private sector. Within the private sector, the largest share of green jobs in 2010 were in Manufacturing (20% of all private green jobs) followed by Construction (17%), Professional and Technical Services (15%) and Administrative and Waste Services. The industries with the greatest intensity of green jobs were Utilities (where 11.9% of all jobs were green), Construction (6.8%) and Transportation and Warehousing (6.2%). Vermont led the nation with 3.8% of private sector jobs being green, almost twice the national average of 2.1%.

Shifting focus from industries to occupations, Pollack finds that employment growth in green occupations is faster than the overall economy. Specifically, the author finds that each percentage point increase in green intensity is associated with a .034% higher rate of employment growth. In addition, green jobs create more accessible opportunities for people without college degrees. Every 1% increase in green intensity within an industry corresponds to a .28% increase in the portion of jobs held by people without a four year degree.

Overall, Pollack finds a slightly positive relationship between the concentration of green employment and growth in employment. The relationship is tenuous, however, because the data covers the time period of the American Recovery and Reinvestment Act (ARRA) which focused heavily on investment in green energy and infrastructure.

Conclusion

As this literature review demonstrates, numerous strategies have been constructed for measuring the impact of the green economy. All share a common definition that involves environmental protection and resource conservation, but beyond these broad themes the definitions and strategies vary immensely. Current federal classification schemes such as the North American Industrial Classification System (NAICS) and Standard Occupational Classifications (SOC) do not specifically identify industries or occupations as green. The industries and occupations that would be considered “green” by conventional rationale are grouped with much larger classifications. This means that any attempt to identify green industry or green occupations must rely on an interpretation of federal data or the collection of primary data.

The Bureau of Labor Statistics, the O*NET collaborative and the Economics & Statistics Administration all rely on analyses of available federal data. This allows them to investigate the extent of the green economy using established datasets with a significant history of reliability. This methodology provides consistency and allows for comparisons across the studies and through time. However, it limits the precision of each estimate because of the aforementioned lack of green identification in coding.

State-level research typically uses federal data as a starting point, expanding that research via surveys of firms in the state. This allows states to remain consistent with federal terminology and classification schemes, while improving their results by including primary data. However, the various interpretations and definitions of green combined with differences in survey design make cross-study comparison difficult. In addition, most state reports are point-in-time studies that are not able to rely on historic data to assess trends. Finally, point-in-time studies at the state level can be heavily influenced by current economic conditions and fiscal policy during the time of the research.

Private-sector research relies on a variety of strategies and definitions using data from federal agencies, private entities and their own primary data collection. This allows them to use unique and often innovative methods to estimate the extent and impact of the green economy. This provides new insights into the topic and expands the knowledge base for researchers. On the other hand, the unique methodologies substantially limit comparability with other research and the exact methodology of the study may not be sufficiently detailed.

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