



The Pennsylvania **Green** Jobs Survey Report

Prepared by the Pennsylvania Department of Labor & Industry

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Executive Summary

This report summarizes the results of a green jobs survey of employers in Pennsylvania. The primary goals of the survey were to identify the number and type of green jobs that exist within the state's economy and to forecast changes in green jobs based on employers' two-year projections. The survey builds upon related research conducted earlier this year that helped to define and identify the kinds of industries and occupations that characterize the green economy, while also clarifying the needs and challenges for the state's green workforce.

What is a Green Job?

Foundational work conducted by the Department of Labor & Industry included reviews of relevant research and discussions with industry that resulted in a definition of green jobs for Pennsylvania. The final definition was reviewed and confirmed by industry employers. During the survey process, employers were asked to review the definition of green jobs and self-report how many of their employees were working in the core green areas described below.

Green jobs are jobs that employ workers in producing or offering products or services that:

- Promote energy efficiency
- Contribute to the sustainable use of resources or renewable energy
- Prevent pollution
- Clean up the environment
- Promote the reduction of harmful emissions
- Provide green education/training, awareness, or compliance

Study Results

The study relied on scientific survey design and procedures to measure employment in green jobs. A total of 14,619 employers covering all of the state's industries participated in the survey. The survey results were subsequently weighted to represent the distribution of green jobs across the broader population of employers. This enabled the computation of statewide estimates of green jobs by industry sector and occupation.

The results show an estimated 183,029 green jobs in Pennsylvania, which account for 3.4 percent of the total employment in the state. Green jobs are found in each of the six core areas represented in the state's definition, and these jobs are found in varying concentrations in all industries in the state. One out of every five responding companies employs workers in green jobs, and small companies with less than 50 employees report that they have green jobs more often than large firms.

Green jobs exist in all industry sectors of Pennsylvania; however, the bulk of this employment occurs in relatively few sectors. The top six industries account for three-quarters of all green jobs; the three largest industries – construction, manufacturing, and professional, scientific & technical services – account for more than half of all green jobs. As a percent of total employment, the proportion of green jobs varies greatly by industry sector, from a high of nearly 19 percent for construction, to a low of just one-tenth of one percent in the health care & social assistance industry sector.

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Green jobs also tend to be concentrated within relatively few occupations. The top 25 occupations include more than half of all green jobs in the state. The top five occupations combined constitute about one-fifth of all green jobs: production workers; heating, air conditioning & refrigeration mechanics & installers; carpenters; electricians; and retail salespersons.

Growth in Green Jobs

Overall, employers estimate green job growth at 6.2 percent annually over the next two years, resulting in 23,232 positions. Growth is forecast across most green occupations, with increases expected in 20 of the 25 most common green jobs. This growth forecast may be due to an increase in new green jobs, a shift in the work of existing employees into jobs considered green, or both. These forecasts probably reflect a conservative estimate, since the survey does not take into account openings due to attrition and retirements. Also, no attempt was made to estimate additional jobs through indirect or induced employment that may be associated with current or future employment in green jobs.

Profiles of Green Core Areas



The **energy efficiency** core area accounts for more than one-third of all green jobs (65,137). The construction industry sector was the largest employer in this core area, with almost 42 percent of these green jobs. Heating, air conditioning, & refrigeration mechanics & installers are the occupation with the largest number of jobs in this core area.



Resource sustainability/renewable energy is the second-largest core area, with 41,141 green jobs, or 22.5 percent of the total. Manufacturing was by far the largest employer in this core area, with more than 40 percent all green jobs. Production worker was the most common occupation, accounting for nearly 15 percent of sustainability/renewable energy jobs.



Pollution prevention accounts for 16.7 percent of green employment in the state, with an estimated 30,566 jobs. Green jobs are most numerous in the manufacturing, construction, and professional, scientific, & technical services industry sectors. Production workers and refuse & recyclable material collectors constitute the largest green occupations.



Green education/training or compliance constitutes 13 percent of all green jobs (23,991). One third of these jobs are in public administration, and 18 percent are in professional, scientific & technical services. The most common occupation in this core area is elementary school teachers (except special education), with nearly 16 percent of these jobs. These teachers often instruct students in green-related subject areas such as general science, biology, or environmental studies, for instance.



Environmental cleanup accounts for 6.4 percent of green jobs (11,672). One-quarter of the environmental cleanup jobs are in the professional, scientific & technical services industry sector. Refuse & recyclable material collectors account for nearly 11 percent of the jobs in this core area.



Harmful emissions reduction has the smallest number of green jobs among the six core areas (10,522), accounting for 5.7 percent of the state's green employment. Transportation & warehousing, and retail trade each cover roughly one-quarter of all jobs in this core area. Automotive service technicians & mechanics account for 28 percent of all jobs in this core area.

Regional Differences in Green Jobs

Green jobs exist in all Workforce Investment Areas (WIAs), though there is wide variation in the number and percentage of green jobs by region. This variation likely reflects differences in regional economic conditions including geographic location, population density, industry mix and the labor markets that characterize each WIA.

The Three Rivers WIA has the most current green jobs (18,318) and the second highest employment forecast, with an additional 4,052 green jobs expected within two years. In contrast, employers in the Northern Tier WIA reported the fewest green jobs, at 2,021. Several WIAs have green employment that is heavily based in a single core area:

- In the West Central WIA, 69.9 percent of green employment is in pollution prevention.
- In the Northwest WIA, 57 percent of green employment is in energy efficiency.
- More than half of all green employment in the Lancaster County WIA is in resource sustainability/renewable energy.

As a percentage of total employment, green jobs average 3.4 percent of employment across all WIAs in the state. Green jobs represent 6.8 percent of total employment in the Southern Alleghenies WIA, the largest proportion of any WIA. Conversely, in the Philadelphia County WIA, only 1.3 percent of regional employment is in green jobs.

Certification Skills

The survey asked employers to report the certifications, green skills and basic skills needed for their green workforce.

Certifications: Overall, 5.7 percent of the employers with green jobs reported that they have a work-related certification. The industries with the most certifications were professional, scientific, & technical services (13.5 percent of the employers in this industry sector) and construction (12.5 percent). Often these certifications were not unique to employees in green jobs, and many certifications cut across multiple industries.

Green Skills: The skills cited by employers varied widely by industry sector. Employers in construction and professional, scientific & technical services reported the greatest number and variety of green skills. Many employers interpreted the question on green skills to include general knowledge requirements for their green workforce (such as existing laws and regulations), as well as specific work skills.

Basic Skills: The basic skills reported by employers are very similar to the skills needed by all employees in the industry sector, whether green or not. In general, employers' responses ranged from personal attributes and general aptitudes to academic skills, college degrees and licenses

Future Research

The survey design establishes a reliable scientific foundation for identifying green jobs in Pennsylvania. As with any research project, there are opportunities for improvement and enhancement, including the following:

- Repeat the green jobs survey every two to three years in order to assess growth in green jobs and the industries that support them.
- Refine the survey instrument so that specific occupations can be linked to industry certifications, basic skills and green skills needed by employers and the workforce.
- Continue to conduct targeted studies by core area and industry sector to determine key growth factors and the education and training needs of employers and employees in the green economy.
- Compare and contrast the findings of this and future green jobs research to the broader economy to assess the total economic effects of green jobs and industry growth in different regions of the state.

Introduction

This report summarizes the results of the Commonwealth of Pennsylvania Green Jobs Survey. The primary goal of the survey was to identify the number of green jobs that exist within the state's economy, and to establish a baseline measure that can be used to track industry and job growth over time. The survey builds upon related research conducted earlier this year that helped to define and identify the kinds of industries and occupations that characterize the green economy, while also clarifying the needs and challenges of the state's green workforce.¹

Pennsylvania's effort to improve its information on green industries and jobs is a part of Pennsylvania's Labor Market Improvement Grant, a \$1.25 million competitive American Recovery and Reinvestment Act (ARRA) grant awarded to the Pennsylvania Department of Labor & Industry. A core goal of this grant is to reduce the gap between traditional labor market data and the information needs of employers, educators and workers. Pennsylvania wants the additional green labor market data it collects to support better decisions by public and private-sector partners about economic development activities and investments in education, training and careers that prepare Pennsylvania's green workforce for the future.

Over the past five years, Pennsylvania has established an active network of more than 70 industry partnerships that bring together employers (and, in some cases, labor unions) to identify common skills requirements in key industries and to communicate those needs to stakeholders to guide policy and program decisions to support development of the state's green economy. Eight of Pennsylvania's industry partnerships have already delivered green training to meet growing markets and workforce demand in clean manufacturing, construction, energy efficiency and utilities.

It is anticipated that the new labor market information contained in this report, in combination with other research by the Pennsylvania Department of Labor & Industry's Center for Workforce Information & Analysis, will provide a valuable benchmark for understanding the current composition of the state's green economy as well as helping to guide future efforts to support future growth in green jobs across Pennsylvania.

Defining Green-Economy Jobs

Foundational work conducted by the Department of Labor & Industry included reviews of relevant research and discussions with industry that resulted in a definition of green jobs for Pennsylvania. Preliminary versions of the definition were reviewed and modified based on additional input from employers, research experts and stakeholders, resulting in the following definition:

Green jobs are jobs that employ workers in producing or offering products or services that:

- Promote energy efficiency
- Contribute to the sustainable use of resources or renewable energy
- Prevent pollution
- Clean up the environment
- Promote the reduction of harmful emissions
- Provide green education/training, awareness, or compliance

The final definition was reviewed and confirmed by industry employers. During the survey process, employers were asked to review the definition of green jobs and self-report how many of their employees were working in the green core areas described above. Employers' identification of green jobs in their own organizations was a central focus of the study.

The Context for Green-Economy Jobs

The Pennsylvania Green Jobs Report, Part 1 defined green jobs, identified five broad industry sectors and projected \$10 billion in public and private investment in the state's green economy. While this report provided baseline information, critical questions remained unanswered. The purpose of the Green Jobs Survey is to follow up on this initial research

¹ *The Pennsylvania green jobs report, part 1*, January 2010: Pennsylvania Department of Labor and Industry; *Greening Pennsylvania's labor market information: Findings from listening sessions with employers and educators*, June, 2010: Pennsylvania Department of Labor and Industry.

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in order to answer several questions relating to the green economy: Where are Pennsylvania's green employers now and in two years from now? What jobs are green and what is the demand? What skills and certifications are associated with these jobs?

This survey is one component of an overall effort of the Pennsylvania Department of Labor & Industry to gain a better understanding of the green economy and to generate industry-level information on green jobs and document occupational demand and skill requirements necessary to target training to green industries' needs. In addition to the survey, Pennsylvania has held seven *Listening Sessions* with employers and educators to gain first hand, personal accounts of how the emergence and growth of the green economy has affected those individuals and their organizations. A *Jobs Tasks Analysis* was also conducted of emerging and evolving green occupations to determine green career pathways. Additionally, an *Inventory of Green Education and Training Capacity* is being conducted to determine if Pennsylvania has the ability to meet the demands of the green economy.

Ultimately, all of these efforts will culminate in the development and deployment of a *Green Career Tool* designed to assist job seekers in finding employment in the green economy. This tool will serve as a comprehensive resource containing all relevant data collected by Labor & Industry on the green economy, in order to aid job seekers in making informed career and educational decisions.

Methodology

The research team determined that accurately identifying and measuring green jobs and industry-sector trends called for a rigorous survey design and sampling method that would establish baseline estimates of green employment that could be used to track green jobs over time.

Survey Protocol Development

Referencing the state's definition and the six core areas for green jobs, the survey asked employers to identify how many of their employees currently work in green jobs by job title. Employers were responsible for identifying which of their jobs were green jobs. Employers were also asked to estimate the number of employees in each job title they expect to have in two years. The survey further asked employers to list any specific green skills, basic skills and certifications needed among employees that constitute their green workforce. Following completion of the survey process, existing data on industry-sector type, occupation and geographical location were integrated into the database to enable breakout analyses of the results for these variables.

The six-category green jobs definition was used to design the survey and was the basis for collecting information about occupational titles and estimating the number of green jobs by industry sector. The definition allowed for the inclusion of direct green jobs (employees who directly produce a green product or provide a service – such as solar panel technician or an environmental engineer) as well as some occupations that support green economy growth – such as educators or trainers. Prior research identified a series of industry sectors and sub-sectors that were expected to hold the majority of green jobs.² This study confirmed that, in most cases, these selections were correct.

Survey Administration

The study relied on a written survey form mailed to Pennsylvania employers in early June 2010. A follow-up mailing and up to three additional phone calls and email contacts were made during the study period. The phone contacts produced the highest number of responses, as would be expected in a survey of this complexity. Towards

the end of the survey period, industries or WIAs responding at lower than optimal rates were given additional staff attention to produce a more even response across all analysis categories.

The first procedure in the survey process was to update address and phone number information in the sample database. Only a “place of business” contact was utilized; legal and accounting firms, noted in the sample as representing the respondent, were not surveyed. The *Detailed Methodology* in the *Appendix* describes the sampling procedures for this survey.

The survey response database was edited daily during the data collection period. This reduced the number of questions needing attention at the end of the collection period. The database was further edited prior to the start of SOC (occupational) coding. The fully coded file was then given a final round of edits prior to submittal to staff producing the employment estimates.

Participation Rate

The sample included private and public-sector employers representing all industry sectors in Pennsylvania. A total of 14,619 usable surveys were received, which represents a participation rate of over 64 percent.

Data Analysis

Nearly 21 percent of the 14,619 employers who submitted usable surveys reported that they had employees in green jobs that related to one or more of the six core areas identified in the state definition. The survey results were subsequently weighted using standard statistical methods to represent the relative distribution of green jobs across the broader population of employers. This approach enabled the computation of statewide estimates of the number of green jobs by industry sector and occupation.

For further explanation of the procedures used in the study, please refer to the *Detailed Methodology* section in the *Appendix*.

² *The Pennsylvania green jobs report, part 1*, January 2010: Pennsylvania Department of Labor and Industry.

Study Results

This survey provides an overview of green jobs in Pennsylvania. It pinpoints where green jobs currently exist and how employers expect them to change. The survey results describe how green jobs are distributed across industries, occupations, and regions of the state. The results are presented below, with separate sections covering each of the following topics in turn:

- Distribution of green jobs among green core areas
- Green jobs by company size
- Summary of green jobs by industry sector
- Summary of green jobs by occupation
- Green employment forecasts by occupation
- Breakdowns of green jobs by Workforce Investment Area
- Skills and certifications for the green workforce

Each of the sections provides tables or graphs and accompanying narrative highlighting the main findings. Following the study results, the conclusions chapter summarizes the findings and offers recommendations for future research.

Table 1

Green Jobs by Core Area

CORE AREA	GREEN JOBS	
	NUMBER	PERCENTAGE
Energy Efficiency	65,137	35.6%
Resource Sustainability/Renewable Energy	41,141	22.5%
Pollution Prevention	30,566	16.7%
Green Education/Training or Compliance	23,991	13.1%
Environmental Cleanup	11,672	6.4%
Harmful Emissions Reduction	10,522	5.7%
Total	183,029	100.0%

³ Total employment is based on 2009 fourth quarter covered employment among the universe of employers used for sampling. This file excluded NAICS 922xxx and 814110. Covered employment means jobs that are covered by unemployment insurance.

Green Core Areas and Employment

Table 1 shows the number of green jobs and how they are distributed across the six green core areas. There are an estimated 183,029 green jobs in Pennsylvania, which account for 3.4 percent of the total employment in the state.³

The data show that green jobs are not evenly distributed across the core areas. In fact, the top three core areas together account for 75 percent of all green jobs. The leading core area is energy efficiency, with more than one-third of green employment. Resource sustainability/renewable energy (22.5 percent) and pollution prevention (16.7 percent) round out the top three core areas. Jobs in green education, training or compliance are slightly less common, at 13.1 percent of all green jobs. Environmental cleanup (6.4 percent) and harmful emissions reduction (5.7 percent) represent the core areas with the fewest jobs.

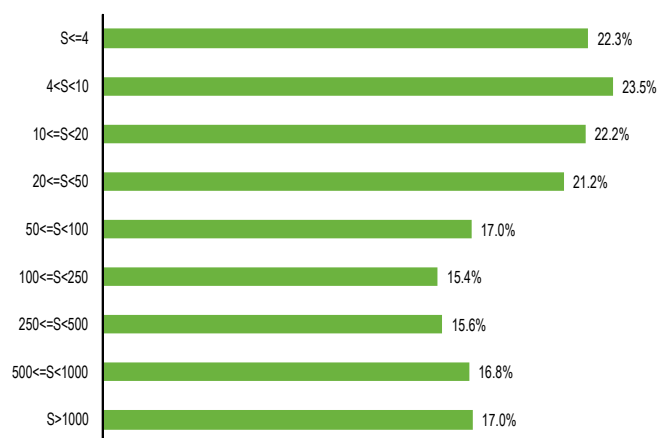
Green Jobs by Company Size

Overall, roughly one out of every five companies in Pennsylvania (20.6 percent) employed workers in green jobs.⁴ In general, smaller companies – those with fewer than 50 employees – were more likely to report having green employment than the larger companies (*Figure 1*).

⁴ Green employment by company size is based on raw numbers, not weighted estimates. For further details by company size, please see Table 14.

Figure 1

Percentage of Companies with any Green Employment by Company Size



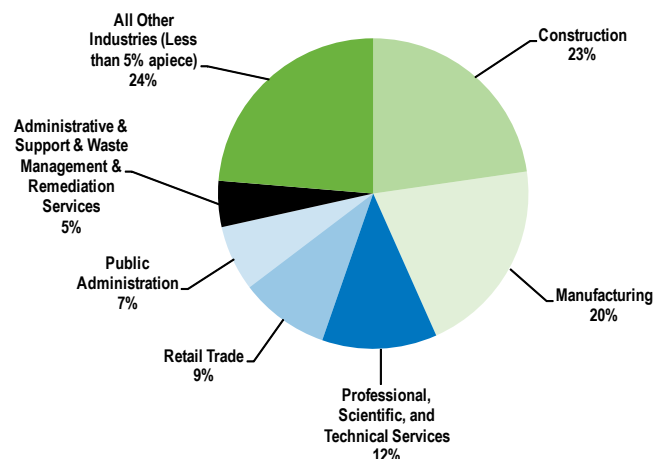
Twenty-two percent of the smaller companies had green employment, compared to 16 percent of the companies with at least 50 employees. (See *Table 14* in the *Appendix* for further details.)

Green Employment Industry Sector

Green jobs exist in all industry sectors of Pennsylvania; however, the bulk of this employment occurs in relatively few sectors. *Figure 2* shows that the top six industries account for three-quarters of all green jobs. In fact, construction, manufacturing, and professional, scientific & technical services alone account for more than half of all green jobs.

Figure 2

Distribution of Green Jobs by Industry Sector



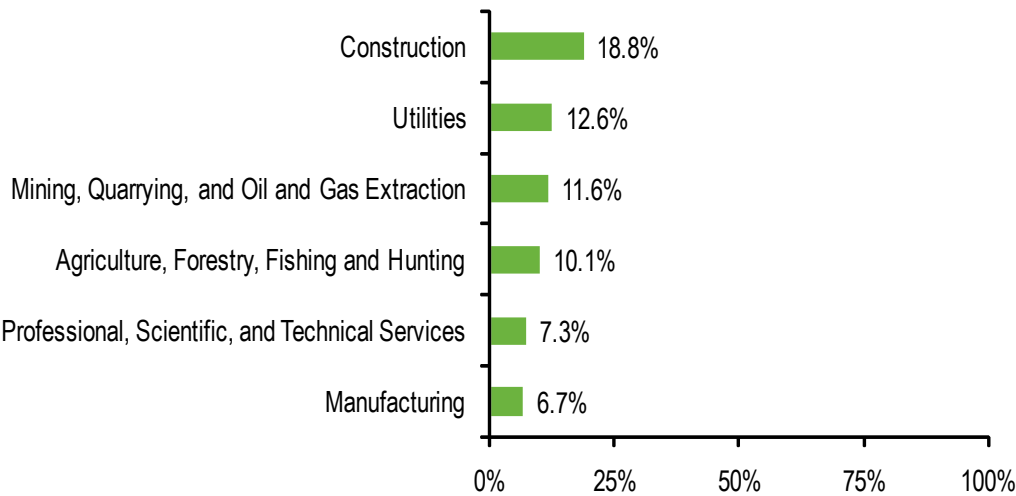
1. **Construction:** Firms in this industry sector offer services such as residential remodeling, new single family housing construction, commercial & institutional building construction, and water & sewer line construction. Construction accounts for both the largest number of green jobs (41,581) and the largest percentage of green jobs (22.7 percent) among all industries. As shown in *Figure 3*, construction also has the greatest proportion of green jobs among all industry-sector employment: Almost 19 percent of all construction jobs are green jobs. The core area of energy efficiency is the largest share of green jobs in construction, with 65.5 percent of green employment (*Table 15*).⁵
2. **Manufacturing:** This industry sector includes firms that fabricate and assemble a wide variety of products. Manufacturers responding to the survey produced a wide range of products, including heating equipment, iron & steel mills, semiconductors and paper envelopes. Manufacturing accounts for the second largest number of green jobs (37,757), accounting for 20.6 percent of the total. While manufacturing produces a significant number of green jobs, this does not necessarily represent a large proportion of the total employment in manufacturing. This is a large sector of the state economy, with total industry sector employment of more than 560,000, but green jobs are less than 7 percent of all manufacturing employment (*Figure 3*). *Table 15* shows that the two core areas that account for the majority of green employment in manufacturing are energy efficiency (32.4 percent) and resource sustainability/renewable energy (44.6 percent).
3. **Professional, Scientific & Technical Services:** This industry sector classification includes a diverse set of firms, including those offering architectural, landscaping, legal and engineering services. The professional, scientific & technical industry sector accounts for 12 percent of all green jobs (21,918). Perhaps reflecting the variety of firms grouped in this industry sector, green employment is split between several core areas (*Table 15*). The top two core areas represented by this industry sector include energy efficiency (28.6 percent) and green education/training or compliance (20.1 percent). Overall, green jobs are 7.3 percent of the employment in this industry sector (*Figure 3*).

⁵ The data referenced in *Table 15* is rounded.

Study Results

When considering all employment in an industry sector – both green and non-green – the proportion of green employment varies widely across the industries. At the upper end of the scale is construction. As noted earlier, almost one in every five construction jobs is a green job (18.8 percent), the highest proportion of any industry sector. Three other industries also have at least 10 percent green employment (*Figure 3*).

Figure 3
Green Jobs as a Percentage of Each Industry Sector's Employment



(Note: Chart displays industries with at least 5% green employment)

In contrast, only 0.1 percent of the health care & social assistance industry sector employment is reported to consist of green jobs, the smallest proportion of any industry sector. Six other industries have less than 2 percent green employment (*Table 2*).

Detailed green employment industry-sector information is presented in two separate tables. *Table 2* provides the distribution of green jobs across 20 NAICS industry sectors. While green jobs appear in all industry sectors, there is quite a bit of variation in the proportion of green employment within each industry sector.

Table 2
Green Employment in 20 NAICS Industry Sectors

NAICS	INDUSTRY SECTOR	GREEN JOBS		ALL EMPLOYMENT REPORTED IN 2009 FOURTH QUARTER ⁶	GREEN JOBS AS A PERCENTAGE OF INDUSTRY-SECTOR EMPLOYMENT
		NUMBER	PERCENTAGE		
23	Construction	41,581	22.7%	221,396	18.8%
31-33	Manufacturing	37,757	20.6%	564,108	6.7%
54	Professional, Scientific, & Technical Services	21,918	12.0%	301,600	7.3%
44-45	Retail Trade	17,117	9.4%	640,064	2.7%
92	Public Administration	12,540	6.9%	692,624	1.8%
56	Administrative & Support & Waste Management & Remediation Services	8,782	4.8%	261,651	3.4%
42	Wholesale Trade	8,206	4.5%	223,655	3.7%
48-49	Transportation & Warehousing	8,196	4.5%	201,705	4.1%
81	Other Services (except Public Administration)	4,954	2.7%	177,501	2.8%
22	Utilities	2,742	1.5%	21,715	12.6%
53	Real Estate & Rental & Leasing	2,627	1.4%	59,844	4.4%
21	Mining, Quarrying, & Oil & Gas Extraction	2,577	1.4%	22,195	11.6%
61	Educational Services	2,371	1.3%	185,666	1.3%
52	Finance & Insurance	2,351	1.3%	255,485	0.9%
11	Agriculture, Forestry, Fishing & Hunting	2,314	1.3%	22,939	10.1%
55	Management of Companies & Enterprises	2,244	1.2%	112,318	2.0%
72	Accommodation & Food Services	1,438	0.8%	405,150	0.4%
51	Information	1,248	0.7%	98,697	1.3%
62	Health Care & Social Assistance	1,151	0.6%	881,782	0.1%
71	Arts, Entertainment, & Recreation	915	0.5%	77,838	1.2%
Total		183,029	100.0%	5,427,930	3.4%

The relationship between industries and the green core areas appear to be fairly consistent with what might be expected. *Table 3* shows how many green jobs are in each of the six green core areas by industry sector (see *Table 15* for percentages). Most of the green jobs in educational services, for instance, are in the green core area of education, training or compliance. Likewise, it is logical that harmful emissions reduction would be the most common core area applying to jobs in transportation & warehousing.

⁶ Total employment is based on 2009 fourth quarter covered employment among the universe of employers used for sampling. This file excluded NAICS 922xxx and 814110. Covered employment means jobs that are covered by unemployment insurance.

Study Results

Table 3

Green Core Area Employment in 20 NAICS Industry Sectors

NAICS	INDUSTRY SECTOR	GREEN JOBS BY CORE AREA						TOTAL	
		ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE	GREEN JOBS	PERCENT OF TOTAL GREEN JOBS
23	Construction	27,216	4,768	4,522	1,989	924	2,162	41,581 ⁷	22.7%
31-33	Manufacturing	12,246	16,828	6,288	504	615	1,276	37,757	20.6%
54	Professional, Scientific, & Tech. Services	6,273	3,930	3,688	2,941	681	4,404	21,918	12.0%
44-45	Retail Trade	9,059	4,229	616	285	2,582	346	17,117	9.4%
92	Public Administration	552	721	2,657	393	235	7,981	12,540	6.9%
56	Admin., Support, & Waste Mgmt. & Remediation Services	2,006	2,026	2,170	1,849	429	302	8,782	4.8%
42	Wholesale Trade	1,674	2,617	3,192	295	- ⁸	428	8,206	4.5%
48-49	Transportation & Warehousing	1,077	1,301	2,122	268	2,856	572	8,196	4.5%
81	Other Services (except Public Admin.)	487	595	1,646	347	1,200	678	4,954	2.7%
22	Utilities	669	359	473	856	169	217	2,742	1.5%
53	Real Estate, Rental & Leasing	1,340	287	282	311	232	175	2,627	1.4%
21	Mining, Quarrying, & Oil & Gas Extraction	260	779	927	319	22	269	2,577	1.4%
61	Educational Services	145	40	19	28	-	2,139	2,371	1.3%
52	Finance & Insurance	1,058	320	188	150	-	634	2,351	1.3%
11	Agriculture, Forestry, Fishing & Hunting	93	1,324	693	51	34	119	2,314	1.3%
55	Mgmt. of Companies & Enterprises	157	393	588	377	541	188	2,244	1.2%
72	Accommodation & Food Services	618	142	12	27	1	638	1,438	0.8%
51	Information	113	332	313	-	-	490	1,248	0.7%
62	Health Care & Social Assistance	58	18	118	448	-	510	1,151	0.6%
71	Arts, Entertainment & Recreation	36	130	52	235	-	461	915	0.5%
Total		65,137	41,140	30,566	11,672	10,522	23,991	183,029	100.0%
Percent		35.6%	22.5%	16.7%	6.4%	5.7%	13.1%	100.0%	

⁷ Due to rounding, the estimated total green construction jobs are slightly different than the sum of the green employment in the core areas.

⁸ Dashes are placed where no employers indicated that they had green jobs in that particular core area. In these cases, no estimates of employment have been computed.

Green Core Area Occupations

On the survey, employers listed the job titles of employees working in positions related to the six green core areas. Based on these titles, all green occupations were classified within the list of standard occupational classification (SOC) codes.⁹ Instead of creating new green job titles, most employers used traditional titles to describe positions focused on producing or offering a green product or service. Even in a relatively new or emerging industry sector like renewable energy, jobs such as solar photovoltaic installer are now included in the SOC codes.

Given that construction and manufacturing industries constitute 44 percent of all green jobs, it is no surprise that occupations in these industries are well represented (*Figure 4*).

Figure 4

Top Green Occupations: Estimated Employment

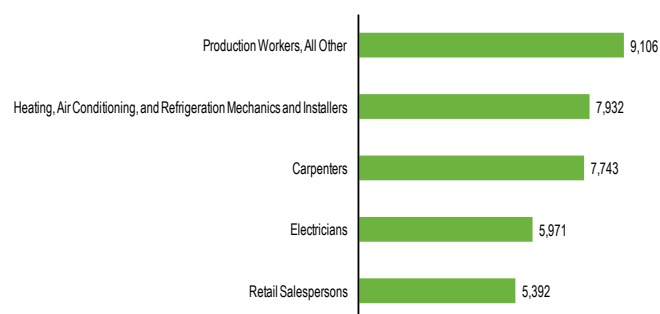


Table 4 shows that green employment is concentrated into relatively few occupations (SOC codes). The top 25 occupations include more than half of the green jobs in the state. In fact, the top five occupations combined constitute about one-fifth of all green jobs. These top occupations are described in further detail as follows:

1. The occupation with the most green jobs is production workers, with 5.0 percent of the total green jobs in the state (estimated at 9,106). Two-thirds of these positions are in the core area of resource sustainability/renewable energy, and an additional one-quarter are in pollution prevention. On the survey, most employers simply used the generic term “production worker” for employees in this category. Thus, it was impossible to code them into more specific production occupation categories. Other job titles reported by employers that were grouped

in this category include “manufacturing production technician”, “manufacturing laborer” and “machine operator”. This occupation represents production work in many different sectors of the economy.

2. Heating, air conditioning, & refrigeration mechanics & installers is the second most common green occupation, with 4.3 percent of the total green jobs. Not surprisingly, the bulk of these positions (84.8 percent) are in the core area of energy efficiency. Examples of occupation titles provided by employers included in this category are “HVAC service technician”, “HVAC specialist” and “HVAC installer”.
3. The occupation with the third-highest number of green jobs is carpenters, at 4.4 percent of green employment in the state. Most of the carpenters (80.6 percent) work in the core area of energy efficiency. Occupation titles listed by employers in this occupation included “construction carpenters” and “home remodeler”.
4. Electricians represent the occupation with the fourth-highest number of green jobs (3.3 percent). As might be expected, the vast majority of green jobs for electricians are in the core area of energy efficiency (91.5 percent). Employers used titles such as “electrician”, “maintenance electrician” and “journeyman electrician” to describe workers in this occupation.
5. The occupation with the fifth-highest number of green jobs is retail salespersons (2.9 percent). These green jobs are split fairly evenly between the core areas of energy efficiency (48.7 percent) and resource sustainability/renewable energy (43.0 percent). Employers identified green retail sales as being tied to the provision of green products, such as insulation, energy control systems and energy-efficient (‘energy star’) appliances. Employers most often used the titles “retail salesperson” and “sales representative” to describe this occupation. Employers listing green retail salespersons included department stores, electronics stores, automotive parts stores, new car dealers, and residential remodelers.

⁹ Federal statistical agencies use the Standard Occupational Classification (SOC) system to classify workers into standard occupational categories. For further information about the SOC system, please see the Bureau of Labor Statistics at <http://www.bls.gov/soc/>.

Study Results

Table 4

Top 25 Occupations by Green Core Area Employment and Percent of Total Green Jobs

SOC	OCCUPATION TITLE	GREEN JOBS BY CORE AREA						TOTAL	
		ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE	GREEN JOBS	PERCENT OF TOTAL GREEN JOBS
51-9199	Production Workers, All Other	695	6,050	2,268	53	10	40	9,106	5.0%
49-9021	Heating, Air Conditioning, & Refrigeration Mechanics & Installers	6,727	593	189	96	230	96	7,932	4.3%
47-2031	Carpenters	6,237	1,059	201	156	9	81	7,743	4.2%
47-2111	Electricians	5,462	389	36	22	-	62	5,971	3.3%
41-2031	Retail Salespersons	2,626	2,318	15	7	427	-	5,392	2.9%
49-3023	Automotive Service Techs. & Mechanics	659	180	988	80	2,950	20	4,877	2.7%
47-2061	Construction Laborers	2,173	653	726	636	116	307	4,612	2.5%
47-2152	Plumbers, Pipefitters, & Steamfitters	3,480	84	331	63	30	35	4,023	2.2%
25-2021	Elementary School Teachers, except Special Education	-	-	-	40	-	3,816	3,856	2.1%
17-2051	Civil Engineers	540	1,012	924	243	61	1,025	3,804	2.1%
51-4199	Metal Workers & Plastic Workers, All Other	496	2,056	783	-	-	-	3,336	1.8%
53-7081	Refuse & Recyclable Material Collectors	64	278	1,596	1,253	-	64	3,254	1.8%
37-3011	Landscaping & Groundskeeping Workers	742	1,157	613	527	20	71	3,130	1.7%
53-3022	Bus Drivers, School or Special Client	329	219	648	-	1,258	441	2,895	1.6%
49-9071	Maintenance & Repair Workers, Gen.	518	257	1,385	314	294	54	2,822	1.5%
41-3099	Sales Reps., Services, All Other	578	1,563	362	6	11	292	2,813	1.5%
53-3032	Heavy & Tractor-Trailer Truck Drivers	449	343	951	108	903	35	2,789	1.5%
17-2081	Environmental Engineers	272	272	594	444	126	936	2,644	1.4%
43-9061	Office Clerks, General	863	1,054	277	45	13	342	2,594	1.4%
17-1011	Architects, except Landscape & Naval	1,327	727	70	9	24	386	2,542	1.4%
53-3033	Light Truck or Delivery Services Drivers	644	946	698	208	2	30	2,529	1.4%
41-4012	Sales Representatives, Wholesale & Mfg., except Technical & Scientific Prods	1,488	287	323	143	38	174	2,452	1.3%
53-7062	Laborers & Freight, Stock, & Material Movers, Hand	65	1,164	1,062	104	-	-	2,395	1.3%
11-9021	Construction Managers	1,172	361	216	102	30	363	2,244	1.2%
51-7042	Woodworking Machine Setters, Oprs., & Tenders, except Sawing	1,442	-	-	-	-	690	2,132	1.2%
Total		39,048	23,022	15,255	4,660	6,543	9,361	97,890	53.5%
Total of all Green Jobs by Core Area		65,137	41,141	30,566	11,672	10,522	23,991	183,029	100.0%
Percent of Total		59.9%	56.0%	49.9%	39.9%	62.2%	39.0%	53.5%	

¹⁰ Dashes are placed where no employers indicated that they had green jobs in that particular core area. In these cases, no estimates of employment have been computed.

Employment Forecasts for Green Occupations

Employers forecast how many employees they will have in two years (2012) in each occupation. Overall, employers estimate green jobs growing by 6.2 percent in the next two years, resulting in 23,232 positions.¹¹ Growth is forecast across most green occupations, with increases expected in 20 of the 25 most common green jobs (*Figure 5*).

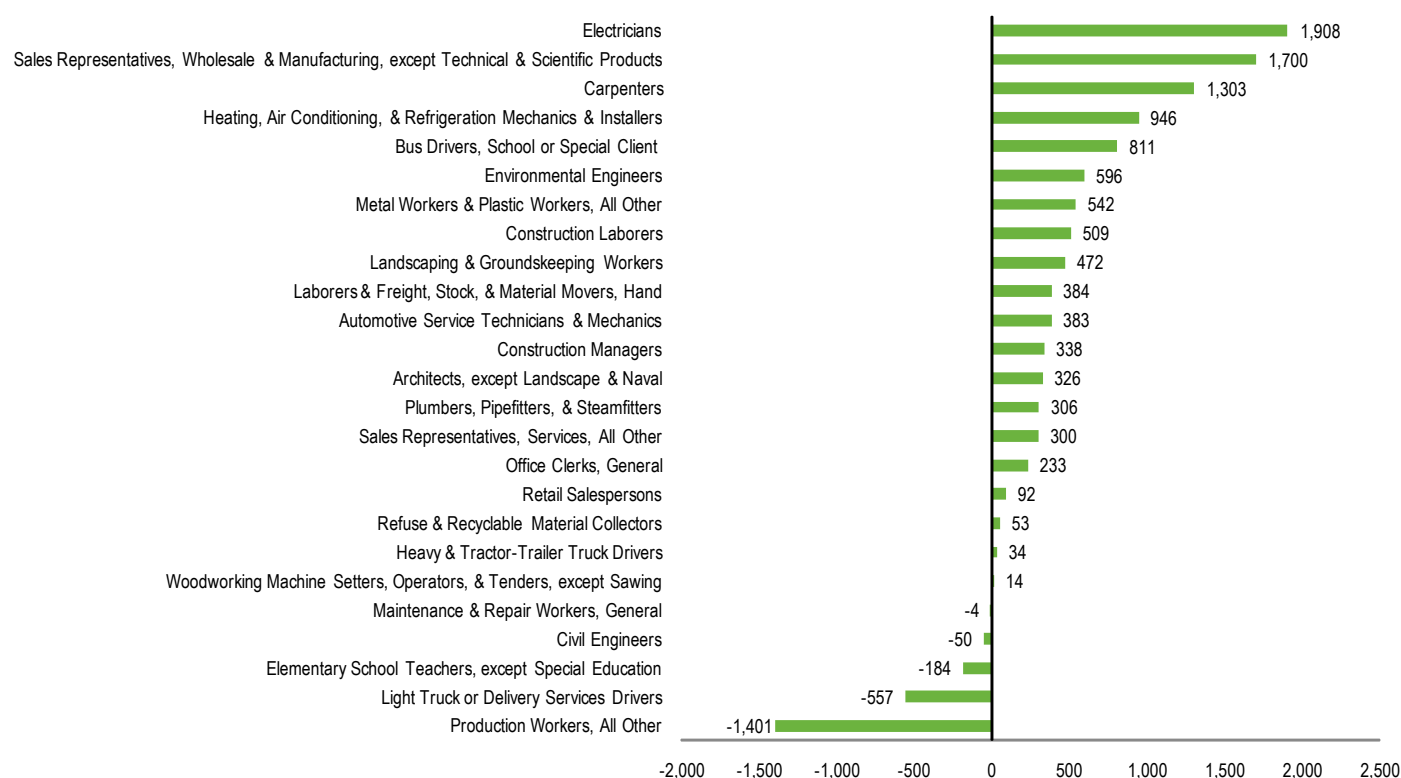
Table 5 presents the estimated annual growth rates and employment for the 25 occupations with the highest green employment in 2010.

It is important to note that forecast growth could have two different interpretations. An increase in the number of green jobs could mean that new jobs will be created. Alternately, the increase could include employees for whom green products and services will become a larger proportion of their duties. One interpretation denotes growth in employment, and the other indicates a shift in the primary responsibilities of existing positions.

These forecasts probably reflect a conservative estimate of the actual number of positions that could be available in the future, since the survey does not take into account openings due to attrition and retirements.

Figure 5

Forecast Change in Green Jobs per Occupation within Two Years (2012)



¹¹ Due to the survey design, growth in green jobs may be slightly under-reported. Forecast employment was tied directly to current green occupations; thus, the survey did not capture employment forecasts for occupations that the employer did not have in 2010 but planned to add by 2012.

Study Results

Table 5 shows that occupations related to construction and manufacturing figure prominently in the forecast for green jobs. The occupation expected to add the largest number of green jobs is electricians, an estimated 1,908 positions, or 14.9 percent growth. Employers of wholesale and manufacturing sales representatives (other than technical & scientific products) forecast adding an estimated 1,700 positions, an increase of 30.1 percent. The occupation with the third-highest expected growth is carpenters, with 1,303 positions or 8.1 percent growth.

Table 5

Top 25 Green Occupations and Employment Forecasts, Growth Rates 2010 to 2012

SOC	OCCUPATION TITLE	ESTIMATED GREEN JOBS IN 2010	FORECAST GREEN JOBS IN 2012	CHANGE IN EMPLOYMENT	ANNUAL GROWTH RATE
47-2111	Electricians	5,971	7,879	1,908	14.9%
41-4012	Sales Reps., Whls. & Manuf., exc. Tech. & Scientific Prods.	2,452	4,153	1,700	30.1%
47-2031	Carpenters	7,743	9,045	1,303	8.1%
49-9021	Heating, Air Cond., & Refrigeration Mechanics & Installers	7,932	8,878	946	5.8%
53-3022	Bus Drivers, School or Special Client	2,895	3,706	811	13.1%
17-2081	Environmental Engineers	2,644	3,240	596	10.7%
51-4199	Metal Workers & Plastic Workers, All Other	3,336	3,878	542	7.8%
47-2061	Construction Laborers	4,612	5,122	509	5.4%
37-3011	Landscaping & Groundskeeping Workers	3,130	3,602	472	7.3%
53-7062	Laborers & Freight, Stock, & Material Movers, Hand	2,395	2,779	384	7.7%
49-3023	Automotive Service Technicians & Mechanics	4,877	5,260	383	3.9%
11-9021	Construction Managers	2,244	2,582	338	7.3%
17-1011	Architects, except Landscape & Naval	2,542	2,869	326	6.2%
47-2152	Plumbers, Pipefitters, & Steamfitters	4,023	4,330	306	3.7%
41-3099	Sales Representatives, Services, All Other	2,813	3,113	300	5.2%
43-9061	Office Clerks, General	2,594	2,828	233	4.4%
41-2031	Retail Salespersons	5,392	5,484	92	0.8%
53-7081	Refuse & Recyclable Material Collectors	3,254	3,307	53	0.8%
53-3032	Heavy & Tractor-Trailer Truck Drivers	2,789	2,822	34	0.6%
51-7042	Woodworking Mach. Setters, Oprs., & Tenders, except Sawing	2,132	2,146	14	0.3%
49-9071	Maintenance & Repair Workers, General	2,822	2,819	-4	-0.1%
17-2051	Civil Engineers	3,804	3,754	-50	-0.7%
25-2021	Elementary School Teachers, except Special Education	3,856	3,672	-184	-2.4%
53-3033	Light Truck or Delivery Services Drivers	2,529	1,972	-557	-11.7%
51-9199	Production Workers, All Other	9,106	7,705	-1,401	-8.0%
Total		97,890	106,946	9,056	4.5%
Total of all Green Jobs by Activities		183,029	206,261	23,232	6.2%
Percent of Total		53%			

Although the occupation production workers (all other) is estimated to have the highest green employment in 2010, this is also the occupation expected to have the greatest loss of jobs (-1,401 jobs or -8.0 percent). The only occupation with a bigger projected loss is light truck or delivery service drivers, at -11.7 percent of green employment, but since this occupation has a smaller base number of jobs, the total loss is estimated to be 557 jobs.

Green Employment by Workforce Investment Area

Regional differences in green employment were examined by reviewing the results for Pennsylvania's 22 Workforce Investment Areas (WIAs). WIAs denote regional labor markets and are used to define local workforce characteristics. This section provides analysis of the current and forecast green employment in each WIA.

Figure 6

Workforce Investment Areas



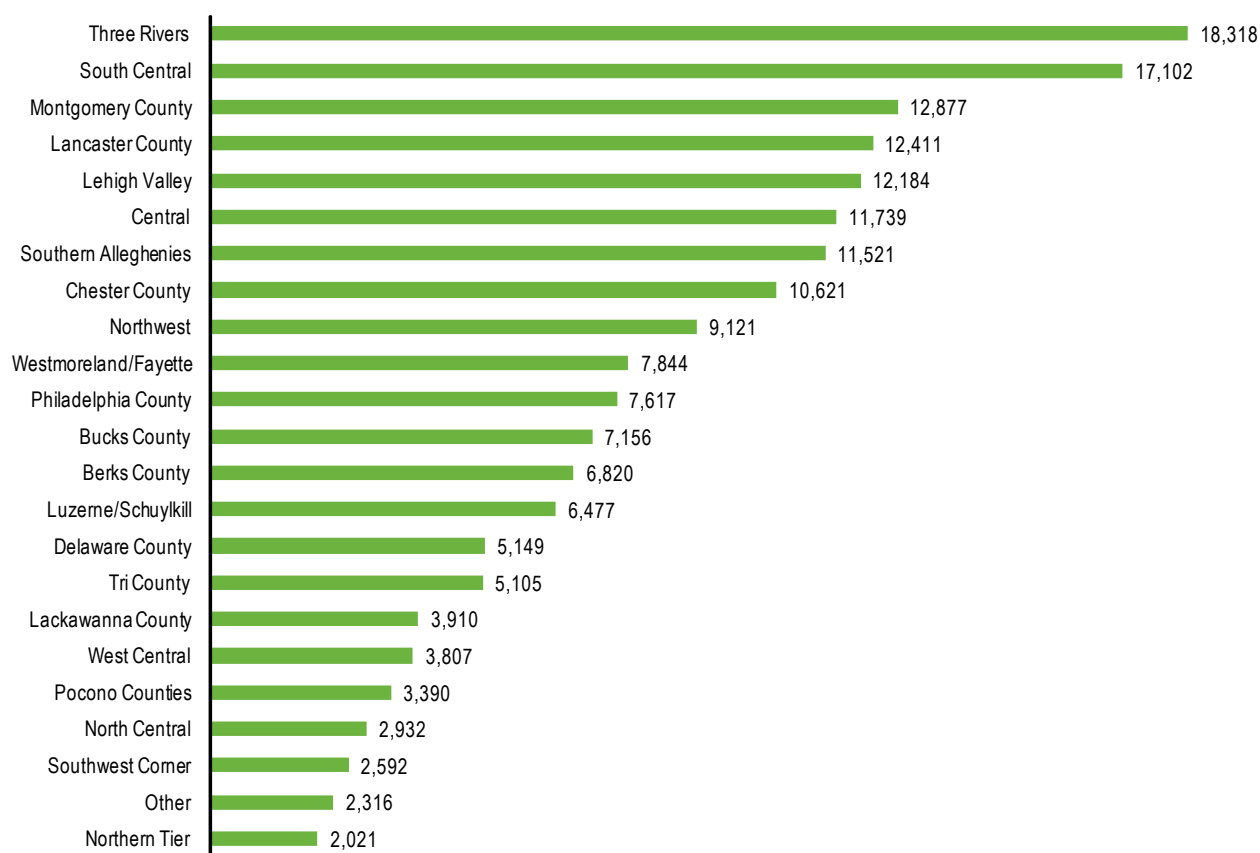
Study Results

Distribution of Green Employment by Workforce Investment Area

Green jobs were reported for all of the WIAs, though there is wide variation in the number of positions and the extent to which green employment permeates each regional economy (*Figure 7*). The WIAs with the greatest numbers of green jobs are Three Rivers (18,318) and South Central (17,102). Employers in the Northern Tier WIA reported the fewest green jobs, at 2,021.

Figure 7

Green Jobs per Workforce Investment Area (WIA)



Several WIAs have green employment that is heavily based in a single core area. (See *Table 12* in the *Appendix* for detailed breakdowns of employment within each core area.)

- In the West Central WIA, 69.9 percent of green employment is in pollution prevention.
- In the Northwest WIA, 57.0 percent of green employment is in energy efficiency.
- More than half of green employment in the Lancaster County WIA is in resource sustainability/renewable energy (50.5 percent).

As Table 6 shows, there is considerable variation in the percentage of WIA employment in green jobs. For example, green jobs represent 6.8 percent of the employment in the Southern Alleghenies WIA, the largest proportion of any WIA. At the other end of the spectrum is the Philadelphia County WIA, where only 1.3 percent of the employment is in green jobs.

Table 6
Green Employment by Workforce Investment Area (WIA)

WORKFORCE INVESTMENT AREA	GREEN JOBS	ALL EMPLOYMENT REPORTED IN 2009 FOURTH QUARTER ¹²	GREEN JOBS AS A PERCENTAGE OF WIA EMPLOYMENT
Southern Alleghenies	11,521	169,200	6.8%
Lancaster County	12,411	216,627	5.7%
West Central	3,807	75,105	5.1%
Central	11,739	238,845	4.9%
Northwest	9,121	200,323	4.6%
Westmoreland/Fayette	7,844	169,664	4.6%
Chester County	10,621	236,136	4.5%
Lehigh Valley	12,184	268,072	4.5%
Berks County	6,820	161,221	4.2%
Lackawanna County	3,910	98,355	4.0%
Tri County	5,105	129,268	3.9%
Northern Tier	2,021	53,306	3.8%
North Central	2,932	80,274	3.7%
Luzerne/Schuylkill	6,477	184,987	3.5%
Pocono Counties	3,390	96,595	3.5%
Bucks County	7,156	249,589	2.9%
Montgomery County	12,877	466,540	2.8%
South Central	17,102	610,014	2.8%
Three Rivers	18,318	666,505	2.7%
Delaware County	5,149	203,052	2.5%
Other ¹³	2,316	103,320	2.2%
Southwest Corner	2,592	145,058	1.8%
Philadelphia County	7,617	605,610	1.3%
Total	183,030	5,427,666	3.4%

¹² Total employment is based on 2009 fourth quarter covered employment among the universe of employers used for sampling. This file excluded NAICS 922xxx and 814110.

¹³ "Other" consists of firms with green jobs in more than one area.

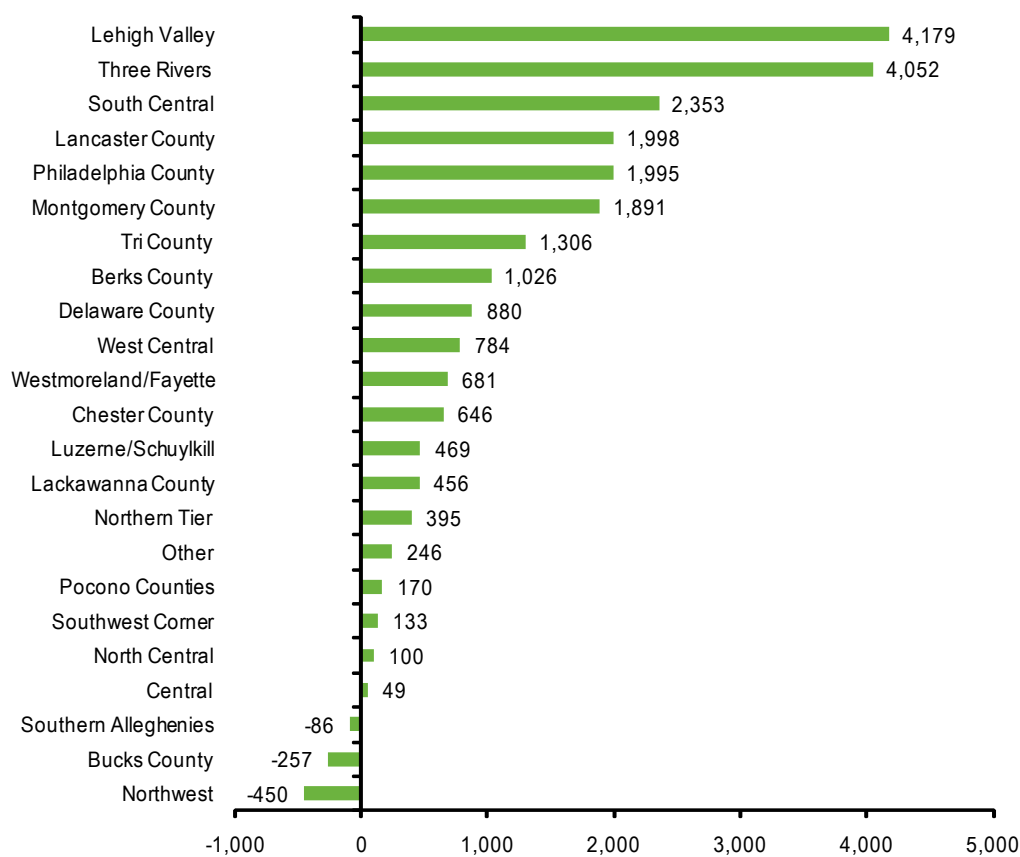
Study Results

Forecast Growth by Workforce Investment Area

As noted earlier, green jobs are projected to grow by 23,262 jobs (6.2 percent) within two years. *Figure 8* shows that employers estimate that green employment will grow in all but three WIAs: Southern Alleghenies, Bucks County, and Northwest. The two WIAs that expect to gain the most new green jobs are Lehigh Valley (4,179) and Three Rivers (4,052).

Figure 8

Forecast Change in Green Jobs per Workforce Investment Area



As shown below in *Table 7*, half of the WIAs have estimated growth rates above the state average of 6.2 percent. The three WIAs with the highest projected growth rates are Lehigh Valley (15.9 percent), Philadelphia County (12.3 percent), and Tri County (12.1 percent). One interesting note is that while the Philadelphia County WIA currently has the smallest proportion of green jobs when compared to all employment in the WIA, it has the second-highest projected growth rate.

Table 7

Forecast Growth in Green Employment by Workforce Investment Area

WORKFORCE INVESTMENT AREA	ESTIMATED GREEN JOBS IN 2010	FORECAST GREEN JOBS IN 2012	CHANGE IN EMPLOYMENT	ANNUAL GROWTH RATE
Lehigh Valley	12,184	16,363	4,179	15.9%
Philadelphia County	7,617	9,612	1,995	12.3%
Tri County	5,105	6,411	1,306	12.1%
Three Rivers	18,318	22,370	4,052	10.5%
West Central	3,807	4,591	784	9.8%
Northern Tier	2,021	2,416	395	9.3%
Delaware County	5,149	6,028	880	8.2%
Lancaster County	12,411	14,409	1,998	7.7%
Berks County	6,820	7,846	1,026	7.3%
Montgomery County	12,877	14,768	1,891	7.1%
South Central	17,102	19,455	2,353	6.7%
Lackawanna County	3,910	4,366	456	5.7%
Other	2,316	2,562	246	5.2%
Westmoreland/Fayette	7,844	8,525	681	4.2%
Luzerne/Schuylkill	6,477	6,946	469	3.6%
Chester County	10,621	11,267	646	3.0%
Pocono Counties	3,390	3,560	170	2.5%
Southwest Corner	2,592	2,724	133	2.5%
North Central	2,932	3,032	100	1.7%
Central	11,739	11,788	49	0.2%
Southern Alleghenies	11,521	11,435	-86	-0.4%
Bucks County	7,156	6,899	-257	-1.8%
Northwest	9,121	8,670	-450	-2.5%
State	183,029	206,261	23,232	6.2%

Certifications and Skills for the Green Workforce

The survey asked employers to report the certifications, green skills and basic skills needed for their green workforce. Because the survey question about skills and certifications was not associated with specific occupations, it is not possible to analyze the results by occupation. However, analysis was possible by industry sector, since each employer is identified with only one standard industry code (NAICS).

Study Results

Certifications for the Green Workforce

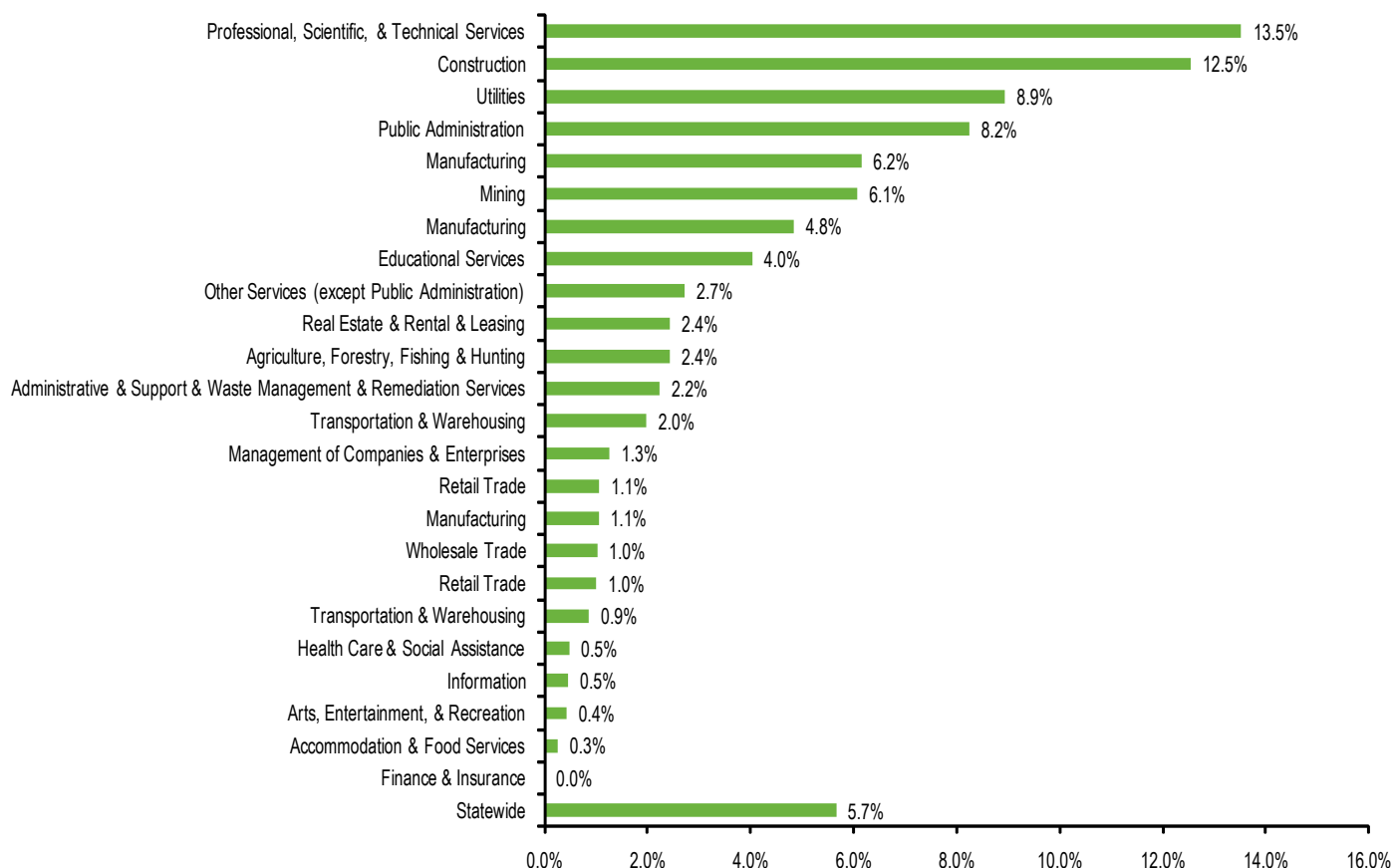
Employers provided examples of the certifications needed for their green workforce. In many cases, these were certifications needed by all employees in the occupation, not certifications specifically related to the green aspects of the jobs. Many certifications were associated with multiple industries. For instance, LEED AP certification was noted by employers from 10 different industries.

Figure 9 provides the percentage of employers in each industry sector reporting certifications, according to their two-digit NAICS industry classification.¹⁴ Overall, 5.7 percent of the employers with green jobs reported that they have a certification. The industries with the most certifications were professional, scientific, & technical services (13.5 percent of the employers in this industry sector) and construction (12.5 percent).

Below are examples of certifications that employers listed within the top two industry sectors. Please see the *Appendix* for all certifications reported by employers in each NAICS industry sector.

Figure 9

Percentage of Employers Reporting Green Certifications by Industry Sector



¹⁴ Data in figure is un-weighted and, therefore, may not necessarily reflect the broader industry population.

Professional, scientific & technical services includes firms offering architecture, landscape and engineering services. Common certifications mentioned by employers in this industry sector are as follows:

- LEED AP Certified
- Registered Architect
- Certified Landscape Architect, Registered Landscape Architect
- Certified Energy Manager
- Certified Planner
- EPA Certified
- Professional Engineer
- Water Treatment Plant Operator Certification

Construction includes firms offering services such as residential remodeling, new single family housing construction, commercial & institutional building construction, and water & sewer line construction. Common certifications reported by construction employers include the following:

- LEED AP Certified
- LEAD Paint Certification
- National Association of Home Building Certified
- OSHA Certification
- Certified Electrician
- HVAC Certified
- Solar Certification
- EPA Refrigerant Certification
- Plumbing License
- Certified Energy Manager
- Green Advantage Environmental Certification

Green Skills Needed by the Green Workforce

Employers also provided examples of the green skills needed by their green workforce (see *Table 19* in the *Appendix* for examples of the types of green skills mentioned by employers within each industry sector). The green skills presented in this report should be viewed as a snapshot of green skills that are important to some employers, not a comprehensive overview of green skill requirements. Additional research (outside of this survey) is currently being conducted, which will provide more in-depth information about the evolving green skills needs of employers in Pennsylvania.

The number and content of responses to this survey question varied considerably by industry sector. Employers in construction and professional, scientific & technical services reported the greatest number and variety of green skills. This may be expected, given that these two sectors represent large numbers of green jobs across a variety of occupations.

Many employers interpreted the question on green skills to include general knowledge requirements for their green workforce, as well as specific work skills. One trend that appeared across multiple industry sectors was the importance of employees understanding state and federal laws, policies, and regulations that apply to their jobs. Examples include laws regarding excavating, restoration, energy and lead, and regulations from the EPA and OSHA.

Basic Skills Needed by the Green Workforce

In general, the basic skills needed by employees in green jobs are very similar to the skills needed by all employees in the occupation, whether green or not. Employers reported a wide variety of basic skills and knowledge, such as the following:

- Personal attributes (e.g., self-starter, dependable, hard worker)
- Physical attributes (e.g., able to work in heat, able to lift heavy items, high level of endurance)
- General aptitudes (e.g., mechanically inclined)
- Basic academic skills (e.g., reading, writing, math)

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- Skills and knowledge specific to the occupation (e.g., backhoe operation, farm plant tending)
- Professional licenses (e.g., Electrical Contractor License, Emissions Inspection License, Wastewater Operator License)
- Academic degrees (e.g., Environmental Engineering Degree, Forestry Degree, Chemical Engineering Degree)

At first, it was somewhat surprising to see professional licenses and academic degrees included in this section. On further review, it appears that some employers also interpreted “basic skills” as the essential prerequisites of the job, not necessarily as simple, rudimentary academic skills (for examples of basic skills reported by employers in each industry sector, please see *Table 20* in the *Appendix*).

Conclusions

The primary goal of this study was to identify the number and type of green jobs in Pennsylvania. The intent was to identify and estimate the current composition of industries, employers and employment in green jobs across the state, and to forecast changes in green jobs based on employers' two-year projections. The scope of the study was limited to self-reported data collected directly from Pennsylvania employers.

The research design provides a statistically-sound foundation for measuring changes in industries and employment over time. The survey builds upon earlier green jobs research conducted by the Department of Labor & Industry.¹⁵ The design can be expanded to incorporate new variables that are subsequently determined to be important to providing high-quality labor market information and guidance that can be used to support future development of green jobs and industries in Pennsylvania.

Current and Future Employment in Green Jobs

The study estimates total statewide green employment of 183,029 across the six green core areas. Compared to all covered employment, green jobs account for only about 3.4 percent of the statewide total. Employers do anticipate growth in the numbers of green jobs in their organizations. Indeed, the employers participating in the survey estimated that over the next two years an additional 23,239 positions will exist beyond current levels. This general increase represents an annualized growth rate of 6.2 percent. Growth is expected to be widespread, occurring across a variety of occupations. In fact, 20 of the 25 most common green occupations are projected to either add new jobs or shift existing positions to job responsibilities that embody an increasingly green focus. Regionally, growth in green jobs is projected across all but three of the state's 22 Workforce Investment Areas.

The number of green jobs should be viewed as a conservative estimate for many reasons. First, employers completing the survey were directed to exclude consultants, outside contractors, vendors and others not considered

regular employees. Additionally, while the survey did include some public-sector jobs, not all government employment was included due to technical adjustments in the survey sample. Although the timing of the survey and seasonal employment fluctuations may have boosted identification of green jobs in some industries, it is also possible that the prolonged economic downturn, especially in large industries like construction and manufacturing, may have moderated the estimates for green jobs. Finally, the survey focused primarily on direct employment in green jobs, and no attempt was made to estimate additional jobs through indirect or induced employment that may be associated with current or future employment in green jobs.

Green Job Characteristics

Green jobs have made a wide impact across the economy in Pennsylvania. They exist within all industries and regions of the state, though the majority of green jobs are concentrated within relatively few industries and occupations.

Leading Green Industries

It is worth noting that a relatively small number of industries account for the largest total number of green jobs in the state. Similarly, only a handful of industries have large proportions of green jobs compared to total employment in the industry sector. Indeed, green jobs are more than 5 percent of total employment in only six of the state's 20 industries.

More than half of the green jobs in Pennsylvania occur within just three industry sectors: construction (22.7 percent), manufacturing (20.6 percent), and professional, scientific, & technical services (12.0 percent). These three sectors are major employers in Pennsylvania, so it seems reasonable that they might account for a large proportion of green jobs. At the same time, however, there are also a disproportionate number of green jobs in these key industries. For example, construction accounts for roughly 4 percent of the state's total covered employment but almost 23 percent of green jobs. Similarly, manufacturing accounts for about 10 percent of the statewide employment but more than 20 percent of green jobs. Professional, scientific, & technical services is close to 6 percent of the total covered employment but 12 percent of green jobs. Clearly, there is considerable variation in the proportion of green jobs within these industries.

¹⁵ See: *The Pennsylvania green jobs report, part 1*, January 2010: Pennsylvania Department of Labor & Industry; *Greening Pennsylvania's labor market information: Findings from listening sessions with employers and educators*, June, 2010: Pennsylvania Department of Labor & Industry.

Conclusions

Construction: Several factors likely contribute to the preponderance of green jobs in the three leading industry sectors. Construction may be affected by the growing influence of green building practices and *Leadership in Energy Environmental Design* (LEED) certified projects, which have been accompanied by a rapid growth in the availability and popularity of new green products and methods. Green jobs were reported by employers in residential new home construction and remodeling, commercial and institutional building construction, and construction related to power and communication lines, bridges and highways. The *U.S. Green Building Council* suggest that continued growth in green building is likely, and that recovery by the industry sector is likely to accelerate green building construction and new green jobs.¹⁶

Manufacturing: Statewide employment in this sector is large, exceeding half a million workers. This industry sector has also been greatly influenced by the increasing number and variety of green products that are a response to growing demand by consumers for environmentally-friendly goods. Shifting consumer expectations has created new markets for green products that pose business opportunities for manufacturers and employment growth. At the same time, many companies have adopted sustainable business practices that enable companies to reduce waste, use less energy and operate in a more environmentally-friendly fashion than in the past.

Professional, scientific & technical services: This industry sector includes a diverse mix of services, and its green jobs are quite different from one sub-sector to another. Employers participating in the survey include firms offering services in architecture, building inspection, engineering, environmental consulting, industrial design, interior design, scientific & technical consulting, logistics consulting, surveying & mapping, and testing. Many of the companies in this industry sector support the highly technical work of highly-trained professional employees such as engineers, consultants and architects. These companies often engage in research, new product development and technical expertise that is generally associated with innovative green products and services. Thus it seems reasonable to expect that this industry sector would be among the top industries that employ workers in green jobs.

Leading Green Occupations

The concentration of green jobs in construction and manufacturing is also reflected in the occupations with the most green jobs: production workers (9,106), heating, air conditioning & refrigeration mechanics & installers (7,932), carpenters (7,743), and electricians (5,971). With the exception of production workers, these occupations are also among those with the greatest projected growth rates over the next two years.

The projections suggest that employers expect to see growth in the number of new jobs or a continued shift of employees' work in support of green products or services. In several recent studies, employers in Pennsylvania have reported seeing job shortages in skilled blue collar occupations.¹⁷ Although the current economic recession has weakened employment demand in most skilled trade occupations, current skill gaps combined with projected increases in craft occupations such as electricians (by 1,908 jobs), carpenters (1,303 jobs) and other skilled trade jobs may portend future labor shortages in these key occupational groups.

Profiles of Green Core Areas¹⁸



The **energy efficiency** core area accounts for more than one-third (35.6 percent) of all green jobs (65,137). The construction industry sector was the

largest employer in this core area, with almost 42 percent of green jobs. Manufacturing contributed 18.8 percent of the jobs in the energy efficiency sector, followed by retail trade (13.9 percent). The most common occupation with a primary focus on energy efficiency was heating, air conditioning, & refrigeration mechanics & installers, contributing more than 10 percent of the energy efficiency green jobs. Carpenters (9.6 percent) and electricians (8.4 percent) round out the top three occupations in this green core area.

¹⁶ See the U.S. Green Building Council and related publications: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718>.

¹⁷ "Greening Pennsylvania's Labor Market Information: Findings from Listening Sessions with Employers and Educators." 2010. Pennsylvania Department of Labor & Industry. Page 3.

¹⁸ "The industry and occupational calculations in this section are derived from data depicted in Table 3 and Table 4."

The large number of energy efficiency-related green jobs is likely, in part, a function of the size and scope of the various industries that constitute this broad core area. Energy efficiency products and services support employment in several large industries, and these products and services have well-established markets and networks in all facets of construction, manufacturing and various professional and technical services companies and occupations.



Resource sustainability/renewable energy was the second-largest core area, with 41,140 green jobs, or 22.5 percent of the total. Manufacturing was by far

the largest employer in this core area, with 40.9 percent of all green jobs. Next largest was construction (11.6 percent), followed by retail trade (10.3 percent) and professional, scientific & technical services (9.6 percent). Production workers (all other) was the most common occupation, accounting for 14.7 percent of the resource sustainability/renewable energy jobs (6,050). Since many of the companies and occupations engaged in resource sustainability and renewable energy projects involve the production of sustainable products and the provision of services such as those needed to design, engineer and construct renewable energy facilities, the distribution of industries and job types in this core area appear to be well aligned.



Pollution prevention accounts for 16.7 percent of green employment in the state, with an estimated 30,566 jobs. No single industry sector captured the bulk of the

pollution prevention jobs. Instead, most jobs are distributed across the manufacturing (20.6 percent), construction (14.8 percent), and professional, scientific & technical services (12.1 percent) sectors. Reflecting the variety of jobs in pollution prevention, no occupation accounted for more than 8 percent of the employment. The most common occupations were production workers (7.4 percent) and refuse & recyclable material collectors (5.2 percent). The type of industries and range of occupations with green jobs are typical of those we might expect to find in this core area.



Education/training or compliance made up 13 percent of green jobs in this core area (23,991). One third of the jobs in this core area are in public administration (33.3 percent), and

18.4 percent are in professional, scientific & technical services. The most common occupation in this core area is elementary school teachers (except special education), with 15.9 percent of the jobs. Oftentimes, these teachers belong to environmental science and environmental studies programs that focus on environmental cleanup, pollution prevention and related green economy subjects. Although education and training employment also occurs in private-sector organizations, the public sector is the largest employer of educators, and government is typically the largest source of employment in compliance-related jobs. Many of the occupations in this core area do not directly produce green products, however they do provide supporting services in green jobs that contribute to the green economy.



Environmental cleanup accounts for 6.4 percent of green jobs (11,672). One-quarter of the environmental cleanup jobs occur in professional, scientific & technical

services (25.2 percent). Other common industries in this core area are construction, with 17.0 percent of the jobs and administrative & support & waste management & remediation services, with 15.8 percent. The occupation accounting for the largest percentage of environmental cleanup jobs is refuse & recyclable material collectors (10.7 percent or 1,253 jobs). This core area represents a fairly specialized function while also relying on a broad range of industries, companies and types of green jobs, ranging from engineering and management to heavy construction and handling of recycled materials. The modest number of green jobs in this core area may reflect its small size relative to other, larger core areas such as energy efficiency.



Harmful emissions reduction is the core area with the smallest number of green jobs (10,522), accounting for 5.7 percent of the state's green employment. Transportation

& warehousing (27.1 percent) and retail trade (24.5 percent) each cover roughly one-quarter of the jobs in this core area. More than one-quarter of the harmful emissions employment is in the occupation automotive service technicians & mechanics (28.0 percent). Industries and occupations in this core area likely reflect efforts by some industries to reduce equipment and process emissions through alternate fuels, better emissions controls and equipment, or by limiting the use of harmful chemicals, paints or other substances with high levels of volatile organic compounds (VOCs). As with

Conclusions

environmental cleanup, this core area is fairly specialized, which may help explain the modest number of green jobs compared to other core areas.

Regional Differences in Green Jobs

Green jobs exist across Pennsylvania, though there is wide variation in the number and percentage of green jobs by WIA. This variation likely reflects differences in regional economic conditions including geographic location, population density, industry-sector mix and the labor markets that characterize each WIA. Some main findings by WIA are summarized below:

- Three Rivers WIA has the most current green jobs (18,318) and the second highest employment forecast, with an additional 4,052 green jobs expected within two years.
- South Central WIA also figures prominently in the discussion of green jobs, coming in second in the number of current green jobs (17,102) and third in projected employment (2,353).
- Employers in the Northern Tier and the Southwest Corner WIAs reported the fewest green jobs, at 2,021 and 2,592, respectively. Projected green employment in the Northern Tier WIA was higher than average (9.2 percent), however this represents an increase of just 395 positions. Projections for the Southwest Corner WIA were very small at 2.5 percent.

Several WIAs have green employment that is heavily based in a single core area:

- In the West Central WIA, 69.9 percent of green employment is in pollution prevention.
- In the Northwest WIA, 57.0 percent of green employment is in energy efficiency.
- More than half of green employment in the Lancaster County WIA is in resource sustainability/renewable energy (50.5 percent).

Other WIAs show considerable variation in the percentage of total green jobs employment. In the Southern Alleghenies WIA, green jobs represent 6.8 percent of total employment, the largest proportion of any WIA. Conversely, in the Philadelphia County WIA, only 1.3 percent of regional employment is in green jobs.

Certifications and Skills

The survey asked employers to report the certifications, green skills and basic skills needed for their green workforce. Because the survey questions in this section were not associated with specific occupations, it was possible to analyze these results by industry sector only.

Certifications: Overall, 5.7 percent of the employers with green jobs reported that they have a certification. The industries with the most certifications were professional, scientific & technical services (13.5 percent of the employers in this industry sector) and construction (12.5 percent).

Employers provided many examples of the certifications needed for their green workforces. In many cases, these were certifications needed by all employees in the occupation, not certifications specifically related to the green aspects of the jobs. Many certifications were associated with multiple industries. For instance, LEED AP certification was noted by employers from 10 different industries. This finding seems consistent with the structure and basic work of these leading industries.

Green Skills: Employers provided a range of responses to this question, and the skills cited among industries varied widely. Employers in construction and professional, scientific & technical services reported the greatest number and variety of green skills. This may be expected, given that these two sectors represent large numbers of green jobs across a variety of occupations.

Many employers interpreted the question on green skills to include general knowledge requirements for their green workforce, as well as specific work skills. Understanding state and federal laws, policies, and regulations that apply to a specific industry sector was frequently cited as a green skill need.

Basic Skills: Overall, the basic skills needed by employees in green jobs are very similar to the skills needed by all employees in the industry sector, whether green or not. Some responses linked skills to specific kinds of occupations, but in general, employers' responses ranged from personal attributes and general aptitudes to academic skills, college degrees and licenses. These results suggest that some employers interpreted "basic skills" as encompassing the essential prerequisites of the job and not simply as rudimentary academic skills.

Future Research

The survey design establishes a reliable scientific foundation for identifying green jobs in Pennsylvania. The study benefitted from reviews of other green jobs research, related research conducted by Labor & Industry, and structured input received from experts and many stakeholders. As with any research project, there are opportunities for improvement.

The following enhancements are suggested:

- Repeat the green jobs survey every two to three years in order to assess growth in green jobs and the industries that support them.
- Conduct further research linking specific occupations to certifications, basic skills and green skills needed by employers and the workforce.
- Continue to conduct targeted studies by core area, industry sector and occupation to determine key growth factors and the education and training needs of employers and employees in the green economy.
- Compare and contrast the findings of this and future green jobs research to the broader economy to assess the total economic effects of green jobs and industry-sector growth in different regions of the state.

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Survey Form

Detailed Methodology

Sample Universe

The sample universe was all establishments with more than zero employees in the 4th quarter of 2009. Multi-establishment employers were included via their parts, so multi-master accounts were excluded. The establishments' North American Industry Classification System (NAICS) code was used to exclude private households (NAICS 814110) and certain government functions including prosecutor's offices, courts, jails, parole officers, police & firefighters (NAICS 922).

Sample Stratification

The universe was stratified into 20 strata according to major sector NAICS. This was generally a two-digit NAICS except for the major groups (31-33, 44-45, and 48-49). All government regardless of NAICS was put into sector 92. This was further stratified if the six-digit NAICS matched the presumed-green list or not. Presumed-green NAICS only occurred in seven NAICS sectors, so there were 27 strata total. The presumed-green strata were sampled with a 1.3 percent uncertainty rate, and the rest were sampled with a 3.2 percent uncertainty rate with a 95 percent confidence level for categorical data.

Sample Selection

The sample sizes for each stratum were defined based on the above procedure. The SAS software (proc SURVEYSELECT) was used for sample selection and estimation. The size of each primary sampling unit (PSU) is defined by the average covered employment in the 4th quarter of 2009. When size was specified, the default selection method was probability proportional to size without replacement (PPS). This method is more complex than selection with replacement but provides the ability to produce more accurate estimations. The estimated size for the presumed-green part of Utilities was very close to the universe so the universe for this stratum was selected for sample. Units with more than 200 employments were included with certainty. Under the PPS method of sample selection for each stratum, the relative size of each sampling unit must not exceed $(1/\text{SAMPsize})$. To avoid these errors

we used option MAXSIZE, which limits each PSU for probability selection by a given number. MAXSIZE cannot be larger than certainty size, but for some cells to avoid probabilities errors we used MAXSIZE significantly lower than certainties. To avoid extreme weights for small units, we used another option, MINSIZE, which interprets each sampling unit of a size less than MINSIZE as equal to the MINSIZE number for probabilities of selection. The MINSIZE was uniform for all strata and equal to eight.

The total of 25,557 PSU, with good spread across the areas, was selected as a sample.

Table 8

Survey Response and Participation Rate

PARTICIPATION RATE		SOURCE							
STATUS	MAIL	PHONE	EMAIL	FAX	PHONE IN	STAFF	OTHER	TOTAL	PERCENT
1. Completed Survey	4,396	6,417	49	849	177	2,410	216	14,514	81.0%
2. Partial Survey		105						105	0.6%
3. Refusal		338		2	1			341	1.9%
4. Invalid Contact Data		1,688	1		4	760		2,453	13.7%
5. Out of Business	34	153		5	3		1	196	1.1%
6. Inactive	11	35		1				47	0.3%
7. Out of State	1	251	1		1			254	1.4%
8. Duplicate		5						5	0.0%
Grand Total	4,442	8,992	51	857	186	3,170	217	17,915	100.0%

Sample 25,557
 Deletions 2,955
 Surveys 14,619
 Participation 64.7%

Weights and Adjustments

Within the total responses, 2,794 were invalid or refusals (see statistical *Table 14* in the *Appendix*) and 14,619 were considered to be valid responses and were used for the estimations. Some companies reported numbers of green jobs larger than the total numbers of jobs used in the sample selection. Seasonal differences in employment, non-covered employment, etc. could be valid reasons for such reports. However, in some cases, it could be that the reported unit included some multi-units, while in the selection we used the single units. The survey group made all possible efforts to split multi reports to a single PSU. For cases where green employment was still larger than the employment size used for selection, the initial weights were adjusted down based on reported employment. We can call these weights primary weights.

To account for missing values (non-responses and non-valid responses), we initially assumed that for each stratum they would have the same distribution as the responded PSU with valid responses. Based on this assumption, primary weights

were adjusted for missing values. (Let's call them secondary weights). Direct use of secondary weights would probably lead to overestimations due to the assumption of the same ratios of green jobs for the responding and non-responding companies and would create some extremely high weights for some PSUs. To compensate for that and to avoid extreme outliers we established upper limits on secondary weights, based on the assumption that the weighted means for each stratum should be somewhere close to reported means. Final weights were produced by applying the upper limits to the secondary weights.

Survey Estimations

The size of the selected sample is a significant portion of the total number of available units in the universe, especially for the presumed-green strata. This fact, along with the sampling selection without replacement, justifies the use of the finite population adjustment option for variance estimations. This option creates decreasing relative variance (estimations errors) by about 1/3 for aggregated estimations of total numbers of green jobs and green jobs by activities.

In other words, without finite population adjustment, relative errors would be about 50 percent larger for the aggregated estimations of totals.

To verify our variance estimations with respect to possible biases in distributions, we additionally tested them with two resampling procedures: Jackknife and Bootstrap. Jackknife is the standard default option for sample replication in `proc SURVEYMEANS` when resampling is produced by cutting one observation each time. Consequently, the number of resamplings is equal the number of responses. For Bootstrap resampling, we used `proc MULTTEST`. This procedure produces resampling with replacement independently for each stratum, and the number of resamplings could be specified. The Jackknife procedure directly produces the same statistics as standard (TAYLOR) estimations in `proc SURVEYMEANS`.

The direct intention of Bootstrap in `proc MULTTEST` is to produce adjustments of p-values for hypothesis tests. However, one of the optional outputs with all resamples could be used to estimate standard deviations for the estimated totals.

Both resampling approaches exclude using finite population adjustment. Consequently, to estimate the impact of possible biases in the distribution on estimated errors we compared the resampling results with standard (TAYLOR) estimations without finite population adjustment. Due to limited computer power, we produced this testing only for a few selected strata. The results show insignificant differences between variance estimations using standard (TAYLOR) estimations and using resampling approaches. These differences are far less than the impact of finite population adjustment for TAYLOR estimations. This fact justified using standard (TAYLOR) estimations with finite population adjustment as the primary tool for all variance estimations.

The Bootstrap option of the `MULTTEST` procedure was directly used to test the hypothesis of differences (Contrast) in the green jobs shares for the presumed-green NAICS and all other NAICS for totals and for each of the seven used two-digit strata, which include green and non-green parts.

Estimations were requested for the different groups (WIA areas, six-digit NAICS, presumed-green and non-green subpopulations). SAS suggests using the `DOMAIN` statement for this type of estimation. “The `DOMAIN` statement names the variables that identify domains, which are called domain variables. It is common practice to compute statistics for domains. The formation of these domains might be unrelated to the sample design. Therefore, the sample sizes for the domains are random variables. In order to incorporate this variability into the variance estimations, you should use a `DOMAIN` statement”.¹⁹

Variance estimations for all used DOMAINS as well as lower and upper limits for 95 percent confidence levels are available and could be provided upon request.

Estimations of Forecasted Employment

The survey requested an estimate of future employment. All forecasts are direct estimations from this survey and do not represent any attempt of forecasting based on time series, econometric models etc.

Not all reported green jobs employers reported forecast estimations. Consequently, the estimated base employment would be incomparable with the estimated forecasted employment. To resolve this issue, we introduced a new group of estimating variables, which constitute the base employment for reporters with reported forecasts. These new variables are comparable with forecasts. The subtotals for the estimated new variables are compared with forecasted subtotals for each estimated group (DOMAINS), and the growth rate is applied to the estimated base employment to come up with comparable forecasts. The results are reported as forecasts.

Estimated Grand Totals

The estimated total number of green jobs for Pennsylvania State is 183,029, which represents 3.37 percent of the total jobs in universe. This is consistent with the share of 3.4 percent reported (not weighted) jobs from the totals of all reporters. The coefficient of variation for the estimated total green jobs is 2.9 percent, which means that with a 95 percent confidence level, the low estimation is 172,537 and the high is 193,520.

¹⁹ SAS/STAT 9.2 User's Guide, Second Edition, Chapter 85. “The `SURVEYMEANS` Procedure” p.6485.

Breakdowns by Green/Non-Green Industry Sectors

Prior research identified a series of industries that were expected to be the major sources of green jobs in Pennsylvania. This study found that overall the “presumed green” industries did, in fact, hold significantly more green jobs than the non-green industries. For instance, within administrative & support & waste management, almost 30 percent of jobs in the presumed green industries were green, compared to less than 3 percent in the presumed non-green industries (*Table 9*). These findings were statistically significant for the following sectors:

- Construction,
- Professional, scientific & technical services,
- Administrative & support & waste management & remediation services, and
- Public administration.

In a few sectors, the green jobs were distributed fairly equally between the presumed green and non-green industries. In these cases, the amount of green employment was not significantly different between the presumed green and non-green industries. These sectors were the following:

- Manufacturing,
- Utilities, and
- Agriculture, forestry, fishing & hunting.

Table 9

Estimated and Forecast Green Employment by Green and Non-Green Industry Sectors

NAICS	INDUSTRY SECTOR	PRESUMED NON-GREEN INDUSTRIES				PRESUMED GREEN INDUSTRIES			
		GREEN EMPL.	PERCENT OF TOTAL INDUSTRY EMPL. THAT IS GREEN	FORECAST GREEN EMPL.	ANNUAL GROWTH RATE FOR GREEN EMPL.	GREEN EMPL.	PERCENT OF TOTAL INDUSTRY EMPL. THAT IS GREEN	FORECAST GREEN EMPL.	ANNUAL GROWTH RATE FOR GREEN EMPL.
11	Agriculture, Forestry, Fishing & Hunting	757	8.9%	573	-13.0%	1,557	10.8%	1,340	-7.2%
21	Mining, Quarrying, & Oil & Gas Extraction	2,577	11.6%	2,786	4.0%				
22	Utilities	1,737	12.3%	2,039	8.3%	1,005	13.3%	1,412	18.5%
23	Construction	9,732	11.3%	11,461	8.5%	31,849	23.5%	37,133	8.0%
31-33	Manufacturing	34,237	6.5%	35,127	1.3%	3,520	9.9%	4,755	16.2%
42	Wholesale Trade	8,206	3.7%	9,545	7.8%				
44-45	Retail Trade	17,117	2.7%	19,248	6.0%				
48-49	Transportation & Warehousing	8,196	4.1%	8,827	3.8%				
51	Information	1,248	1.3%	1,518	10.3%				
52	Finance & Insurance	2,351	0.9%	2,487	2.8%				
53	Real Estate & Rental & Leasing	2,627	4.4%	4,489	30.7%				
54	Professional, Scientific, & Technical Services	3,383	1.6%	4,753	18.5%	18,535	19.8%	22,707	10.7%
55	Management of Companies & Enterprises	2,244	2.0%	2,328	1.9%				
56	Admin. & Support & Waste Mgmt. & Remediation Svcs.	6,065	2.4%	7,164	8.7%	2,717	29.9%	2,819	1.9%
61	Educational Services	2,371	1.3%	2,603	4.8%				
62	Health Care & Social Assistance	1,151	0.1%	1,006	-6.5%				
71	Arts, Entertainment, & Recreation	915	1.2%	797	-6.7%				
72	Accommodation & Food Services	1,438	0.4%	1,970	17.0%				
81	Other Services (except Public Administration)	4,954	2.8%	5,018	0.6%				
92	Public Administration	9,112	1.4%	9,006	-0.6%	3,428	13.6%	3,401	-0.4%
Total		120,418	2.4%	132,381	4.8%	62,611	19.5%	73,971	8.7%

Appendices

The study examined the common green occupations in the industries that were not expected to have a high concentration of green employment (*Table 10*). The most common green occupations in the presumed non-green industries were production workers (all other), retail salespersons, and automotive service technicians & mechanics.

Table 10

Top 25 Green Occupations in Presumed Non-Green Industries

SOC	OCCUPATION TITLE	GREEN EMPLOYMENT	PERCENT OF TOTAL INDUSTRY EMPLOYMENT THAT IS GREEN
51-9199	Production Workers, All Other	9,057	7.5%
41-2031	Retail Salespersons	5,369	4.5%
49-3023	Automotive Service Technicians & Mechanics	4,836	4.0%
25-2021	Elementary School Teachers, except Special Education	3,856	3.2%
51-4199	Metal Workers & Plastic Workers, All Other	3,336	2.8%
47-2031	Carpenters	3,084	2.6%
37-3011	Landscaping & Groundskeeping Workers	2,897	2.4%
53-3022	Bus Drivers, School or Special Client	2,895	2.4%
49-9071	Maintenance & Repair Workers, General	2,664	2.2%
53-3032	Heavy & Tractor-Trailer Truck Drivers	2,642	2.2%
53-3033	Light Truck or Delivery Services Drivers	2,523	2.1%
41-3099	Sales Representatives, Services, All Other	2,447	2.0%
41-4012	Sales Reps., Wholesale & Manufacturing, except Technical & Scientific Products	2,383	2.0%
51-7042	Woodworking Machine Setters, Operators, & Tenders, except Sawing	2,132	1.8%
53-7062	Laborers & Freight, Stock, & Material Movers, Hand	2,128	1.8%
51-2099	Assemblers & Fabricators, All Other	2,023	1.7%
43-9061	Office Clerks, General	1,995	1.7%
53-7051	Industrial Truck & Tractor Operators	1,897	1.6%
47-2152	Plumbers, Pipefitters, & Steamfitters	1,840	1.5%
25-2031	Secondary School Teachers, except Special & Career/Technical Education	1,825	1.5%
25-2022	Middle School Teachers, except Special & Career/Technical Education	1,807	1.5%
51-8031	Water & Wastewater Treatment Plant & System Operators	1,622	1.3%
47-2061	Construction Laborers	1,566	1.3%
47-2121	Glaziers	1,509	1.3%
41-3021	Insurance Sales Agents	1,375	1.1%
Total		69,708	57.9%

Among the industries that were expected to have green jobs, the most common occupations were heating, air conditioning, & refrigeration mechanics & installers, electricians, and carpenters (*Table 11*).

Table 11

Top 25 Green Occupations in Presumed Green Industries

SOC	OCCUPATION TITLE	GREEN EMPLOYMENT	PERCENT OF TOTAL INDUSTRY EMPLOYMENT THAT IS GREEN
49-9021	Heating, Air Conditioning, & Refrigeration Mechanics & Installers	6,685	10.7%
47-2111	Electricians	5,825	9.3%
47-2031	Carpenters	4,659	7.4%
17-2051	Civil Engineers	3,480	5.6%
47-2061	Construction Laborers	3,046	4.9%
17-1011	Architects, except Landscape & Naval	2,379	3.8%
53-7081	Refuse & Recyclable Material Collectors	2,372	3.8%
17-2081	Environmental Engineers	2,240	3.6%
47-2152	Plumbers, Pipefitters, & Steamfitters	2,184	3.5%
11-9021	Construction Managers	1,544	2.5%
47-2181	Roofers	1,340	2.1%
47-1011	First-Line Supervisors of Construction Trades & Extraction Workers	1,162	1.9%
45-2092	Farmworkers & Laborers, Crop, Nursery, & Greenhouse	1,135	1.8%
17-2071	Electrical Engineers	1,016	1.6%
17-2141	Mechanical Engineers	1,004	1.6%
17-3011	Architectural & Civil Drafters	920	1.5%
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	845	1.3%
19-2041	Environmental Scientists & Specialists, Including Health	828	1.3%
11-9041	Architectural & Engineering Managers	651	1.0%
43-4051	Customer Service Representatives	645	1.0%
47-2211	Sheet Metal Workers	632	1.0%
19-4093	Forest & Conservation Technicians	626	1.0%
43-9061	Office Clerks, General	599	1.0%
51-2022	Electrical & Electronic Equipment Assemblers	589	0.9%
17-3029	Engineering Technicians, Except Drafters, All Other	553	0.9%
Total		46,958	75.0%

Appendices

Other Detailed Tables

Table 12

Green Employment by WIA and Core Area

WIA NAME	GREEN JOBS BY CORE AREA												TOTAL
	ENERGY EFFICIENCY		RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY		POLLUTION PREVENTION		ENVIRONMENTAL CLEANUP		HARMFUL EMISSIONS REDUCTION		GREEN EDUCATION/ TRAINING OR COMPLIANCE		
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	
Berks County	1,574	23.1%	2,208	32.4%	1,412	20.7%	429	6.3%	413	6.0%	784	11.5%	6,820
Bucks County	2,983	41.7%	1,214	17.0%	1,224	17.1%	588	8.2%	475	6.6%	673	9.4%	7,156
Central	4,741	40.4%	1,445	12.3%	2,819	24.0%	573	4.9%	622	5.3%	1,539	13.1%	11,739
Chester County	3,126	29.4%	2,151	20.2%	1,426	13.4%	937	8.8%	773	7.3%	2,208	20.8%	10,621
Delaware County	2,480	48.2%	529	10.3%	495	9.6%	319	6.2%	606	11.8%	720	14.0%	5,149
Lackawanna County	1,183	30.3%	1,362	34.8%	594	15.2%	130	3.3%	403	10.3%	238	6.1%	3,910
Lancaster County	3,697	29.8%	6,265	50.5%	957	7.7%	608	4.9%	231	1.9%	654	5.3%	12,411
Lehigh Valley	3,962	32.5%	2,180	17.9%	2,786	22.9%	567	4.7%	1,054	8.7%	1,635	13.4%	12,184
Luzerne/ Schuylkill	2,386	36.8%	1,513	23.4%	989	15.3%	564	8.7%	518	8.0%	506	7.8%	6,477
Montgomery County	4,823	37.5%	2,453	19.1%	1,563	12.1%	491	3.8%	885	6.9%	2,662	20.7%	12,877
North Central	926	31.6%	279	9.5%	1,310	44.7%	177	6.0%	82	2.8%	158	5.4%	2,932
Northern Tier	362	17.9%	662	32.8%	398	19.7%	260	12.8%	30	1.5%	310	15.3%	2,021
Northwest	5,200	57.0%	1,286	14.1%	1,518	16.6%	261	2.9%	71	0.8%	786	8.6%	9,121
Philadelphia County	2,477	32.5%	1,306	17.1%	391	5.1%	499	6.5%	474	6.2%	2,470	32.4%	7,617
Pocono Counties	960	28.3%	859	25.3%	198	5.8%	345	10.2%	69	2.0%	959	28.3%	3,390
South Central	6,102	35.7%	4,770	27.9%	2,785	16.3%	1,283	7.5%	1,017	5.9%	1,145	6.7%	17,102
Southern Alleghenies	3,146	27.3%	3,789	32.9%	1,867	16.2%	421	3.7%	977	8.5%	1,321	11.5%	11,521
Southwest Corner	880	34.0%	192	7.4%	493	19.0%	660	25.5%	0	0.0%	366	14.1%	2,592
Three Rivers	7,692	42.0%	1,814	9.9%	2,811	15.3%	1,458	8.0%	806	4.4%	3,737	20.4%	18,318
Tri County	2,419	47.4%	906	17.8%	837	16.4%	219	4.3%	209	4.1%	515	10.1%	5,105
West Central	364	9.6%	357	9.4%	2,660	69.9%	165	4.3%	166	4.4%	94	2.5%	3,807
Westmoreland/ Fayette	2,216	28.2%	3,067	39.1%	987	12.6%	526	6.7%	622	7.9%	428	5.5%	7,844
Other	1,439	62.1%	533	23.0%	46	2.0%	194	8.4%	20	0.9%	84	3.6%	2,316
Total	65,137	35.6%	41,141	22.5%	30,566	16.7%	11,672	6.4%	10,522	5.7%	23,991	13.1%	183,030

Table 13

Employers Reporting Certifications Required of Green Workers by Industry Sector (Two-Digit NAICS Code)²⁰

NAICS	INDUSTRY SECTOR	TOTAL RESPONSES	EMPLOYERS WITH CERTIFICATIONS	PERCENTAGE OF EMPLOYERS WITH CERTIFICATIONS
11	Agriculture, Forestry, Fishing & Hunting	699	17	2%
21	Mining	214	13	6%
22	Utilities	179	16	9%
23	Construction	2,519	316	13%
31-33	Manufacturing	765	36	12%
42	Wholesale Trade	391	4	1%
44-45	Retail Trade	681	7	2%
48-49	Transportation & Warehousing	468	8	3%
51	Information	433	2	0%
52	Finance & Insurance	469	-	0%
53	Real Estate & Rental & Leasing	534	13	2%
54	Professional, Scientific, & Technical Services	2,158	292	14%
55	Management of Companies & Enterprises	315	4	1%
56	Admin. & Support & Waste Mgmt. & Remediation Services	849	19	2%
61	Educational Services	620	25	4%
62	Health Care & Social Assistance	829	4	0%
71	Arts, Entertainment, & Recreation	693	3	0%
72	Accommodation & Food Services	760	2	0%
81	Other Services (except Public Administration)	697	19	3%
92	Public Administration	291	24	8%
Total		14,564	824	6%

²⁰ This table reports raw numbers, not weighted estimates.

Table 14

Green Employment by Company Size²¹

GROUP	SIZE (\$)	NUMBER OF VALID RESPONSES	REPORTED GREEN EMPLOYMENT	TOTAL ALL EMPLOYMENT REPORTED IN 2009 FOURTH QUARTER	NUMBER OF RESPONSES WITH GREEN EMPLOYMENT	PERCENT OF COMPANIES REPORTED GREEN EMPLOYMENT	PERCENT OF REPORTED GREEN EMPLOYMENT TO TOTAL EMPLOYMENT REPORTED IN 2009 FOURTH QUARTER ²²
1	S<=4	4,330	2,664	8,558	967	22.3%	31.1%
2	4<S<10	1,935	2,508	12,782	454	23.5%	19.6%
3	10<=S<20	1,861	4,133	26,610	413	22.2%	15.5%
4	20<=S<50	2,576	9,033	83,761	546	21.2%	10.8%
5	50<=S<100	1,469	7,036	103,127	249	17.0%	6.8%
6	100<=S<250	1,324	7,747	225,150	204	15.4%	3.4%
7	250<=S<500	698	5,865	238,632	109	15.6%	2.5%
8	500<=S<1000	279	1,759	192,279	47	16.8%	0.9%
9	S>1000	147	534	321,893	25	17.0%	0.2%
Total		14,619	41,279	1,212,791	3,014	20.6%	3.4%

²¹ This table reports raw numbers, not weighted estimates.

²² Total employment is based on 2009 fourth quarter covered employment among the universe of employers used for sampling. This file excluded NAICS 922xxx and 814110.

Table 15

Green Core Area Employment in 20 NAICS Industry Sectors (Percentages)

NAICS	INDUSTRY SECTOR	GREEN JOBS BY CORE AREA						TOTAL
		ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE	
		PERCENT	PERCENT	PERCENT	PERCENT	PERCENT	PERCENT	
23	Construction	66%	11%	11%	5%	2%	5%	100%
31-33	Manufacturing	32%	45%	17%	1%	2%	3%	100%
54	Professional, Scientific, & Technical Services	29%	18%	17%	13%	3%	20%	100%
44-45	Retail Trade	53%	25%	4%	2%	15%	2%	100%
92	Public Administration	4%	6%	21%	3%	2%	64%	100%
56	Administrative & Support & Waste Management & Remediation Services	23%	23%	25%	21%	5%	3%	100%
42	Wholesale Trade	20%	32%	39%	4%	- ²³	5%	100%
48-49	Transportation & Warehousing	13%	16%	26%	3%	35%	7%	100%
81	Other Services (Except Public Administration)	10%	12%	33%	7%	24%	14%	100%
22	Utilities	24%	13%	17%	31%	6%	8%	100%
53	Real Estate & Rental & Leasing	51%	11%	11%	12%	9%	7%	100%
21	Mining, Quarrying, & Oil & Gas Extraction	10%	30%	36%	12%	1%	10%	100%
61	Educational Services	6%	2%	1%	1%	-	90%	100%
52	Finance & Insurance	45%	14%	8%	6%	-	27%	100%
11	Agriculture, Forestry, Fishing & Hunting	4%	57%	30%	2%	1%	5%	100%
55	Management of Companies & Enterprises	7%	17%	26%	17%	24%	8%	100%
72	Accommodation & Food Services	43%	10%	1%	2%	0%	44%	100%
51	Information	9%	27%	25%	-	-	39%	100%
62	Health Care & Social Assistance	5%	2%	10%	39%	-	44%	100%
71	Arts, Entertainment, & Recreation	4%	14%	6%	26%	-	50%	100%
Total		36%	23%	17%	6%	6%	13%	100%

²³ Dashes are placed where no employers indicated that they had green jobs in that particular core area. In these cases, no estimates of employment have been computed.

Table 16

Top 25 Occupations by Green Core Area Employment (Percentages)

SOC	OCCUPATION TITLE	GREEN JOBS BY CORE AREA						TOTAL	PERCENT OF TOTAL GREEN JOBS
		ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE		
		PERCENT	PERCENT	PERCENT	PERCENT	PERCENT	PERCENT		
51-9199	Production Workers, All Other	8%	66%	25%	1%	24	0%	100%	5.0%
49-9021	Heating, Air Conditioning, & Refrigeration Mechanics & Installers	85%	7%	2%	1%	3%	1%	100%	4.3%
47-2031	Carpenters	81%	14%	3%	2%	0%	1%	100%	4.2%
47-2111	Electricians	91%	7%	1%	0%	-	1%	100%	3.3%
41-2031	Retail Salespersons	49%	43%	0%	0%	8%	-	100%	2.9%
49-3023	Automotive Service Technicians & Mechanics	14%	4%	20%	2%	60%	0%	100%	2.7%
47-2061	Construction Laborers	47%	14%	16%	14%	3%	7%	100%	2.5%
47-2152	Plumbers, Pipefitters, & Steamfitters	86%	2%	8%	2%	1%	1%	100%	2.2%
25-2021	Elem. School Teachers, except Special Educ.	-	-	-	1%	-	99%	100%	2.1%
17-2051	Civil Engineers	14%	27%	24%	6%	2%	27%	100%	2.1%
51-4199	Metal Workers & Plastic Workers, All Other	15%	62%	23%	-	-	-	100%	1.8%
53-7081	Refuse & Recyclable Material Collectors	2%	9%	49%	39%	-	2%	100%	1.8%
37-3011	Landscaping & Groundskeeping Workers	24%	37%	20%	17%	1%	2%	100%	1.7%
53-3022	Bus Drivers, School or Special Client	11%	8%	22%	-	43%	15%	100%	1.6%
49-9071	Maint. & Repair Workers, Gen.	18%	9%	49%	11%	10%	2%	100%	1.5%
41-3099	Sales Reps., Services, All Other	21%	56%	13%	0%	0%	10%	100%	1.5%
53-3032	Heavy & Tractor-Trailer Truck Drivers	16%	12%	34%	4%	32%	1%	100%	1.5%
17-2081	Environmental Engineers	10%	10%	22%	17%	5%	35%	100%	1.4%
43-9061	Office Clerks, General	33%	41%	11%	2%	1%	13%	100%	1.4%
17-1011	Architects, exc. Landscape & Naval	52%	29%	3%	0%	1%	15%	100%	1.4%
53-3033	Light Truck or Delivery Services Drivers	25%	37%	28%	8%	0%	1%	100%	1.4%
41-4012	Sales Representatives, Wholesale & Mfg., Except Technical & Scientific Prods	61%	12%	13%	6%	2%	7%	100%	1.3%
53-7062	Laborers & Freight, Stock, & Material Movers, Hand	3%	49%	44%	4%	-	-	100%	1.3%
11-9021	Construction Managers	52%	16%	10%	5%	1%	16%	100%	1.2%
51-7042	Woodworking Machine Setters, Oprs., & Tenders, except Sawing	68%	-	-	-	-	32%	100%	1.2%
Total		39,048	23,022	15,255	4,660	6,543	9,361	97,890	53.5%
Total of all Green Jobs by Core Area		65,137	41,141	30,566	11,672	10,522	23,991	183,029	100.0%
Percent of Total		59.9%	56.0%	49.9%	39.9%	62.2%	39.0%	53.5%	

²⁴ Dashes are placed where no employers indicated that they had green jobs in that particular core area. In these cases, no estimates of employment have been computed.

Table 17

Reported Green Employment within Each Occupation (SOC Code) by Green Core Area²⁵

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
11-1011	Chief Executives	21	1	8			1	11
11-1021	General & Operations Managers	213	31	38	39	41	22	42
11-2021	Marketing Managers	14	2	6		1		5
11-2022	Sales Managers	17	7	1	1	1		7
11-2031	Public Relations & Fundraising Managers	6						6
11-3011	Administrative Services Managers	7	5		1			1
11-3021	Computer & Information Systems Managers	5	2	1				2
11-3031	Financial Managers	44	26	3	1	1	6	7
11-3051	Industrial Production Managers	55	8	2	23	4	8	10
11-3061	Purchasing Managers	10	1	2	2			5
11-3071	Transportation, Storage, & Distribution Managers	13	1	1	6	1	2	2
11-3111	Compensation & Benefits Managers	1	1					
11-3121	Human Resources Managers	11	2	1		1		7
11-3131	Training & Development Managers	2						2
11-9013	Farmers, Ranchers, & Other Agricultural Managers	71	1	45	21		1	3
11-9021	Construction Managers	532	293	81	51	28	8	71
11-9032	Education Administrators, Elementary & Secondary School	7	1					6
11-9033	Education Administrators, Postsecondary	26	5	7	1	1		12
11-9039	Education Administrators, All Other	2						2
11-9041	Architectural & Engineering Managers	484	79	122	117	27	80	59
11-9061	Funeral Service Managers	8			4			4
11-9081	Lodging Managers	3						3
11-9111	Medical & Health Services Managers	5		1				4
11-9121	Natural Sciences Managers	3						3
11-9141	Property, Real Estate, & Community Association Managers	27	21				1	5
11-9151	Social & Community Service Managers	9		6				3
11-9199	Managers, All Other	10		8		1		1
13-1022	Wholesale & Retail Buyers, except Farm Products	5	2	3				
13-1023	Purchasing Agents, except Wholesale, Retail, & Farm Products	18		5	10			3

²⁵ This table is based on unweighted data, not statistical estimations.

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SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
13-1041	Compliance Officers	82		1	10	12	5	54
13-1051	Cost Estimators	126	60	17	13	11	3	22
13-1071	Human Resources Specialists	20	8	3	4	4		1
13-1081	Logisticians	49	5		12		31	1
13-1111	Management Analysts	19				3		16
13-1141	Compensation, Benefits, & Job Analysis Specialists	1	1					
13-1151	Training & Development Specialists	48	1		19		1	27
13-1161	Market Research Analysts & Marketing Specialists	129	77	16	3	1		32
13-1199	Business Operations Specialists, All Other	367	120	108	35	34	3	67
13-2011	Accountants & Auditors	30	13	2	1	4	6	4
13-2051	Financial Analysts	2				1	1	
13-2072	Loan Officers	51	27		20			4
13-2099	Financial Specialists, All Other	2	2					
15-1111	Computer & Information Research Scientists	15		15				
15-1131	Computer Programmers	21	2	11		2		6
15-1132	Software Developers, Applications	11	9				2	
15-1133	Software Developers, Systems Software	20	18		1		1	
15-1134	Web Developers	10						10
15-1141	Database Administrators	3					1	2
15-1142	Network & Computer Systems Administrators	6	4				1	1
15-1151	Computer User Support Specialists	1						1
15-1199	Computer Occupations, All Other	144	133	8	3			
17-1011	Architects, except Landscape & Naval	892	431	267	26	4	11	153
17-1012	Landscape Architects	113	33	40	8	24	1	7
17-1022	Surveyors	136	68	16	23	7		22
17-2011	Aerospace Engineers	7	7					
17-2021	Agricultural Engineers	15	3	3	8		1	
17-2041	Chemical Engineers	108	33	20	24	5	24	2
17-2051	Civil Engineers	1569	212	414	379	80	25	459
17-2061	Computer Hardware Engineers	12				6		6
17-2071	Electrical Engineers	446	314	59	35	7	12	19
17-2072	Electronics Engineers, Except Computer	6	1		5			
17-2081	Environmental Engineers	972	112	86	204	162	33	375

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
17-2111	Health & Safety engineers, Except Mining Safety Engineers & Inspectors	28	3	3	8	4		10
17-2112	Industrial Engineers	162	36	18	49	2	51	6
17-2121	Marine Engineers & Naval Architects	17	4	6	3		4	
17-2131	Materials Engineers	46	24	20	2			
17-2141	Mechanical Engineers	485	280	79	39	24	32	31
17-2151	Mining & Geological Engineers, including Mining Safety Engineers	29	4	3	3	7	4	8
17-2161	Nuclear Engineers	3		2	1			
17-2171	Petroleum Engineers	4		4				
17-2199	Engineers, All Other	163	61	42	24	12	10	14
17-3011	Architectural & Civil Drafters	394	218	67	45	22	9	33
17-3012	Electrical & Electronics Drafters	27	19	3	1		2	2
17-3013	Mechanical Drafters	54	23	4	14		7	6
17-3019	Drafters, All Other	37	20	2	4		1	10
17-3022	Civil Engineering Technicians	50	15	11	15	5	1	3
17-3023	Electrical & Electronics Engineering Technicians	142	98	17	21	1	4	1
17-3024	Electro-Mechanical Technicians	6	5					1
17-3025	Environmental Engineering Technicians	177	2	13	56	91	5	10
17-3026	Industrial Engineering Technicians	24	16	6		1		1
17-3027	Mechanical Engineering Technicians	11	10			1		
17-3029	Engineering Technicians, except Drafters, All Other	242	20	25	158	13	2	24
19-1013	Soil & Plant Scientists	355	350	1	4			
19-1022	Microbiologists	17		12	5			
19-1023	Zoologists & Wildlife Biologists	26	5		5	1		15
19-1029	Biological Scientists, All Other	41		9	2	28		2
19-1031	Conservation Scientists	64		8	27	5		24
19-1032	Foresters	55	4	40	2	4		5
19-1041	Epidemiologists	1					1	
19-2012	Physicists	6				6		
19-2021	Atmospheric & Space Scientists	7		7				
19-2031	Chemists	176	3	7	4	157	1	4
19-2041	Environmental Scientists & Specialists, including Health	350	24	50	74	116	26	60

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SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
19-2042	Geoscientists, Except Hydrologists & Geographers	153	12	10	23	87		21
19-2043	Hydrologists	30		13	6	11		
19-3011	Economists	1			1			
19-3051	Urban & Regional Planners	36	16	2	2	6		10
19-3092	Geographers	1		1				
19-4011	Agricultural & Food Science Technicians	18		8	10			
19-4021	Biological Technicians	4				1		3
19-4031	Chemical Technicians	241	13	16	17	151	44	
19-4041	Geological & Petroleum Technicians	1			1			
19-4051	Nuclear Technicians	2						2
19-4091	Environmental Science & Protection Technicians, Including Health	351	5	14	137	71	82	42
19-4093	Forest & Conservation Technicians	192	3	40	114	7	1	27
19-4099	Life, Physical, & Social Science Technicians, All Other	8	2	2	3	1		
21-1012	Educational, Guidance, School, & Vocational Counselors	3						3
21-1015	Rehabilitation Counselors	10		10				
21-1019	Counselors, All Other	14				7		7
21-1021	Child, Family, & School Social Workers	8						8
21-1099	Community & Social Service Specialists, All Other	2						2
23-1011	Lawyers	32	3	1	3	8	1	16
23-1023	Judges, Magistrate Judges, & Magistrates	1						1
25-1011	Business Teachers, Postsecondary	1						1
25-1031	Architecture Teachers, Postsecondary	13						13
25-1032	Engineering Teachers, Postsecondary	122						122
25-1041	Agricultural Sciences Teachers, Postsecondary	3						3
25-1042	Biological Science Teachers, Postsecondary	32						32
25-1043	Forestry & Conservation Science Teachers, Postsecondary	2						2
25-1051	Atmospheric, Earth, Marine, & Space Sciences Teachers, Postsecondary	4						4
25-1052	Chemistry Teachers, Postsecondary	15						15
25-1053	Environmental Science Teachers, Postsecondary	393			2			391

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
25-1061	Anthropology & Archeology Teachers, Postsecondary	2						2
25-1063	Economics Teachers, Postsecondary	5						5
25-1064	Geography Teachers, Postsecondary	15						15
25-1065	Political Science Teachers, Postsecondary	11						11
25-1066	Psychology Teachers, Postsecondary	3						3
25-1067	Sociology Teachers, Postsecondary	2						2
25-1071	Health Specialties Teachers, Postsecondary	14						14
25-1081	Education Teachers, Postsecondary	1						1
25-1111	Criminal Justice & Law Enforcement Teachers, Postsecondary	1						1
25-1112	Law Teachers, Postsecondary	30						30
25-1123	English Language & Literature Teachers, Postsecondary	15						15
25-1125	History Teachers, Postsecondary	2						2
25-1126	Philosophy & Religion Teachers, Postsecondary	3						3
25-1191	Graduate Teaching Assistants	6						6
25-1194	Vocational Education Teachers, Postsecondary	39	3	1	2			33
25-1199	Postsecondary Teachers, All Other	1						1
25-2021	Elementary School Teachers, except Special Education	302				2		300
25-2022	Middle School Teachers, except Special & Career/Technical Education	228	75					153
25-2023	Career/Technical Education Teachers, Middle School	2						2
25-2031	Secondary School Teachers, except Special & Career/Technical Education	364			2			362
25-2059	Special Education Teachers, All Other	3	1			1		1
25-3021	Self-Enrichment Education Teachers	1						1
25-3099	Teachers & Instructors, All Other	51	2			1		48
25-4011	Archivists	3		2				1
25-4012	Curators	2						2
25-4021	Librarians	37						37
25-9031	Instructional Coordinators	25					14	11
27-1011	Art Directors	1						1
27-1012	Craft Artists	3		3				
27-1014	Multimedia Artists & Animators	7						7

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SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
27-4012	Broadcast Technicians	8						8
27-4099	Media & Communication Equipment Workers, All Other	3	1	1	1			
29-9011	Occupational Health & Safety Specialists	135		3	4	17	12	99
29-9012	Occupational Health & Safety Technicians	6				6		
33-2021	Fire Inspectors & Investigators	3				3		
33-2022	Forest Fire Inspectors & Prevention Specialists	9			2		7	
33-3031	Fish & Game Wardens	5	5					
33-9032	Security Guards	1				1		
33-9099	Protective Service Workers, All Other	7			5			2
35-2014	Cooks, Restaurant	9		9				
35-2021	Food Preparation Workers	1		1				
35-3021	Combined Food Preparation & Serving Workers, Including Fast Food	32	32					
37-1011	First-Line Supervisors of Housekeeping & Janitorial Workers	9	2		5			2
37-1012	First-Line Supervisors of Landscaping, Lawn Service, & Groundskeeping Workers	14	2	1	2	5		4
37-2011	Janitors & Cleaners, Except Maids & Housekeeping Cleaners	299	1		25	9	253	11
37-2012	Maids & Housekeeping Cleaners	211		8	87	116		
37-2021	Pest Control Workers	69		1	68			
37-3011	Landscaping & Groundskeeping Workers	387	58	109	67	142	1	10
37-3012	Pesticide Handlers, Sprayers, & Applicators, Vegetation	3			1	2		
37-3013	Tree Trimmers & Pruners	11		8			2	1
37-3019	Grounds Maintenance Workers, All Other	11	3		7	1		
39-1021	First-Line Supervisors of Personal Service Workers	8						8
39-3091	Amusement & Recreation Attendants	61						61
39-4021	Funeral Attendants	6			6			
39-7011	Tour Guides & Escorts	1						1
41-1012	First-Line Sprvs. of Non-Retail Sales Workers	18	10	5			1	2
41-2021	Counter & Rental Clerks	23	14	3	6			
41-2022	Parts Salespersons	1						1
41-2031	Retail Salespersons	520	117	344	8	1	50	
41-3011	Advertising Sales Agents	9						9

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
41-3021	Insurance Sales Agents	160	14	14	6	6		120
41-3099	Sales Representatives, Services, All Other	375	133	113	78	3	5	43
41-4011	Sales Representatives, Wholesale & Manufacturing, Technical & Scientific Products	37	4	3	30			
41-4012	Sales Representatives, Wholesale & Manufacturing, except Technical & Scientific Products	202	74	29	64	15	4	16
41-9021	Real Estate Brokers	12	5	5				2
41-9022	Real Estate Sales Agents	43	36	2	2	2		1
43-1011	First-Line Supervisors of Office & Administrative Support Workers	14	5	1	5			3
43-2099	Communications Equipment Operators, All Other	4				4		
43-3021	Billing & Posting Clerks	20		1	15			4
43-3031	Bookkeeping, Accounting, & Auditing Clerks	63	23		33			7
43-3051	Payroll & Timekeeping Clerks	2	2					
43-3061	Procurement Clerks	11		5			6	
43-4011	Brokerage Clerks	1	1					
43-4051	Customer Service Representatives	459	318	54	24	7	21	35
43-4161	Human Resources Assistants, except Payroll & Timekeeping	7	2	1		3		1
43-4171	Receptionists & Information Clerks	10	1	1	1	6		1
43-5032	Dispatchers, Except Police, Fire, & Ambulance	8	2	3	2	1		
43-5041	Meter Readers, Utilities	2	1		1			
43-5061	Production, Planning, & Expediting Clerks	2	1				1	
43-5071	Shipping, Receiving, & Traffic Clerks	47	1	11	32	1	1	1
43-5081	Stock Clerks & Order Fillers	105		103	2			
43-5111	Weighers, Measurers, Checkers, & Samplers, Recordkeeping	1			1			
43-6011	Executive Secretaries & Executive Administrative Assistants	25	1	19		1		4
43-6014	Secretaries & Administrative Assistants, except Legal, Medical, & Executive	188	7	117	20	16	1	27
43-9021	Data Entry Keyers	19	1	10	5			3
43-9022	Word Processors & Typists	1	1					
43-9061	Office Clerks, General	491	223	105	73	20	4	66
43-9199	Office & Administrative Support Workers, All Other	63	37	4	5	8		9

Appendices

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
45-1011	First-Line Supervisors of Farming, Fishing, & Forestry Workers	15		11	1	1		2
45-2091	Agricultural Equipment Operators	39	1	35	3			
45-2092	Farmworkers & Laborers, Crop, Nursery, & Greenhouse	758	51	425	225	32	8	17
45-2093	Farmworkers, Farm, Ranch, & Aquacultural Animals	118		43	67	1	1	6
45-4011	Forest & Conservation Workers	28	5	3				20
45-4021	Fallers	2		2				
45-4022	Logging Equipment Operators	13		13				
45-4029	Logging Workers, All Other	20		15			5	
47-1011	First-Line Supervisors of Construction Trades & Extraction Workers	543	168	97	68	59	40	111
47-2021	Brickmasons & Blockmasons	38	38					
47-2022	Stonemasons	4	4					
47-2031	Carpenters	1,670	1,280	259	79	27	3	22
47-2041	Carpet Installers	25	7	1	15	1	1	
47-2042	Floor Layers, except Carpet, Wood, & Hard Tiles	9					9	
47-2051	Cement Masons & Concrete Finishers	86	18	48	15		5	
47-2061	Construction Laborers	1,711	737	279	288	211	46	150
47-2071	Paving, Surfacing, & Tamping Equipment Operators	31		1	30			
47-2073	Operating Engineers & Other Construction Equipment Operators	214	19	116	43	23	13	
47-2111	Electricians	2,148	1,981	137	9	8		13
47-2121	Glaziers	171	145	10		3		13
47-2131	Insulation Workers, Floor, Ceiling, & Wall	15	15					
47-2141	Painters, Construction & Maintenance	118	3	43	61		9	2
47-2152	Plumbers, Pipefitters, & Steamfitters	590	458	16	90	5	10	11
47-2171	Reinforcing Iron & Rebar Workers	1	1					
47-2181	Roofers	412	349	15	37	3	2	6
47-2211	Sheet Metal Workers	315	315					
47-2221	Structural Iron & Steel Workers	51	18	6	27			
47-2231	Solar Photovoltaic Installers	154	50	98				6
47-3012	Helpers--Carpenters	46	23	8	5	5		5
47-3013	Helpers--Electricians	20	17	3				

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
47-3014	Helpers-Painters, Paperhangers, Plasterers, & Stucco Masons	2			2			
47-3015	Helpers-Pipelayers, Plumbers, Pipefitters, & Steamfitters	8	8					
47-3019	Helpers, Construction Trades, All Other	1	1					
47-4011	Construction & Building Inspectors	124	23	6	22	3	3	67
47-4031	Fence Erectors	25			25			
47-4041	Hazardous Materials Removal Workers	349	1	28	81	210	27	2
47-4071	Septic Tank Servicers & Sewer Pipe Cleaners	265	27		201	35		2
47-5012	Rotary Drill Operators, Oil & Gas	33		22	7		2	2
47-5013	Service Unit Operators, Oil, Gas, & Mining	151	29	38	67	16		1
47-5021	Earth Drillers, except Oil & Gas	84	7	49	4	24		
47-5041	Continuous Mining Machine Operators	2			2			
47-5042	Mine Cutting & Channeling Machine Operators	76		28	40	8		
47-5081	Helpers-Extraction Workers	1	1					
47-5099	Extraction Workers, All Other	14	1			7		6
49-1011	First-Line Supervisors of Mechanics, Installers, & Repairers	89	35	10	8	7	7	22
49-2022	Telecommunications Equipment Installers & Repairers, except Line Installers	13		10	3			
49-2094	Electrical & Electronics Repairers, Commercial & Industrial Equipment	63	28	35				
49-2098	Security & Fire Alarm Systems Installers	3	3					
49-3021	Automotive Body & Related Repairers	11			4		7	
49-3023	Automotive Service Technicians & Mechanics	226	24	9	61	4	127	1
49-3031	Bus & Truck Mechanics & Diesel Engine Specialists	64		4		9	51	
49-3041	Farm Equipment Mechanics & Service Technicians	2		2				
49-3042	Mobile Heavy Equipment Mechanics, except Engines	70	10	10	44	1	5	
49-3053	Outdoor Power Equipment & Other Small Engine Mechanics	2	2					
49-3093	Tire Repairers & Changers	3			2	1		
49-9021	Heating, Air Conditioning, & Refrigeration Mechanics & Installers	2,023	1,690	185	47	25	57	19
49-9031	Home Appliance Repairers	3	3					
49-9041	Industrial Machinery Mechanics	167	52	57	24	5	1	28

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
49-9043	Maintenance Workers, Machinery	33	29	4				
49-9044	Millwrights	2		2				
49-9051	Electrical Power-Line Installers & Repairers	3	3					
49-9052	Telecommunications Line Installers & Repairers	7	4			3		
49-9069	Precision Instrument & Equipment Repairers, All Other	2			2			
49-9071	Maintenance & Repair Workers, General	604	137	104	231	46	78	8
49-9081	Wind Turbine Service Technicians	6		6				
49-9096	Riggers	48		40	4	4		
49-9099	Installation, Maintenance, & Repair Workers, All Other	89	38	14	34		3	
51-1011	First-Line Supervisors of Production & Operating Workers	286	109	22	43	89	2	21
51-2022	Electrical & Electronic Equipment Assemblers	231	142	38	51			
51-2041	Structural Metal Fabricators & Fitters	5	5					
51-2092	Team Assemblers	20	1		19			
51-2099	Assemblers & Fabricators, All Other	549	227	279	30	4	9	
51-3092	Food Batchmakers	40			40			
51-4011	Computer-Controlled Machine Tool Operators, Metal & Plastic	223	220	3				
51-4012	Computer Numerically Controlled Machine Tool Programmers, Metal & Plastic	1	1					
51-4031	Cutting, Punching, & Press Machine Setters, Operators, & Tenders, Metal & Plastic	20	2	18				
51-4041	Machinists	126	46	57	13		10	
51-4072	Molding, Coremaking, & Casting Machine Setters, Operators, & Tenders, Metal & Plastic	8		8				
51-4111	Tool & Die Makers	32	26	6				
51-4121	Welders, Cutters, Solderers, & Brazers	99	39	43	4	10	3	
51-4122	Welding, Soldering, & Brazing Machine Setters, Operators, & Tenders	6		6				
51-4194	Tool Grinders, Filers, & Sharpeners	19			19			
51-4199	Metal Workers & Plastic Workers, All Other	974	261	683	30			
51-5112	Printing Press Operators	180		180				
51-6031	Sewing Machine Operators	2	2					
51-6092	Fabric & Apparel Patternmakers	3			3			
51-7021	Furniture Finishers	4			4			

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
51-7042	Woodworking Machine Setters, Operators, & Tenders, except Sawing	123	100					23
51-8012	Power Distributors & Dispatchers	7	1	5	1			
51-8013	Power Plant Operators	126	5	77	8	11	20	5
51-8021	Stationary Engineers & Boiler Operators	47	7	21	1	7	11	
51-8031	Water & Wastewater Treatment Plant & System Operators	673	14	36	290	295		38
51-8091	Chemical Plant & System Operators	30	6	9	6	6	2	1
51-8093	Petroleum Pump System Operators, Refinery Operators, & Gaugers	103	8	22	64		9	
51-8099	Plant & System Operators, All Other	30		17	5	2	6	
51-9011	Chemical Equipment Operators & Tenders	2	2					
51-9021	Crushing, Grinding, & Polishing Machine Setters, Operators, & Tenders	144	100		44			
51-9041	Extruding, Forming, Pressing, & Compacting Machine Setters, Operators, & Tenders	2				2		
51-9061	Inspectors, Testers, Sorters, Samplers, & Weighers	274	60	13	75	2		124
51-9122	Painters, Transportation Equipment	7			3		4	
51-9141	Semiconductor Processors	212	7	203	1			1
51-9196	Paper Goods Machine Setters, Operators, & Tenders	472	49	410	7		5	1
51-9199	Production Workers, All Other	1,373	202	393	753	23		2
53-1021	First-Line Supervisors of Helpers, Laborers, & Material Movers, Hand	13	1	4	7	1		
53-1031	First-Line Supervisors of Transportation & Material-Moving Machine & Vehicle Operators	26	3	2	8	4	6	3
53-3021	Bus Drivers, Transit & Intercity	2			2			
53-3022	Bus Drivers, School or Special Client	408	37	15	117		160	79
53-3031	Driver/Sales Workers	6				6		
53-3032	Heavy & Tractor-Trailer Truck Drivers	407	40	90	105	53	107	12
53-3033	Light Truck or Delivery Services Drivers	208	30	108	28	40	1	1
53-3041	Taxi Drivers & Chauffeurs	17					17	
53-3099	Motor Vehicle Operators, All Other	5			2	3		
53-5011	Sailors & Marine Oilers	1			1			
53-5021	Captains, Mates, & Pilots of Water Vessels	4			4			
53-6011	Bridge & Lock Tenders	1	1					

SOC	OCCUPATION TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
53-6031	Automotive & Watercraft Service Attendants	1	1					
53-6041	Traffic Technicians	9	8			1		
53-6051	Transportation Inspectors	1					1	
53-7021	Crane & Tower Operators	4		4				
53-7032	Excavating & Loading Machine & Dragline Operators	62	6	25	30	1		
53-7051	Industrial Truck & Tractor Operators	121	39	53	8	17	2	2
53-7061	Cleaners of Vehicles & Equipment	5			5			
53-7062	Laborers & Freight, Stock, & Material Movers, Hand	306	18	114	121	53		
53-7063	Machine Feeders & Offbearers	8	1		3	4		
53-7071	Gas Compressor & Gas Pumping Station Operators	14				14		
53-7073	Wellhead Pumpers	10	7	3				
53-7081	Refuse & Recyclable Material Collectors	1,487	38	120	671	635		23
53-7121	Tank Car, Truck, & Ship Loaders	24		19	5			
53-7199	Material Moving Workers, All Other	27		26		1		

Table 18

Reported Green Employment within Each Industry (Six-Digit NAICS Code) by Green Core Area²⁶

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
111110	Soybean Farming	3		3				
111150	Corn Farming	43		30	7			6
111199	All Other Grain Farming	4			4			
111211	Potato Farming	1						1
111219	Other Vegetable (except Potato) & Melon Farming	128	2	70	46			10
111331	Apple Orchards	94	25	52	8	5		4
111339	Other Noncitrus Fruit Farming	1						1
111411	Mushroom Production	50		35	15			
111419	Other Food Crops Grown Under Cover	3				3		
111421	Nursery & Tree Production	458	4	329	120	4		1
111422	Floriculture Production	74	3	14	43	1	9	4
111940	Hay Farming	17		17				
111998	All Other Miscellaneous Crop Farming	10		4	6			
112111	Beef Cattle Ranching & Farming	9	1	5	2		1	
112120	Dairy Cattle & Milk Production	66		29	37			
112210	Hog & Pig Farming	4			1	1	1	1
112511	Finfish Farming & Fish Hatcheries	19		14	4			1
112910	Apiculture	6	2	2				2
112920	Horses & Other Equine Production	11			6			5
112990	All Other Animal Production	32			32			
113110	Timber Tract Operations	12	1	8		2		1
113210	Forest Nurseries & Gathering of Forest Products	1		1				
113310	Logging	64	4	55			5	
115112	Soil Preparation, Planting, & Cultivating	19	2	15				2
115210	Support Activities for Animal Production	14		5	4	5		
115310	Support Activities for Forestry	22	1	14	2			5
211111	Crude Petroleum & Natural Gas Extraction	80	16	62	1	1		
212111	Bituminous Coal & Lignite Surface Mining	40			14	26		
212112	Bituminous Coal Underground Mining	4			1	2		1
212113	Anthracite Mining	42	16	20		2		4
212311	Dimension Stone Mining & Quarrying	40	10	18		12		
212312	Crushed & Broken Limestone Mining & Quarrying	196	3	15	102	2	5	69

²⁶ This table is based on unweighted data, not statistical estimations.

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
212319	Other Crushed & Broken Stone Mining & Quarrying	78	2	13	63			
212321	Construction Sand & Gravel Mining	9			9			
212325	Clay & Ceramic & Refractory Minerals Mining	21	17		1	1		2
213111	Drilling Oil & Gas Wells	104		70	16	4	2	12
213112	Support Activities for Oil & Gas Operations	151		16	119	3	2	11
213113	Support Activities for Coal Mining	56	1	22		33		
213115	Support Activities for Nonmetallic Minerals (except Fuels)	63	5	15	15	21		7
221111	Hydroelectric Power Generation	7		7				
221112	Fossil Fuel Electric Power Generation	137	27	28	12	20	43	7
221113	Nuclear Electric Power Generation	17	2	3	3	1	6	2
221119	Other Electric Power Generation	17		17				
221121	Electric Bulk Power Transmission & Control	6	2	1	1			2
221122	Electric Power Distribution	323	194	68	4	1	12	44
221210	Natural Gas Distribution	44	19	1	4	10	5	5
221310	Water Supply & Irrigation Systems	686	30	31	192	405		28
221320	Sewage Treatment Facilities	293	2		252	16		23
221330	Steam & Air-Conditioning Supply	32	6	2		8	16	
236115	New Single-Family Housing Construction (except Operative Builders)	379	285	30	20	28		16
236116	New Multifamily Housing Construction (except Operative Builders)	2	2					
236117	New Housing Operative Builders	4	3					1
236118	Residential Remodelers	800	608	43	17	109	2	21
236210	Industrial Building Construction	163	72	14	68		7	2
236220	Commercial & Institutional Building Construction	1,075	596	46	67	5	4	357
237110	Water & Sewer Line & Related Structures Construction	763	20	214	318	116		95
237120	Oil & Gas Pipeline & Related Structures Construction	8			3		5	
237130	Power & Communication Line & Related Structures Construction	56	4	51				1
237210	Land Subdivision	10	6	2	1	1		
237310	Highway, Street, & Bridge Construction	249	31	61	90	18	40	9
237990	Other Heavy & Civil Engineering Construction	29	2	4		23		
238111	Residential Poured Foundation Contractors	20			20			

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
238112	Nonresidential Poured Foundation Contractors	114	4	81	1	22		6
238122	Nonresidential Structural Steel Contractors	65	8		56			1
238131	Residential Framing Contractors	6	6					
238141	Residential Masonry Contractors	10	10					
238142	Nonresidential Masonry Contractors	65	64					1
238151	Residential Glass & Glazing Contractors	110	75	18	2	3	6	6
238152	Nonresidential Glass & Glazing Contractors	168	155					13
238161	Residential Roofing Contractors	82	80	2				
238162	Nonresidential Roofing Contractors	344	275	18	35	3	2	11
238191	Other Residential Exterior Contractors	2	2					
238211	Residential Electrical Contractors	357	262	64	15	6	7	3
238212	Nonresidential Electrical Contractors	1,954	1,723	204	8	8		11
238221	Residential Plumbing & HVAC Contractors	1,779	1,549	123	36	7	19	45
238222	Nonresidential Plumbing & HVAC Contractors	1,810	1,164	131	154	86	122	153
238291	Other Residential Equipment Contractors	12	12					
238292	Other Nonresidential Equipment Contractors	113	67		44			2
238311	Residential Drywall Contractors	130	103		21			6
238312	Nonresidential Drywall Contractors	385	379			4		2
238321	Residential Painting Contractors	86	10	2	71		3	
238322	Nonresidential Painting Contractors	51		38	5	6	1	1
238331	Residential Flooring Contractors	10	5	3		1	1	
238332	Nonresidential Flooring Contractors	5		4				1
238341	Residential Tile & Terrazzo Contractors	7		7				
238342	Nonresidential Tile & Terrazzo Contractors	19		1	9		9	
238351	Residential Finish Carpentry Contractors	193	189					4
238352	Nonresidential Finish Carpentry Contractors	55	29	22		4		
238392	Other Nonresidential Finishing Contractors	3						3
238911	Residential Site Preparation Contractors	230	25	100	59	46		
238912	Nonresidential Site Preparation Contractors	231	10	53	66	82	9	11
238991	All Other Residential Trade contractors	82	10	65				7
238992	All other nonresidential Trade Contractors	52			33	8	3	8
311330	Confectionery Manufacturing from Purchased Chocolate	2				2		
311612	Meat Processed from Carcasses	2	2					
311615	Poultry Processing	1			1			

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
311941	Mayonnaise, Dressing, & Other Prepared Sauce Manufacturing	5	3		1			1
312111	Soft Drink Manufacturing	10			3	3	2	2
313221	Narrow Fabric Mills	8	5		3			
315991	Hat, Cap, & Millinery Manufacturing	60		60				
321113	Sawmills	10		9				1
321213	Engineered Wood Member (except Truss) Manufacturing	2			2			
321219	Reconstituted Wood Product Manufacturing	100	100					
321911	Wood Window & Door Manufacturing	466	139	323	1			3
321918	Other Millwork (including Flooring)	25						25
321991	Manufactured Home (Mobile Home) Manufacturing	153	67	43	43			
321992	Prefabricated Wood Building Manufacturing	3		3				
321999	All Other Miscellaneous Wood Product Manufacturing	30	1	25	1	1	1	1
322121	Paper (except Newsprint) Mills	594	86	412	44	2	41	9
322211	Corrugated & Solid Fiber Box Manufacturing	214		214				
322222	Coated & Laminated Paper Manufacturing	15	15					
322232	Envelope Manufacturing	228		226	1			1
322233	Stationery, Tablet, & Related Product Manufacturing	203		201	1			1
323121	Tradebinding & Related Work	3	1	2				
324110	Petroleum Refineries	58	9	9	12	9	17	2
324199	All Other Petroleum & Coal Products Manufacturing	34	9	5	2	16	1	1
325199	All Other Basic Organic Chemical Manufacturing	24		14		10		
325211	Plastics Material & Resin Manufacturing	74	12	10	12	14	8	18
325412	Pharmaceutical Preparation Manufacturing	7		7				
325612	Polish & Other Sanitation Good Manufacturing	160	34		121			5
325998	All Other Miscellaneous Chemical Product & Preparation Manufacturing	5			5			
326111	Plastics Bag & Pouch Manufacturing	496			496			
326113	Unlaminated Plastics Film & Sheet (except Packaging) Manufacturing	2		1				1
326130	Laminated Plastics Plate, Sheet (except Packaging), & Shape Manufacturing	184	183					1

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
326191	Plastics Plumbing Fixture Manufacturing	1	1					
326192	Resilient Floor Covering Manufacturing	5	1	1		1	1	1
326199	All Other Plastics Product Manufacturing	1,089	344	685	60			
326291	Rubber Product Manufacturing for Mechanical Use	300	150		150			
327215	Glass Product Manufacturing Made of Purchased Glass	40		40				
327310	Cement Manufacturing	84	2	3	76	1		2
327320	Ready-Mix Concrete Manufacturing	20	18					2
327390	Other Concrete Product Manufacturing	148		137	11			
327992	Ground or Treated Mineral & Earth Manufacturing	2			2			
331111	Iron & Steel Mills	5	1		1	1	2	
331421	Copper Rolling, Drawing, & Extruding	228	228					
331492	Secondary Smelting, Refining, & Alloying of Nonferrous Metal (except Copper & Aluminum)	19			15		4	
331521	Aluminum Die-Casting Foundries	8	5		2		1	
332117	Powder Metallurgy Part Manufacturing	2	1					1
332321	Metal Window & Door Manufacturing	99	99					
332322	Sheet Metal Work Manufacturing	6		6				
332323	Ornamental & Architectural Metal Work Manufacturing	2	1	1				
332420	Metal Tank (Heavy Gauge) Manufacturing	297		297				
332710	Machine Shops	25	6	6	10		2	1
332722	Bolt, Nut, Screw, Rivet, & Washer Manufacturing	7	7					
332913	Plumbing Fixture Fitting & Trim Manufacturing	1	1					
332919	Other Metal Valve & Pipe Fitting Manufacturing	18	2	2	2	4	4	4
333120	Construction Machinery Manufacturing	15					10	5
333131	Mining Machinery & Equipment Manufacturing	3					3	
333298	All Other Industrial Machinery Manufacturing	10		10				
333411	Air Purification Equipment Manufacturing	14	14					
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing	216	36	174	2	1	2	1
333415	Air-Conditioning & Warm Air Heating Equipment & Commercial & Industrial Refrigeration Equipment Manufacturing	146	87	46	3	7	1	2

Appendices

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
333611	Turbine & Turbine Generator Set Units Manufacturing	14	2	9	1		1	1
333911	Pump & Pumping Equipment Manufacturing	47	21	8	2	16		
333922	Conveyor & Conveying Equipment Manufacturing	30			30			
333994	Industrial Process Furnace & Oven Manufacturing	175	175					
334413	Semiconductor & Related Device Manufacturing	30	13	9	4	1	1	2
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing	3			3			
334419	Other Electronic Component Manufacturing	26	26					
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, & Appliance Use	90	82	8				
334513	Instruments & Related Prods. Manuf. for Measuring, Displaying, & Controlling Industrial Process Variables	72	33	30	4		5	
334514	Totalizing Fluid Meter & Counting Device Manufacturing	54	1		52		1	
335110	Electric Lamp Bulb & Part Manufacturing	140	80		60			
335311	Power, Distribution, & Specialty Transformer Manufacturing	21	6	6	5	3		1
335312	Motor & Generator Manufacturing	37					37	
335313	Switchgear & Switchboard Apparatus Manufacturing	1						1
335314	Relay & Industrial Control Manufacturing	2	1	1				
335911	Storage Battery Manufacturing	78	15	63				
335991	Carbon & Graphite Product Manufacturing	1				1		
335999	All Other Miscellaneous Electrical Equipment & Component Manufacturing	88	60	6	22			
336312	Gasoline Engine & Engine Parts Manufacturing	8					8	
336350	Motor Vehicle Transmission & Power Train Parts Manufacturing	10		8	2			
336412	Aircraft Engine & Engine Parts Manufacturing	1						1
336991	Motorcycle, Bicycle, & Parts Manufacturing	1			1			
337110	Wood Kitchen Cabinet & Countertop Manufacturing	17	4	10		1		2
339112	Surgical & Medical Instrument Manufacturing	45			45			
339991	Gasket, Packing, & Sealing Device Manufacturing	120	120					
339999	All Other Miscellaneous Manufacturing	7			7			

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
423110	Automobile & Other Motor Vehicle Merchant Wholesalers	1						1
423140	Motor Vehicle Parts (Used) Merchant Wholesalers	4				4		
423220	Home Furnishing Merchant Wholesalers	26		20	3			3
423310	Lumber, Plywood, Millwork, & Wood Panel Merchant Wholesalers	106		106				
423330	Roofing, Siding, & Insulation Material Merchant Wholesalers	10	5	5				
423420	Office Equipment Merchant Wholesalers	16			16			
423450	Medical, Dental, & Hospital Equipment & Supplies Merchant Wholesalers	3	1					2
423610	Elect. Apparatus & Equipment, Wiring Supplies, & Related Equipment Merchant Wholesalers	32	25			6		1
423720	Plumbing & Heating Equipment & Supplies (Hydronics) Merchant Wholesalers	22		11	11			
423730	Warm Air Heating & Air-Conditioning Equipment & Supplies Merchant Wholesalers	5	5					
423820	Farm & Garden Machinery & Equipment Merchant Wholesalers	54	2	52				
423830	Industrial Machinery & Equipment Merchant Wholesalers	20	1		19			
423840	Industrial Supplies Merchant Wholesalers	6				4		2
423850	Service Establishment Equipment & Supplies Merchant Wholesalers	29	1	4	24			
423990	Other Miscellaneous Durable Goods Merchant Wholesalers	12		12				
424130	Industrial & Personal Service Paper Merchant Wholesalers	31			31			
424440	Poultry & Poultry Product Merchant Wholesalers	3		3				
424490	Other Grocery & Related Products Merchant Wholesalers	49			49			
424710	Petroleum Bulk Stations & Terminals	9	9					
424720	Petroleum & Petroleum Products Merchant Wholesalers (except Bulk Stations & Terminals)	19			19			
424910	Farm Supplies Merchant Wholesalers	9						9
424990	Other Miscellaneous Nondurable Goods Merchant Wholesalers	40			40			
425110	Business to Business Electronic Markets	2	2					
425120	Wholesale Trade Agents & Brokers	143	120	14	1	1		7

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
441110	New Car Dealers	151	51				99	1
441120	Used Car Dealers	8		1	1		6	
441310	Automotive Parts & Accessories Stores	2		2				
441320	Tire Dealers	2					2	
442110	Furniture Stores	14		11	1			2
442210	Floor Covering Stores	2		2				
442291	Window Treatment Stores	4	4					
443112	Radio, Television, & Other Electronics Stores	1			1			
444110	Home Centers	22	4	8	3	7		
444120	Paint & Wallpaper Stores	3		3				
444130	Hardware Stores	41	37		2	2		
444190	Other Building Material Dealers	55	33	3	3	3	3	10
445110	Supermarkets & Other Grocery (except Convenience) Stores	150		150				
445299	All Other Specialty Food Stores	26		26				
452111	Department Stores (except Discount Department Stores)	54	54					
452112	Discount Department Stores	1	1					
452910	Warehouse Clubs & Supercenters	248		245	3			
453310	Used Merchandise Stores	23	23					
454210	Vending Machine Operators	3					3	
454311	Heating Oil Dealers	24	23					1
454312	Liquefied Petroleum Gas (Bottled Gas) Dealers	3	3					
483211	Inland Water Freight Transportation	7			7			
484110	General Freight Trucking, Local	66	20	20	25			1
484121	General Freight Trucking, Long-Distance, Truckload	146	15		100	5	24	2
484122	General Freight Trucking, Long-Distance, Less Than Truckload	20					20	
484220	Specialized Freight (except Used Goods) Trucking, Local	47	2	3		40	1	1
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance	100	29				71	
485111	Mixed Mode Transit Systems	11	4					7
485113	Bus & Other Motor Vehicle Transit Systems	2			2			
485320	Limousine Service	17					17	

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
485410	School & Employee Bus Transportation	338	43	15	117		129	34
485510	Charter Bus Industry	90					45	45
485999	All Other Transit & Ground Passenger Transportation	2					2	
486210	Pipeline Transportation of Natural Gas	1					1	
488490	Other Support Activities for Road Transportation	14	9	2	1	1		1
493110	General Warehousing & Storage	19	3	7	2	2	2	3
493190	Other Warehousing & Storage	7		7				
511110	Newspaper Publishers	180		180				
511120	Periodical Publishers	7						7
511199	All Other Publishers	6			6			
511210	Software Publishers	1						1
512110	Motion Picture & Video Production	3	1	1	1			
515120	Television Broadcasting	12						12
517110	Wired Telecommunications Carriers	6	6					
517210	Wireless Telecommunications Carriers (except Satellite)	5	1		4			
518210	Data Processing, Hosting, & Related Services	32	1		30			1
519120	Libraries & Archives	36						36
522110	Commercial Banking	26	3		20			3
522130	Credit Unions	182	182					
523920	Portfolio Management	20	20					
524126	Direct Property & Casualty Insurance Carriers	153		1				152
524210	Insurance Agencies & Brokerages	42	16	14	6	6		
524292	Third Party Administration of Insurance & Pension Funds	1						1
531110	Lessors of Residential Buildings & Dwellings	41	23		1	11	1	5
531120	Lessors of Nonresidential Buildings (except Miniwarehouses)	75	64	5	5			1
531130	Lessors of Miniwarehouses & Self-Storage Units	3	2					1
531190	Lessors of Other Real Estate Property	2			2			
531210	Offices of Real Estate Agents & Brokers	50	37	7	2	2		2
531311	Residential Property Managers	6	2	2			2	
531312	Nonresidential Property Managers	5	5					
531390	Other Activities Related to Real Estate	2	2					
532111	Passenger Car Rental	8	8					

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NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
532120	Truck, Utility Trailer, & RV (Recreational Vehicle) Rental & Leasing	45			35		10	
532299	All Other Consumer Goods Rental	12			2	10		
532310	General Rental Centers	6	3	3				
532490	Other Commercial & Industrial Machinery & Equipment Rental & Leasing	6	2	1	1	1		1
541110	Offices of Lawyers	31	3	1	9	4	1	13
541310	Architectural Services	1,360	632	399	70	20	15	224
541320	Landscape Architectural Services	101	31	31	8	31		
541330	Engineering Services	3,600	958	689	870	375	137	571
541350	Building Inspection Services	41	24		2		3	12
541360	Geophysical Surveying & Mapping Services	14	3	1	6	4		
541370	Surveying & Mapping (except Geophysical) Services	96	62	9	11	3	1	10
541380	Testing Laboratories	500	80	48	233	112	7	20
541410	Interior Design Services	61	36	11	4			10
541420	Industrial Design Services	1			1			
541511	Custom Computer Programming Services	17	3	11				3
541512	Computer Systems Design Services	19	15		1		2	1
541611	Administrative Management & General Management Consulting Services	23	11	9				3
541613	Marketing Consulting Services	1						1
541614	Process, Physical Distribution, & Logistics Consulting Services	84	36	8	2		1	37
541620	Environmental Consulting Services	807	42	40	109	278	51	287
541690	Other Scientific & Technical Consulting Services	287	87	68	6	30	6	90
541712	Research & Development in the Physical, Engineering, & Life Sciences (except Biotechnology)	383	50	25	26	250	31	1
541810	Advertising Agencies	20						20
541820	Public Relations Agencies	10	5			5		
541990	All Other Professional, Scientific, & Technical Services	2				2		
551112	Offices of Other Holding Companies	5					5	
551114	Corporate, Subsidiary, & Regional Managing Offices	890	59	102	270	153	257	49
561110	Office Administrative Services	11	9		1			1

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
561311	Employment Placement Agencies	10		10				
561312	Executive Search Services	5	2	1	1	1		
561320	Temporary Help Services	15	4			11		
561422	Telemarketing Bureaus & Other Contact Centers	5	1		4			
561499	All Other Business Support Services	132	132					
561611	Investigation Services	2						2
561710	Exterminating & Pest Control Services	85			84			1
561720	Janitorial Services	290		5	23		253	9
561730	Landscaping Services	486	388	44	30	17	1	6
561740	Carpet & Upholstery Cleaning Services	8	2	1	5			
561790	Other Services to Buildings & Dwellings	1	1					
562111	Solid Waste Collection	1,030	8	96	423	481	1	21
562119	Other Waste Collection	93	29	6	27	28	2	1
562212	Solid Waste Landfill	213	4	6	74	123	1	5
562213	Solid Waste Combustors & Incinerators	263		161	52	50		
562219	Other Nonhazardous Waste Treatment & Disposal	176	3	21	72	56		24
562910	Remediation Services	66	5	37	1	21		2
562991	Septic Tank & Related Services	4			4			
562998	All Other Miscellaneous Waste Management Services	3			3			
611110	Elementary & Secondary Schools	956	96	3	3	17		837
611210	Junior Colleges	70	3	4	4			59
611310	Colleges, Universities, & Professional Schools	713	6	16	2	4		685
611410	Business & Secretarial Schools	1						1
611691	Exam Preparation & Tutoring	1						1
611710	Educational Support Services	7						7
622110	General Medical & Surgical Hospitals	77	8	3	43	23		
622210	Psychiatric & Substance Abuse Hospitals	130			30	100		
622310	Specialty (except Psychiatric & Substance Abuse) Hospitals	11	6			5		
623210	Residential Mental Retardation Facilities	16	6		5	5		
623311	Continuing Care Retirement Communities	13		12				1
623990	Other Residential Care Facilities	31				10		21
624190	Other Individual & Family Services	23	15		1	5		2

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
624310	Vocational Rehabilitation Services	37	13					24
712110	Museums	26						26
712130	Zoos & Botanical Gardens	67			1	21		45
712190	Nature Parks & Other Similar Institutions	6				5		1
713910	Golf Courses & Country Clubs	146	13	20	23	78		12
713990	All Other Amusement & Recreation Industries	2						2
721110	Hotels (except Casino Hotels) & Motels	65	26	1	10	20	1	7
721214	Recreational & Vacation Camps (except Campgrounds)	67						67
722110	Full-Service Restaurants	9		9				
722211	Limited-Service Restaurants	32	32					
722310	Food Service Contractors	4				1		3
722320	Caterers	1		1				
811111	General Automotive Repair	87	6	8	34	7	30	2
811112	Automotive Exhaust System Repair	6	1	1	1		3	
811113	Automotive Transmission Repair	5			5			
811118	Other Automotive Mechanical & Electrical Repair & Maintenance	4			2		2	
811121	Automotive Body, Paint, & Interior Repair & Maintenance	34			11		22	1
811192	Car Washes	9			7		2	
811198	All Other Automotive Repair & Maintenance	7	7					
811310	Commercial & Industrial Machinery & Equipment (except Automotive & Electronic) Repair & Maintenance	18	9			9		
811490	Other Personal & Household Goods Repair & Maintenance	60			60			
812210	Funeral Homes & Funeral Services	16			10		2	4
812220	Cemeteries & Crematories	2			2			
812320	Drycleaning & Laundry Services (except Coin-Operated)	6	2	1		1		2
812332	Industrial Launderers	1			1			
813312	Environment, Conservation & Wildlife Organizations	5						5
813319	Other Social Advocacy Organizations	8						8
813410	Civic & Social Organizations	26		22				4
813910	Business Associations	11		1	1	1		8

NAICS	INDUSTRY TITLE	TOTAL	GREEN JOBS BY CORE AREA					
		GREEN JOBS EMPLOYMENT	ENERGY EFFICIENCY	RESOURCE SUSTAINABILITY/ RENEWABLE ENERGY	POLLUTION PREVENTION	ENVIRONMENTAL CLEANUP	HARMFUL EMISSIONS REDUCTION	GREEN EDUCATION/ TRAINING OR COMPLIANCE
813920	Professional Organizations	30						30
813930	Labor Unions & Similar Labor Organizations	2	1					1
921140	Executive & Legislative Offices, Combined	428	17	16	164	44	83	104
924110	Administration of Air & Water Resource & Solid Waste Management Programs	146		79	57	4		6
924120	Administration of Conservation Programs	198	5	21	124	14	2	32
925110	Administration of Housing Programs	1	1					
925120	Administration of Urban Planning & Community & Rural Development	81	61	1		3	1	15
926130	Regulation & Administration of Communications, Electric, Gas, & Other Utilities	2						2
926140	Regulation of Agricultural Marketing & Commodities	12		1	1			10
926150	Regulation, Licensing, & Inspection of Miscellaneous Commercial Sectors	154						154
928110	National Security	5	1	1			1	2

Appendices

Table 19

Examples of Green Skills and Knowledge Reported by Employers by NAICS Industry Sector²⁷

NAICS	INDUSTRY SECTOR	EXAMPLES OF GREEN SKILLS AND KNOWLEDGE REPORTED BY EMPLOYERS
11	Agriculture, Forestry, Fishing & Hunting	Composting; organic crop pest control and vegetable production; soil science; sustainability
21	Mining, Quarrying, & Oil & Gas Extraction	Hazmat training; reclaiming; restoration; MSHA training; knowledge of laws on extraction and restoration
22	Utilities	Emissions reduction, monitoring and reporting; energy efficiency; sewer treatment operations; understanding environmental regulations
23	Construction	Energy auditing; energy efficiency product knowledge; knowledge of energy laws; installing geothermal products, solar products, windmills, high efficiency HVAC equipment, insulation upgrades, fiber optic wiring, and on-demand water heaters; green building design; pollution prevention; recycling; reclamation; wind design
31-33	Manufacturing	Knowledge of DEPA and EPA regulations; chemical process technology; biodiesel manufacturing; environmental engineering; instrumentation control technology; spill prevention
42	Wholesale Trade	Green product knowledge; knowledge of manufacturing processes; able to provide contractors/engineers with green training
44-45	Retail Trade	Product knowledge; application of fertilizers and pesticides
48-49	Transportation & Warehousing	Energy auditing; green cleaning practices; pollution prevention; renewable energy specifications development
53	Real Estate & Rental & Leasing	Green building design; solar knowledge
54	Professional, Scientific, & Technical Services	Home inspections; energy audits; agronomy; architectural design; Best Management Practices; building energy use modeling software; civil engineering; conservation design; design ecosystem restoration and stream bank stabilization projects; design sustainable energy systems; design sustainable water treatment systems; knowledge of environmental assessment, codes and regulations; geo-engineering; instrumentation skills; weatherization; wetland identification; knowledge of grant funding for green improvements
55	Management of Companies & Enterprises	Energy auditing; green education and marketing; alternative energy options
56	Administrative & Support & Waste Management & Remediation Services	Chemistry; energy efficiency; recycling; solid waste collection; resource management; spillage clean-up; water testing; pest control
61	Educational Services	Auto emissions training; chemical engineering; civil engineering; custodial/maintenance training; environmental science; environmental management; hazardous materials and assessments; plant types and care; solar training; weatherization training; hydrology
62	Health Care & Social Assistance	Energy efficiency; paper recycling; resource sustainability
71	Arts, Entertainment, & Recreation	Public display botanical gardens; clean stream knowledge; sustainability practices; horticulture
72	Accommodation & Food Services	Recycling; pond and stream pollution control; electrical skills; mechanical skills
81	Other Services (except Public Administration)	Erosion and sedimentation control; hazardous materials awareness; sustainable green printing; safe practices regarding automotive body/paint; knowledge of governmental policies and regulations
92	Public Administration	Energy auditing; irrigation; environmental regulations and litigation; hazardous materials; knowledge of USDA conservation programs; maintenance of water distribution systems; resource management; knowledge of LEED; wastewater; weatherization

²⁷ No employers in industry sectors 51 (Information) or 52 (Finance and Insurance) reported any green skills or knowledge needs on the survey.

Table 20

Examples of Basic Skills and Knowledge Reported by Employers by NAICS Industry Sector

NAICS	INDUSTRY SECTOR	EXAMPLES OF GREEN SKILLS AND KNOWLEDGE REPORTED BY EMPLOYERS
11	Agriculture, Forestry, Fishing & Hunting	Equipment maintenance; crop culture knowledge; diesel mechanic; drivers license; Forest Technician Degree; horticultural knowledge; safety training; ability to work in heat; PA Emission Inspection License
21	Mining, Quarrying, & Oil & Gas Extraction	Geothermal well drilling; heavy equipment operator; rigger training; engineering principles; drug free; journeyman electrician license
22	Utilities	Combustion theory; electrical skills; math; mechanical ability; computer skills; Environmental Engineering Degree; Sewer Operator License
23	Construction	Air conditioning system design; asbestos training; basic carpentry skills; blueprints; computer skills; drafting capability; electrical knowledge; general plumbing experience; HVAC skills; oil refining skills; power plant skills; able to follow instructions; Architectural Drafter Degree; construction safety training
31-33	Manufacturing	Project management; backhoe operator; chemical knowledge; mechanical aptitude, welding; electrical skills; Electrical Engineering Degree; safety awareness; Wastewater Technician Degree; math; reading
42	Wholesale Trade	Good work ethic; Engineering Degree; alternative energy product knowledge
44-45	Retail Trade	Customer service; cash register operations; mechanically inclined; GM product training; social skills
48-49	Transportation & Warehousing	CDL Class A/B; project management; IT skills; diesel trained; environmental emergency response
51	Information	Broadcasting experience; editorial skills; printing press operation knowledge
52	Finance & Insurance	Knowledge of financial services; Broker License; written/verbal communication; math
53	Real Estate & Rental & Leasing	Maintenance; clerical; janitorial; Professional Recycling of PA (PROP); math, reading and writing; Real Estate License
54	Professional, Scientific, & Technical Services	Architectural Degree; basic landscaping; bio/physical chemistry process design; carpentry; Civil Engineering Degree; Economics Degree; field investigation; GIS; accuracy; honesty; member of American Society of Architectural Illustration; CDL Class A; Microsoft Excel and Word
55	Management of Companies & Enterprises	Communications Degree; return on investment calculations; Environmental Engineering Degree; knowledge of appliances
56	Administrative & Support & Waste Management & Remediation Services	CDL Class A/B/C; health and safety training; logging pick-ups; mold removal; reliability; clean driving record; customer service; math; able to lift 50 lbs
61	Educational Services	Architectural Degree; Association of Physical Plant Administrator; computer skills; Environmental Science Degree; public relations; teaching; math; physics
62	Health Care & Social Assistance	Knowledge of landscaping equipment; able to work outdoors under extreme conditions
71	Arts, Entertainment, & Recreation	Canoe Safety License; CPR; venom training; reading; writing; pruning; guiding tours; lecturing
72	Accommodation & Food Services	Chemical application; control run-off; maintenance and facilities skills
81	Other Services (except Public Administration)	General automotive repair; mechanical ability; diesel mechanic; AC Unit License; physically fit
92	Public Administration	Cartography/GIS; Commonwealth Operators Permit; budgeting; basic construction skills; Environmental Science Degree; computer skills; grant writing and administration; maintain records; Municipal Industrial Treatment Plan Administrator

Appendices

Table 21

Certifications Reported by Employers in Each Industry Sector (Two-Digit NAICS Code)

Note: This table lists the certifications as they were reported by the employers. This is the raw data, unduplicated by distinct certification title. Duplication will appear where employers provided different titles for the same certification.

11 - Agriculture, Forestry, Fishing & Hunting
Agronomy Certification
Application Certification
ASC Conservation Guidelines
Certified Crop Advisor
Certified Private Pesticide License
Creamery Certified
EPA Certified
Farm Services Certification
Fertilizer Certification
Herbicide Certification
Live Roof Certification
Organic Certified
Organic Farmer Certification
Pesticide Applicator License
Pesticide Certification
Pesticide Certification in Future
Pesticide Certified/Training
Pesticide License
SFI
Sustainable Forest Initiative Certification
21 - Mining
Certified Welder
DOT License
EPA Certified
First Aid
Heavy Equipment Operator Certified
IGSHPA Certification
Mine Safety and Health Administration Certification
OSHA
OSHA Certification
Safety Certification
Safety Courses
Well-Control School Certification (Driller)
22 - Utilities
Carbon Reduction Certification
Certified Energy Manager

Certified Welder
NIULPE Class I or II License
OSHA
PA Sewage Enforcement Certification
PE (Optional)
Professional Engineer
Safety
Sewer Operator License
State Certifications
Visible Emissions Certification
Water Treatment Plant Operator Certification
Water Works Operator Certificate (Class A; Type 1)
23 - Construction
ACI Certification
Asbestos Certification
Boiler Certification
BPI Certification
Building Analyst
Building Performance Institute
Carpenter Certification
Certified Building and Energy Training
Certified Building Designer
Certified Dealer
Certified Electrician
Certified Energy Manager
Certified for installation of Energy Efficient Windows
Certified Gas Line Pipe
Certified Green Professional
Certified Solar Installers
Certified Welder
Design-Build Institute of America (DBIA)
Energy Star Certified
EPA
EPA Certified
EPA IGSPAA
EPA LEAD Abatement
EPA LEAD Paint Safety Certification
EPA LEED Law
EPA Refrigerant Certification
EPA Renovator
EPA/ASE Cert.

Appendices

EPDM Certified (Rubber Roofing)
Fire Extinguisher Service Cert.
Fire Suppression Systems
First Aid
Flagger Certification
Flatwork Certified
Fork Lift Training Certification
Freon Certification
FSC Certified
GeoPro Cert.
Green Advantage Environmental Certification
GREEN Associate Certification
Green Awareness
Green Course Certification
Green Professional; NAHB
Hazardous Materials Training
Hazmat Certification
Heat Controller Certified
Home Improvement Certification
HV Certification
HVA Federal Certification
HVAC Certified
HVAC Compliant
HVAC Load Calculations
IGSHPA Certification
IMSA Level I; II; III Certifications
Inspection and Emission Certification
Installing HVAC Certificate
IQ Drive AC Certification
IREC Certification
Journey Plumber
Journeyman Certification
Keystone Energy Course for Grants (Home Upgrades)
LEAD
LEAD Certification
LEAD Paint Certification
LEAD Safe (EPA) Certified
Lead Safe Certification
LEAD Training
Leadership in Energy/Environmental Design
LEED Abatement Certified

LEED AP Certified
LEED Green Associate
Licensed
Licensed Electrician
Licensed in PA
Licensed Plumber
Licensed Refrigeration EPA
Lighting Design
Manufacturers Training and Certification
Manufacturers Classes
Marine Certification
Master Electrician Certification
Mine Safety and Health Administration Certification
NABCEP
NABCEP (Solar Wind)
NADCA (National Air Duct Cleaners Association)
NATE
NATE Certification
NATE Certified
National Association of Home Building Certified
National Comfort Institute (N.C.I.)
National Oil Heat Research Alliance
NEBB or TABB
NORA
North American Board of Certified Energy Practitioners
NWEA Certified
Oil Heat Certification
OSHA
OSHA (Web)
OSHA 10/30 EPA RRP
OSHA Certification
PA Broiler License
PA Certified
PA Certified Weatherization
PA Department of Environmental Protection PADEP Certificate
PA Particulate AIR Emissions Certification
PA Particulate AIR Emissions Certification
PA PV Installer
PA Solar Installation Electrician Certification
PA State Solar Installer Certification
PA Sunshine Cert.

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PA Sunshine Certification
PA Sunshine Grant Approved
PA Sunshine Program
Paint Removal Certification
Pesticide Applicator License
Plumber Certification
Plumber License
Plumbers License
Plumbing
Plumbing Apprenticeship
Plumbing Certification
Plumbing License
PMI Certification
PPC Certification
Professional Engineer (P.E.)
Professional Engineer (PE)
PUC Certified
PV Certification
R410A
Refrigerant
Refrigerant Certification
Refrigerant Certified by EPA
Refrigerant Recovery
Refrigeration Certification
Refrigeration Certified by EPA
Refrigeration Service Engineers Society
Renovation; Repair Painting Certification
REPA
RES
Residential Energy Service Network Certification
RSES Universal Refrigerant License
Safety
Safety Qualified through OSHA
Schooling; Training
Solar Certification
SPLIT
Spray Foam Certification
Steam Fitter Certified
Sustainability Certified
Sustainable Building Certification
Trained Applicator

Training Certification (FM200/FE25)
Trex Deck Certified
TWIC
Type I and II Refrigerant Certification
USJ
VISCA Star (Equipment Certs. for New Equip.)
Water Treatment Plant Operator Certification
Weatherization Certification
31-33 - Manufacturing
Hazmat Certification
Opacity Certification
ACI Certification
Cement Certification
CPR/First Responder
DOT Hama
EPA Certified
EPA RCRA
FEE Certification
Forklift Certification
FSC Certified
Hazmat Certification
ISO 14001
Mine Safety and Health Administration Certification
OSHA
OSHA Certification
Overhead Crane Certification
PTI - Bonded/Unbonded
SCS-Scientific Certification Systems
SFI
STADD Pro
Sustainable Forest Initiative Certification
Tool Die Maker
5 S Program
ASME Certified
BPI Certification
Certified Safety Professional
Certified Welder
Department of Environmental Protection Certification
Electrical Engineering Degree
Energy License
Environmental Certification

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EPA Certified
EPA Refrigerant Certification
Hazmat Certification
Insulation (Co. Provides Training)
IPC 610
IPC 620
ISO 1401 Certification
LEED AP Certified
NABCEP
OSHA
PA Certified Water Treatment Operator License
Quick-Lock Installation Certification
Residential Energy Service Network Certification
Solar Rating and Certification Corporation (SRCC)
Solar Thermal Certification
42 - Wholesale Trade
FSC Certified
Hazmat Certification
LEED AP Certified
Professional Engineer Degree
44-45 - Retail Trade
Emissions Certification
EPA Certified
Hazmat Certification
Inspection and Emission Certification
Green Building Certification
48-49 - Transportation & Warehousing
Certified Energy Manager
Certified Industrial Hygienist
Diesel Certification
LEED AP Certified
Mechanic Certification
PA Inspection Certification
PA State Certification
Regular Driver License
Renewable Energy Professional
Refrigerating Engineers and Tech. Association
51 - Information
FSC Certified
Rattle Snake Certification
Wildlife Certification

53 - Real Estate & Rental and Leasing
EPA Certified
Green Certification
Green Certified
HVAC Certified
Information Technology Certification
LEED AP Certified
Mechanic Certification
National Association of Home Building Certified
Pesticide Certified
Property Management License
Solid Waste Association of North America (SWANA)
Surface Mine Certificate
Water Certification through Culligan Training
Water Treatment Plant Operator Certification
54 - Professional, Scientific, & Technical Services
150 9000 Certified
ACTAR
American Society of Home Inspector Certification
ARC (Safety) Safety Certification
Asbestos Certification
BPI Certification
Building Performance Institute
Carbon Reduction Certification
Cert. of Authorization
Certified Drafter
Certified Electrician
Certified Energy Auditor
Certified Energy Manager
Certified Green Professional
Certified Hazardous Materials Management
Certified Industrial Hygienist
Certified Landscape Architect
Certified Planner
Certified Safety Professional
Certified Safety Trainers
Certified Sewage Enforcement Officer
Certified Sustainable Bldg Advisor
Commercial Building Inspector Certified
Confined Space Certification
Conservation Planner

Appendices

CSBA
DEP Permit Training
DEP Radon Tester
EIT Certification
Energy Inspector Certified
Energy Star Certified
Environmental Certification
EPA
EPA Certified
ERAIL Safe Certification
Fellow American College of Epidemiology
Forestry Certified
FRA Safety Certification
Fundamentals in Engineering Certification
GIS Certification
Hazmat Certification
Home Inspection Certification
ICC 2009 Energy Conservation Code
IGSHPA Certification
Industrial Hygienist
Inspection and Emission Certification
Inspector/Plan Examiner Certified
ISO 1401 Certification
IT 1401 Certified
Land Development Certification
Land Surveyor Certification
Landscape Architect
LEAN Manufacturing Certificate
LEED Abatement Certified
LEED AP Certified
LEED Green Associate
LEED OM
LEED/U.S. Green Building Council
Licensed Architect
Licensed Engineer
Licensed Professional Surveyor
Lighting Certified from the NCQLP
M.B.E
MA History
Metallurgy Certification
Mold/Remediation

MS Historic Preservation
National Association of Home Builders Certified Green Professional (NAHB CGP)
National Association of Home Building Certified
National Certifications
National Flood Association Certification
National Institute for Certification in Engineering Technology
National Pollutant Discharge Elimination System (NPDES)/Erosion Control Regulations
NECEPT Certification
NFPA Certification
NICET
NICET Certification
Operator Certification
OSHA
OSHA Certification
PADEP
PADEP Certified UST Installer
PaDEP Course
Paramedic
PE
Pesticide Training
PP Certification
Professional Engineer
Professional Engineer (P.E.)
Professional Engineer Certification
Professional Engineer License
Professional Engineer License (P.E.)
Professional Engineers
Professional Engineers License
Professional Geologist
Professional Geologist (PG); PE
Professional License
Professional License Engineering
Professional Wetland Scientist Certified
PSM (Process Safety Management)
PSS - PG - PWS
RA; LEED - AP
Radon Certification
Radon Testing Certified
Register Architect
Register Engineer
Registered Architect

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Registered Architect/Designer
Registered Landscape Architect
Residential Energy Service Network Certification
Safety Qualified through OSHA
Septic Certification
Site Training- 40 HR + 8 HR Annual
Solar Certification
Storm Water Infiltration
Surveying Certificate
Sustainable Building Certification
Treatment Plant Operator License
UCC (United Communications)
Warranty Certification
Water or Waste Water License
Water Treatment Plant Operator Certification
55 - Management of Companies & Enterprises
Associate in Electric Technology
EPA Compliance
LEAN Manufacturing
LEED AP Certified
56 - Administrative & Support & Waste Management & Remediation Services
Asbestos Certification
ASME Certified
Energy Manager Certification
EPA Method 9/Visible Emissions
Forklift Certification
Green Risk Certified
Health and Safety Training
LEED AP Certified
OSHA
PA AG Department
Pesticide Applicator Certification
Pesticide Certification
Professional Certifications
PROP Certification
QRO Certification
Recovery Operator Certification
Recycling Certification
Transportation Worker Identification Credential
Tree Worker- International Society of Arboriculture
Water Treatment Plant Operator Certification

61 - Educational Services
Advanced Placement Certified
BPI Certification
Certified Energy Manager
Certified in Science
Certified Science Teacher
Educational Certificate
Emissions Certification
Green Cleaning Certification
Hazmat Certification
High School Teaching Certification
Instructor Certification
LEED AP Certified
NCCER
OSHA Certification
PA State Certified /Teaching Degree
Pesticide Applicator License
Professional Geologist
Refrigerant Certified by EPA
Residential Energy Service Network Certification
Science Teaching Certificate
Secondary Science Cert.
Special Education Certification
Teaching Certificate
Weatherization certification
62 - Health Care & Social Assistance
Certified Energy Auditor
Certified Energy Manager
Certified Energy Procurement Professional
NCCER
71 - Arts, Entertainment, & Recreation
Audubon Certification
First Aid
Pesticide License
72 - Accommodation & Food Services
Chemical Application
Pesticide Licensing
Universal CFC License
81 - Other Services (except Public Administration)
A E Certified
A/C Certification

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ASE Certification
Certified Environment Professor
Certified Wildlife Biologist
Emission Technician/Repair Technician ASE Certified
Emissions Certification
EPA Certified
EPA Certified Painter
EPA Compliance
EPA Paint Certification
EPA Vehicle Emissions Certification
I-Care
Mechanic Certification
OJT and In-house Training
OSHA
92 - Public Administration
Agricultural Conservation Technician Certification
Certification with all Subclasses Required
Certified Energy Manager
Collection System Certification
Commonwealth Operators Permit
DEP Recycling Training
Emissions Certification
Environmental Certification
Environmental Conservation Technician Certification
EPA Certified
EPA Laboratory Certification
ESM-DGR
GISP
Hazmat Certification
Licensed Wastewater Operator
MIPP (Municipal Industrial Treatment Plan Administrator)
N Endorsement because they are Required to Drive
N I C E T Certification
NICET Certification
Nutrient Management Certification
Nutrient MGMT
Pennsylvania or Reciprocal License
Operators Certificate issued by the Commonwealth
PA DEP Certification
PA Dept of AG Certification
PA Professional Recycler Certification

Possession of a Class A; Type 1; Wastewater
Possession of Certification Playground Safety
Possession of Class E Certification for Wastewater
Possession of Class E Certification for Water
Professional Engineers License
Related Degrees
SEO Certification
Sewage Enforcement Officer Certification
Sewer Plant Certification
State Certification
Water Treatment Plant Operator Certification
Weatherization Auditor

SURVEY FORM

COMMONWEALTH OF PENNSYLVANIA GREEN JOBS SURVEY



ABOUT THE SURVEY

The U.S. Department of Labor is taking a multi-state approach in refining its industry and occupational descriptions to keep up with the rapidly evolving green economy. As one of the states selected for a federal award in this national effort, Pennsylvania is partnering with the Washington State Employment Security Department to conduct an economy-wide employer survey. The goal of this partnership is to develop a green workforce, and we need our employers' help.

This survey will give us a baseline for the current number of green jobs and expected job growth, and help us identify unique green skill requirements. The data collected will be targeted to workforce development practitioners and educators to help them prepare businesses and job seekers for opportunities within the green economy. It is vital that our state aligns our public policy investments with your business activities so that we benefit from this dynamic change in Pennsylvania's economy.

Pennsylvania defines green jobs as jobs that employ workers in producing or offering products or services that:

1. Promote energy efficiency;
2. Contribute to the sustainable use of resources or renewable energy;
3. Prevent pollution;
4. Clean up the environment;
5. Promote the reduction of harmful emissions; and
6. Provide green education/training, awareness, or compliance.

COMPLETING THE SURVEY

- Please direct this survey to your Operations Manager or Human Resources Department.
- Include information about the location shown on the address label above.
- Return the survey in the enclosed postage-paid envelope, or
- Fax both sides to (360) 438-3215, or
- Contact us at (800) 837-3074 to report by telephone or receive answers to your questions.
- Please respond before August 13, 2010.
- All information will be treated confidentially.

CONTACT PERSON

Name: _____
Title: _____
Telephone: () _____
Date: _____

PLEASE REPORT FOR THE LOCATION LISTED ON THE ADDRESS LABEL

How many employees do you currently have at this location? _____

Do you provide goods or services in any of the **six core areas** as listed above? Yes ____ No ____

If 'Yes,' please complete back of survey.

If 'No' stop here and mail or fax back the survey.

THANK YOU FOR PARTICIPATING BY AUGUST 13, 2010

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COMMONWEALTH OF PENNSYLVANIA GREEN JOBS SURVEY



Please enter information for the past three months' business activities only.

SECTION 1: Total Number of Employees and Job Titles Related to Six Core Areas

- Enter total number of employees for each job title and the main core area in which they work. **Choose only one core area per employee.**
- Please estimate how many employees will work in the six core areas as their primary focus two years from now.
- Exclude consultants, outside contractors, vendors, and others not considered employees.

Core Areas for Green Jobs

Job Title Related to Core Area	Total No. of Current Employees in Position	Estimated No. of Employees in Position in Two Years	1	2	3	4	5	6
			Energy Efficiency	Resource Sustainability/ Renewable Energy	Pollution Prevention	Environmental Cleanup	Harmful Emissions Reduction	Green Education/ Training, or Compliance
Example: <i>Civil Engineer</i>	3	4		2				1

SECTION 2: List any green skills, basic skills, or certifications needed for your green workforce.

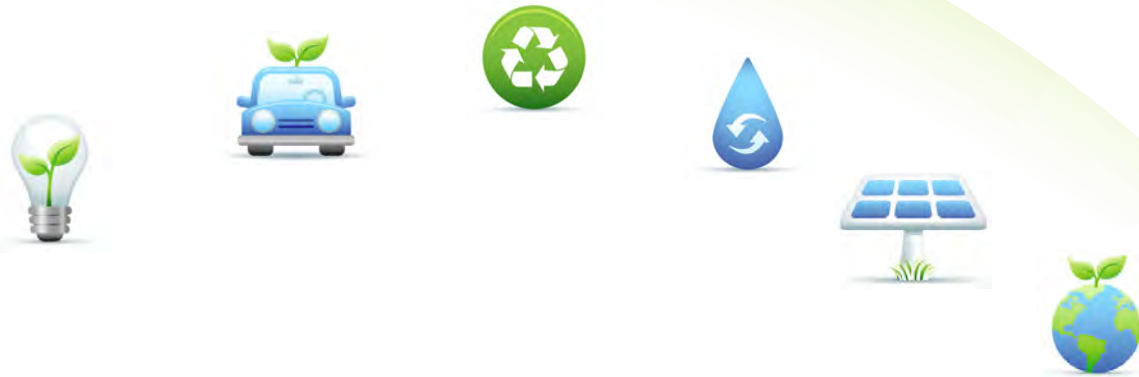
Green Skills	Basic Skills	Certifications

Thank you for your participation by August 13, 2010.

If more space is needed, please contact us for another copy or make a photocopy of this page.

For more information on Pennsylvania's Green Survey, please call (800) 837-3074; Fax: (360) 438-3215
 Washington State Employment Security Department, Labor Market and Economic Analysis; PO Box 9046 Olympia, WA 98507-9046
 For questions regarding the survey, E-mail: Robert Haglund at rhaglund@esd.wa.gov or Tim McElhinny at tmcElhinny@state.pa.us

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The Pennsylvania **Green** Jobs Survey Report

December 2010

Commonwealth of Pennsylvania

Edward G. Rendell, Governor

Sandi Vito, Secretary,
Department of Labor & Industry

Dr. Robert Garraty,
Deputy Secretary for Workforce Development,
Department of Labor & Industry

Sue Mukherjee, Director,
Center for Workforce Information & Analysis

For more information, call the
Center for Workforce Information & Analysis
at (717) 787-3266
or visit www.paworkforce.state.pa.us.

