Green Jobs in Indiana

Employment Prospects in the Green Economy

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INDIANA WORKFORCE DEVELOPMENT
AND ITS WorkOne CENTERS

Indiana Green Jobs

EMPLOYMENT PROSPECTS IN THE GREEN ECONOMY

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DRIVING CHANGE
Greening the Automotive Workforce

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For more information, visit www.drivingworkforcechange.org.

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Executive Summary

Structural and cyclical economic forces have had a devastating effect on the labor force across the entire economy and the auto sector especially. Well before the Great Recession, as the auto industry restructured, Indiana steadily lost auto sector jobs. Those small but steady losses during good economic times turned into a torrent as the economic downturn took hold.

Many workers who lost jobs still need work and many will never be hired back into the auto industry. Team assemblers and assemblers/fabricators were the two auto manufacturing occupations experiencing the largest job losses. More than 60 percent of these workers have only a high school education. Where will these displaced workers find jobs?

Many economists, workforce analysts and policymakers across the nation assert that the burgeoning green economy may provide new job opportunities. There is great interest in obtaining information about the quantity and characteristics of jobs produced by the green economy, but traditional sources of information on industries and occupations are not specific enough to accurately measure the number of green jobs in the economy.

The green jobs research documented in this report attempts to answer the following questions:

- Is the green economy of sufficient size to absorb workers displaced as a result of manufacturing restructuring and the Great Recession?
- In what industries are green jobs concentrated?
- What are the characteristics of green jobs—the types of work activities, expectations for hiring and training requirements?
- Are green occupations expected to grow in Indiana?
- What other occupations have brighter prospects for growth?

Indiana, like Michigan and Ohio (the other Driving Change research partners), conducted a statewide green jobs survey to help answer the first three questions, essentially providing a benchmark for the number and characteristics of green jobs in each state.

The Indiana research team also compiled secondary data on the current labor market supply and demand as well as federal and state occupation projections. The Driving Change research—collecting these data, conducting these analyses and developing resources to identify the occupations with the brightest future prospects—is motivated by helping displaced workers find new jobs.

Survey Findings

The survey results show that green jobs span a wide range of industries and occupations from engineering jobs to production jobs. More specifically:

- Indiana has an estimated 46,879 direct green jobs, or 1.7 percent of Indiana's total workforce. There are also 17,400 jobs that support green production activities.
- Green jobs are concentrated in manufacturing and construction, the industries most affected by the recent economic downturn. Because green jobs are concentrated in industries that are cyclical, they are more sensitive to economic cycles.
- Most green job in Indiana are involved in either increasing energy efficiency or in agriculture and natural resource conservation.
- Employers stated that most green jobs simply required on-the-job training. This finding comports with other Driving Change research that found that production green jobs did not require special skills, but jobs such as engineering did.

The surveys found that demand for these jobs varied across Indiana based on the industry mix and employers' perceptions of green. Surprisingly, there were significant differences in the green jobs survey results between Michigan and Indiana that can only partially be explained by the different types of production activities in the two states.

Occupations of Opportunity

Despite the effects of the Great Recession, industries within the professional, scientific and technical services sector were not only less sensitive to the economic downturn, but employment actually increased through 2009. Unfortunately, Indiana is not relatively strong in engineering, testing and consulting services and agriculture and natural resource conservation, the green-related industry clusters that have enjoyed employment growth from 2005 through 2009.

The occupations that are in demand today and poised for high growth in the future are those requiring expanded skill sets and higher levels of education and training. Automakers stated in interviews conducted as part of the Driving Change project that green products and production techniques will have a more profound effect on engineering and technical staff requirements than on the production and trades worker skill sets.

About 16 percent of growing jobs in Indiana are green. Of the 256 unique occupations that are growing—both in high demand and earning above average wages—only 42 are green. Those green occupations are concentrated in two families of jobs: the construction and extraction occupations and the architecture and engineering occupations. Growing but non-green jobs are concentrated in two job families: healthcare practitioners and technical occupations and the business and financial operations occupations.

Most of the green occupations are in the STEM disciplines and management positions that require a higher level of education. As a result, a green job, on average, has a wage premium of $7,700 compared to a non-green growing occupation.

Conclusion

For the dislocated worker, the question of how to move from an old job to a new occupation job is far from academic. The Driving Change research consortium overriding purpose is to assist

the dislocated worker to meet the challenges of a changing labor market. As a result, the project has developed resources and web-based tools to help workers navigate the transition from one job to another. In addition to the new pathway career cluster analysis and a simple method to measure the estimated time to transition to a new occupation,[1] the consortium has also developed the Tri-State Training Program Database that can help dislocated workers make decisions about which new occupations make the most sense for them.

These resources, tools and analysis will be online and free of charge, helping today's displaced workers in the tri-state region find suitable employment, but also serving as a foundation for expanding the workforce development toolkit in the future.

The Driving Change study has been a collaborative effort of workforce development agencies of Indiana, Michigan and Ohio and their strategic partners. This project was supported by a grant from the Employment and Training Administration, U.S. Department of Labor. The research was conducted by Indiana University, Kelley School of Business, Indiana Business Research Center and the Indiana Department of Workforce Development—Research and Analysis.

All Driving Change research findings, reports and resources can be found at:

www.drivingworkforcechange.org

[1] For more information about these resources, please see the companion report: Navigating Change: Exploring New Career Pathways in an Evolving Labor Market.

1. Introduction

The economic potential of the green economy is an increasingly high-profile topic in Indiana and across the nation.

Nationally, the 2009 American Recovery and Reinvestment Act targeted U.S. renewable energy industries and also funded investments in weatherizing federal buildings and private housing throughout the country.

There is also great interest in obtaining information about the quantity and characteristics of jobs produced by the green economy. Only recently, however, have private and public research organizations attempted to define and measure green jobs for the U.S. and for individual states.

There are several reasons for this. First, traditional information sources and databases on industries and occupations are not specific enough to accurately measure the number of green jobs in the economy. In addition, a uniform definition of green jobs is still under development. An examination of existing studies on the topic reveals that most reports define green jobs slightly differently. This makes it difficult to conduct direct comparisons and evaluate trends using these studies.

The need for better information about the green economy overwhelms the conceptual, measurement and data collection challenges. The effects of climate change, the potential health benefits from pollution prevention, the need to reduce domestic dependence on foreign oil, and the opportunity that the green sector presents for new business opportunities and job creation are all reasons for further study of the green sector.

The following analysis focuses on the jobs, industries and occupations of the green economy. This report presents the results from the first survey of Indiana employers to quantify the number of green jobs in Indiana. It focuses on the number and broad activities of current green jobs in Indiana and it serves as a baseline to track future green industry growth. As part of the broader Driving Change project, this report complements the other Driving Change detailed analytical reports that use existing workforce data from the Indiana Department of Workforce Development to assess the characteristics of auto-sector green jobs as well as other green and growing sectors.[2]

1.1 The Potential of Indiana's Green Economy

There are several dimensions to the green economy, from developing new technologies that advance the production and use of clean energy to activities that conserve or even augment the earth's natural resources. "Green businesses" provide products or services that are ecologically, as well as economically, sustainable.

[2] Learn more information about the Driving Change project and access additional reports at www.drivingworkforcechange.org/.

In contrast to this broad understanding of the green economy, researchers need definitions that are more precise and focus on specific economic sectors. This report defines the Indiana green economy as industries that provide products or services related to renewable energy, increased energy efficiency, clean transportation and fuels, agriculture and natural resource conservation, and pollution prevention or environmental cleanup.

As the green economy expands, Hoosiers will realize a variety of benefits. First, greener energy production will necessitate the manufacture of new equipment for electricity generation. An emphasis on sustainable energy sources would help reduce the state's carbon footprint and improve air and water quality. Expanding green and sustainable energy production would also support national goals of meeting future energy needs while reducing reliance on foreign oil.

Major benefits may also accrue to Indiana's workforce. The greening of the economy may hold the promise of new and diverse employment opportunities. By moving the economy toward renewable and clean energy, Indiana can establish a more diverse mix of industries, be better positioned to capitalize on future high-growth sectors and reduce the cyclical effects of economic downturns. Indiana's long-term goal has been to increase the diversification of the state economy and invest in the jobs of the future. Existing Indiana companies would benefit by transforming their products, parts and services to supply the many sectors within the green economy.

1.2 Defining Green Jobs

Previous research has used many different conceptualizations, definitions and methods for a green job. If defined too broadly, the term "green jobs" can quickly lose relevance or can be impossible to quantify or measure. That said, the definition for a green job must be flexible enough to encompass the different economic activities that are related to the production of green products or services.

In this study, researchers estimated the number of green jobs in the Indiana economy by surveying employers, who provided head counts using categories for the green activities of their employees. Based on definitions culled and refined from previous attempts to measure green jobs and the green economy, researchers asked employers the number of green jobs at their locations. The following definitions, or guideposts, helped employers determine whether a job was green or not:

- **Green Economy**: Industries providing products or services related to renewable energy, increased energy efficiency, clean transportation and fuels, agriculture and natural resource conservation, and pollution prevention or environmental cleanup.
- **Green Jobs**: Primary occupations engaged in generating a firm's green-related products or services, as well as other support jobs created by the firm's green-related revenue.
- **Green-Related Industry**: A detailed industry sector likely to contain firms that produce parts, components, products or services related to the green economy.

Industries and firms were classified as green-related based on their primary product or service, not based on whether they were taking internal steps to use less energy or be more environmentally responsible.

- **Green-Related Occupations**: Green-related industries frequently use job titles that are green or green-related. These green-related occupations have a variety of educational and skill levels, such as:
    - Scientists and engineers involved in energy research
    - Skilled production workers utilized in a manufacturing setting
    - Critical occupations at small, start-up green firms, such as technical sales staff
    - Construction laborers and skilled trades used in LEED construction projects

1.3 The Tri-State Research Approach

The Labor Market Information agencies of Indiana, Michigan and Ohio, together with research partners in each state, comprise the Driving Change research consortium. The consortium used a three-pronged approach to study green jobs. The qualitative approach used focus groups and employer surveys to understand the green transformation in the workforce, especially in the auto sector. The analytical approach used secondary state and federal data—merging labor market information, industry and occupation statistics to determine trends and measure work force training needs for the future. The third prong—the quantitative approach—was the employer survey. The present report focuses on the results of Indiana's green jobs survey, as well as the secondary data analysis.

The survey was critical because it is not possible to accurately estimate the current number of green jobs using standard information sources. The survey also helped to identify the share of jobs in detailed industries related to the green economy. The survey questions classified green workers by core green activity. In addition, the survey collected information regarding employer expectations about future green employment levels, about difficulty in hiring qualified workers, whether green occupations require unique skills and whether green occupations need special employee training.

In the second quarter of 2010, the Indiana Department of Workforce Development and the Indiana Business Research Center conducted the Indiana Green Jobs Survey. The Ohio Department of Job and Family Services conducted its green jobs survey in the first quarter of 2011. These were the first attempts to survey employers directly to measure the current number of green jobs in these states. Michigan had already completed a green jobs survey in the first quarter of 2009.

Before embarking on their green jobs survey, the Michigan research staff conducted an extensive review of existing studies on the green economy. As of late 2008 and early 2009, several states had recently conducted, or were conducting, studies on green jobs and the green economy. After reviewing the survey methods and instruments across these states, Michigan settled on a survey design adapted from one employed in Washington.

The research staffs in Indiana and Ohio also reviewed previous research on defining and measuring green jobs conducted by other states and found that Michigan's methodology was rigorous and well implemented. To the degree possible, both Indiana and Ohio followed Michigan's green jobs definition and survey methodology step for step. In this way, Indiana and Ohio could gain from Michigan's experience in conducting such a survey. In addition, sharing a common method would allow for greater comparability across the three states.[3]

[3] More information about green jobs in the tri-state region is available at www.drivingworkforcechange.org/greenjobs.asp.

2. Indiana Green Jobs Survey Results

To estimate the number of green jobs in the Indiana economy, the Indiana Department of Workforce Development (IDWD) and the Indiana Business Research Center (IBRC) conducted a statewide employer survey during the second quarter of 2010. The sample of survey respondents, representing a broad spectrum of private as well as public sector industries, provided information on existing green jobs by detailed occupation in their respective firms. This chapter presents the survey results.

Based on the survey data, Indiana employers currently have an estimated 46,879 direct green jobs. **Table 1** shows the distribution of those jobs among the five core green areas. Green jobs accounted for 1.7 percent of total employment in Indiana. Further detailed survey results, including the primary industry sectors that generate green jobs, the occupational concentration of these jobs, and employers' future expectations regarding hiring, skills and training are provided in the narrative that follows.

Table 1: Summary of Indiana Direct Green Jobs by Core Area

Core Area	Direct Green Jobs	Percentage of All Direct Green Jobs
Total Direct Green Jobs	**46,879**	**100.0%**
Increasing Energy Efficiency	15,715	33.5%
Agriculture and Natural Resource Conservation	10,334	22.0%
Pollution Prevention and Environmental Cleanup	9,003	19.2%
Renewable Energy Production	4,152	8.9%
Clean Transportation and Fuels	2,234	4.8%
Green Jobs Not Assigned to a Core Area	5,442	11.6%

Source: IBRC, using Indiana Green Jobs Survey data

Most of the information collected in the survey reflects only "direct" green jobs: those employees whose primary function is the production of green-related products or services for a particular firm. The presence of direct green business activities, however, may also generate additional jobs to support those direct green activities. These support jobs range from accounting staff to human resources staff to clerical staff. For example, a manufacturing firm may have 20 machinists building wind turbine blades, as well as one accountant and two clerical positions that support the wind turbine business. Without the wind turbine blade revenue, the three support jobs would not exist.

Thus, in addition to collecting data on the number of direct green jobs, the survey asked firms to quantify the number of jobs that support their green business activities. The survey results show that an additional 17,437 jobs support green business activities in Indiana.

2.1 Direct Green Jobs by Core Green Area

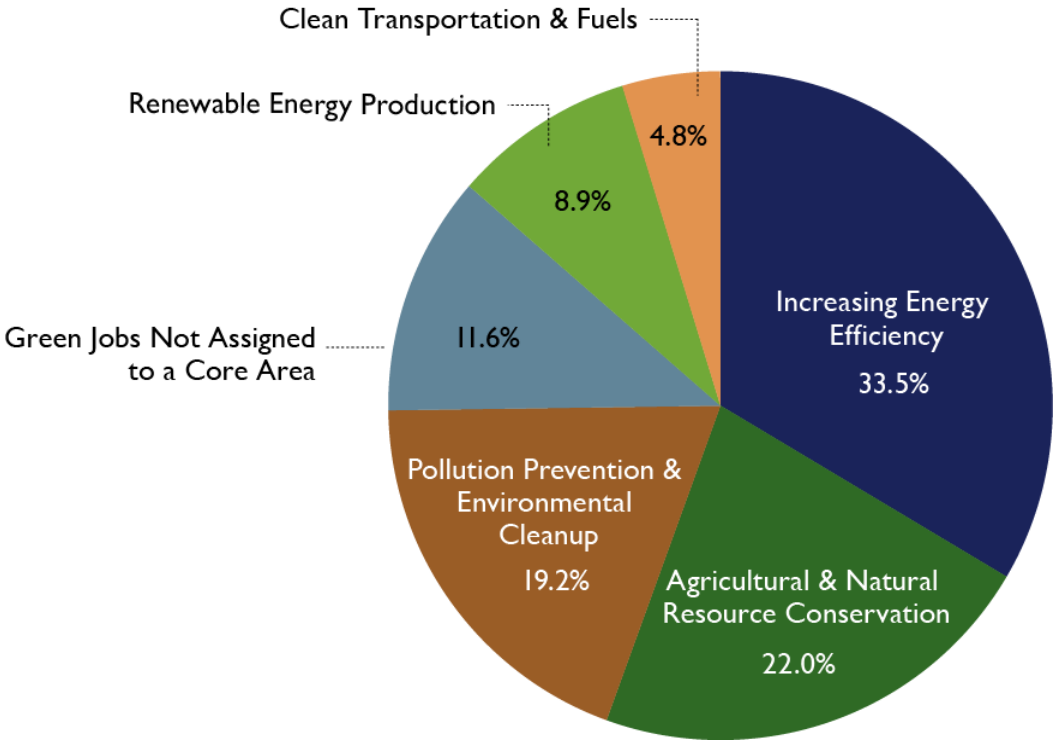
One reason for conducting a new survey to estimate the number of green jobs in the Indiana economy is that existing economic classification systems and databases are not designed for measuring the green economy. For example, industries are classified based on the North American Industrial Classification System (NAICS), but this system has limits in the measurement of green jobs. NAICS is based on how products or services are produced, not who consumes them or why. NAICS does not differentiate a tailor who makes shirts of polyester from one that uses organic cotton. In the same way, no code or group of codes distinguishes a firm producing gears for wind turbines from a firm that produces gears for race cars. An industry classification is no indication of whether an establishment is "green" or not.

As a result, the Indiana survey asked firms to identify occupations that were green-related and classify them into the following green "core areas:"

- Agriculture and natural resource conservation
- Clean transportation and fuels
- Increasing energy efficiency
- Pollution prevention and environmental cleanup
- Renewable energy production

These categories add to the data by contrasting the number of Indiana green jobs in each of these core areas (i.e., categories of business activities). These core areas illustrate the primary green business activities that generate jobs in the Indiana economy. **Figure 1** presents the distribution of green jobs in Indiana by core area according to the survey results.

Figure 1: Distribution of Indiana Direct Green Jobs by Core Area



Source: IBRC, using Indiana Green Jobs Survey data

Considering the importance of the auto industry in Indiana, the clean transportation and fuels core area accounts for a surprisingly small share of the state's green jobs, less than 5 percent of the total. In contrast, increasing energy efficiency accounted for 33.5 percent of green jobs in Indiana. This core area is most closely associated with the construction industry. The next largest area was agriculture and natural resource conservation, at 22.0 percent of green jobs in the state.

2.2 Direct Green Jobs by Detailed Industry

Going beyond the broader core areas identified by the survey, a key next step was to examine the primary industry sectors in Indiana that generate large numbers of green jobs. **Table 2** presents survey results on the primary industries that generate the largest numbers of Indiana's green jobs based on three-digit NAICS industry classification.

Table 2: Top Indiana Industries Generating Direct Green Jobs

NAICS	Industry	Green Jobs	Total Jobs	Green Jobs as a Percent of Industry Employment
238	Specialty Trade Contractors	10,411	76,681	13.6%
561	Administrative and Support Services	5,826	132,113	4.4%
541	Professional, Scientific, and Technical Services	5,322	94,278	5.6%

NAICS	Industry	Green Jobs	Total Jobs	Green Jobs as a Percent of Industry Employment
423	Merchant Wholesalers, Durable Goods	4,483	69,569	6.4%
924	Administration of Environmental Quality Programs	2,809	4,475	62.8%
325	Chemical Manufacturing	1,947	29,337	6.6%
236	Construction of Buildings	1,872	30,525	6.1%
336	Transportation Equipment Manufacturing	1,709	78,736	2.2%
332	Fabricated Metal Product Manufacturing	1,350	45,696	3.0%
811	Repair and Maintenance	919	25,800	3.6%
111	Crop Production	781	5,950	13.1%
921	General Government Administration	704	86,073	0.8%
333	Machinery Manufacturing	687	36,143	1.9%
321	Wood Product Manufacturing	592	11,481	5.2%
326	Plastics and Rubber Products Manufacturing	374	31,210	1.2%
221	Utilities	295	17,081	1.7%
112	Animal Production	82	5,410	1.5%
999	All Other Combined Industries	6,716	449,615	1.5%

Source: IDWD, QCEW 2009Q2 for total jobs; IBRC, Indiana Green Jobs Survey data for green jobs

Somewhat surprisingly, a majority of Indiana green jobs were not in manufacturing industries. Rather, construction, services and trade accounted for well over 60 percent of green jobs. Of the 17 industries presented in **Table 2**, only six industries were engaged in manufacturing and accounted for a mere 6,660 of the 40,160 jobs detailed in the table. In contrast to research consortium partner Michigan—reporting 25,780 green jobs in transportation equipment manufacturing in 2009—Indiana posted a mere 1,700. This may be attributed to the fact that many of the Michigan green jobs in this industry are involved in engineering and design, occupations that are focused on improving fuel economy and developing new electric vehicles. Indiana, on the other hand, produces many auto parts that may or may not be a component of a green vehicle.

As in Michigan, Indiana's green jobs span across a wide range of industries. The professional, scientific and technical services and specialty trade contractors were in the top three industries for green jobs in both states.

Table 3 highlights the greatest industry concentration of green jobs for each core area. In accordance with the economic makeup of Indiana, detailed industries in the construction and manufacturing sectors contribute a significant job share to several core areas. For the most part, green jobs in the core areas were highly concentrated in two or three industry sectors. Employment in increasing energy efficiency, the largest core area, was distributed in construction, manufacturing, and professional, scientific and technical services.

Table 3 presents the total number of green jobs in that industry, the number of jobs in that core area and the percentage of total core area green jobs in a specific industry. Crop production, for

instance, has a total of 781 green jobs, of which 632 are in the core area of agriculture and natural resource conservation. Within that core area, crop production accounts for a relatively small share, about 6.1 percent of all the green jobs in that core area.

Table 3: Dominant Industries for Direct Green Jobs by Core Area

NAICS	Industries within Core Area	Green Jobs in Industry	Green Jobs in Core Area	Percentage of Green Jobs in Core Area
Increasing Energy Efficiency			**15,715**	
238	Specialty Trade Contractors	10,411	8,190	52.1%
541	Professional, Scientific, and Technical Services	5,322	1,986	12.6%
236	Construction of Buildings	1,872	1,334	8.5%
332	Fabricated Metal Product Manufacturing	1,350	668	4.3%
336	Transportation Equipment Manufacturing	1,709	597	3.8%
Agricultural and Natural Resource Conservation			**10,334**	
561	Administrative and Support Services	5,826	3,774	36.5%
924	Administration of Environmental Quality Programs	2,809	2,417	23.4%
541	Professional, Scientific, and Technical Services	5,322	1,061	10.3%
423	Merchant Wholesalers, Durable Goods	4,483	966	9.3%
111	Crop Production	781	632	6.1%
Pollution Prevention and Environmental Cleanup			**9,003**	
541	Professional, Scientific, and Technical Services	5,322	2,101	23.3%
561	Administrative and Support Services	5,826	1,863	20.7%
238	Specialty Trade Contractors	10,411	752	8.4%
423	Merchant Wholesalers, Durable Goods	4,483	653	7.3%
921	General Government Administration	704	442	4.9%
Renewable Energy Production			**4,152**	
325	Chemical Manufacturing	1,947	1,696	40.8%
238	Specialty Trade Contractors	10,411	358	8.6%
423	Merchant Wholesalers, Durable Goods	4,483	339	8.2%
333	Machinery Manufacturing	687	203	4.9%
321	Wood Product Manufacturing	592	150	3.6%
Clean Transportation and Fuels			**2,234**	
336	Transportation Equipment Manufacturing	1,709	1,002	44.9%
811	Repair and Maintenance	919	282	12.6%
326	Plastics and Rubber Products Manufacturing	374	203	9.1%
423	Merchant Wholesalers, Durable Goods	4,483	119	5.3%
333	Machinery Manufacturing	687	105	4.7%

Source: IBRC, using Indiana Green Jobs Survey data

While a few industry sectors dominate employment in the individual core areas, some industry sectors are vital to multiple segments of the green economy. Merchant wholesalers of durable goods, for example, cut across four core green areas, with increasing energy efficiency being the only core area without a significant presence in this industry. Specialty trade contractors and professional, scientific and technical services industries cut across three core areas. Specialty trade contractors are of particular note. They engage in a wide variety of construction-related activities from site preparation to electrical work. Employment in this sector is highly concentrated in the energy efficiency core area, representing more than half of the core area's green employment. Administrative and support services, found in three of the five core areas, includes the employment services industry, whose employees may be contracted to other industries. Industry assignments for such workers are generally unavailable from employment services firms.

2.3 Green Jobs by Detailed Occupation

The survey also asked companies to specify the detailed occupational titles for employees working in any of the green core areas. These responses, translated into Standard Occupational Classification (SOC) codes, provide survey-based estimates of the types of jobs and job titles most prevalent in Indiana's green economy. In addition, employers provided employment estimates for these occupations. **Table 4** lists the occupations in Indiana with the most green jobs, according to the survey results.

There does not appear to be a common theme among the more prominent green occupations in Indiana. Landscaping and grounds keeping workers reported the largest share of green-related jobs in Indiana, accounting for about more than 6 percent of Indiana's green employment. There was a smattering of production occupations (manufacturing), construction jobs and transportation and material handling occupations. Counterintuitively, occupations that are obviously green, such as environmental scientists and specialists and environmental engineers, command a smaller share of the occupation ledger at about 1 percent each. This may be explained by the fact that these positions are taken up by comparatively fewer, but more highly qualified, individuals. Also surprisingly, agriculture-related jobs do not appear to be an important source of green jobs in Indiana. Agriculture-related occupations supplied about 4 percent of green jobs reported in the survey.

Table 4: Leading Indiana Direct Green Occupations

SOC	Occupation	Total Direct Green Jobs	Percent of Total Direct Green Jobs
n/a	**Total, All Green Occupations**	**46,879**	**100.0%**
37-3011	Landscaping and groundskeeping workers	2,990	6.4%
47-2111	Electricians	1,906	4.1%
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	1,629	3.5%

SOC	Occupation	Total Direct Green Jobs	Percent of Total Direct Green Jobs
17-2051	Civil engineers	1,511	3.2%
47-2131	Insulation workers, floor, ceiling, and wall	1,501	3.2%
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	1,375	2.9%
43-9061	Office clerks, general	1,307	2.8%
53-7062	Laborers and freight, stock, and material movers, hand	1,269	2.7%
45-2092	Farmworkers and laborers, crop, nursery, and greenhouse	1,057	2.3%
37-2011	Janitors and cleaners, except maids and housekeeping cleaners	1,041	2.2%
51-1011	First-line supervisors/managers of production and operating workers	918	2.0%
17-2141	Mechanical engineers	873	1.9%
11-1021	General and operations managers	811	1.7%
51-2092	Team assemblers	630	1.3%
49-9042	Maintenance and repair workers, general	616	1.3%
47-1011	First-line supervisors/managers of construction trades and extraction workers	589	1.3%
47-2181	Roofers	570	1.2%
43-3031	Bookkeeping, accounting, and auditing clerks	568	1.2%
47-2031	Carpenters	548	1.2%
53-3032	Truck drivers, heavy and tractor-trailer	520	1.1%
17-2071	Electrical engineers	501	1.1%
11-9021	Construction managers	495	1.1%
19-2041	Environmental scientists and specialists, including health	474	1.0%
49-3023	Automotive service technicians and mechanics	473	1.0%
51-4081	Multiple machine tool setters, operators, and tenders, metal and plastic	469	1.0%
17-2081	Environmental engineers	457	1.0%
11-9141	Property, real estate, and community association managers	425	0.9%
11-3011	Administrative services managers	401	0.9%
45-2041	Graders and sorters, agricultural products	389	0.8%
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products	369	0.8%

Source: IBRC, using Indiana Green Jobs Survey data

Table 5 displays the distribution of green-related occupations by core area in a fashion similar to the approach of organizing industries based on the type of green business activity. The table presents the number of direct green positions for each occupation, the number of positions for that occupation in the core area and the core green area jobs as a share of that occupation (or percentage of green positions in the core area to the total direct green positions in that occupation).

As with the breakdown by industry, energy efficiency is the largest core green area in terms of direct jobs. The majority of occupations in the energy efficiency area are construction-related, with electricians and installation workers leading the occupation list.

Agriculture and natural resource conservation is Indiana's second largest core area for occupations. In keeping with Indiana's many farms, nurseries and greenhouses, the state has a significant number of farm workers and material movers. The largest occupation in the core area is landscaping and groundskeeping workers. This core area represents almost 80 percent of all the direct green jobs for this occupation.

The landscaping and groundskeeping occupation also appears in significant numbers in the core area of pollution prevention and environmental cleanup. Other occupations in this core area run the gamut from workers who operate recycling trucks and sanitation workers to the scientists and engineers who research and develop pollution control equipment. Nearly all janitors and cleaners, as well as environmental engineers, who were considered to have a direct green job are in this core green area.

The dominance of Indiana's automobile industry is not very evident from the green job titles in clean transportation and fuels. Only two production occupations, multiple machine tool setters and team assemblers, made the top five occupations list in this core area, accounting for about 25 percent and 7 percent shares, respectively. In contrast to Michigan, where over 40 percent of this core area was attributed to engineering occupations, relatively few engineers inhabit Indiana's clean transportation and fuels core area. One can speculate, however, that as demand and production of fuel-efficient and alternative fuel vehicles continues to grow, the share of jobs involved with the research, engineering and production in this core area will likely increase.

The renewable energy production core area is occupationally diverse, with a wide range of occupations providing green jobs, such as production workers, maintenance and repair workers, office personnel and sales representatives.

Table 5: Top Five Occupations in Each Core Green Area

SOC	Occupation	Total Direct Green Jobs	Direct Green Jobs in Core Area	Share of Core Area Direct Green Jobs by Occupation
Increasing Energy Efficiency			**10,065**	
47-2111	Electricians	1,906	1,885	98.9%
47-2131	Insulation workers, floor, ceiling, and wall	1,501	1,501	100.0%
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	1,375	1,224	89.0%
17-2051	Civil engineers	1,511	1,197	79.2%
41-4012	Sales representatives, wholesale and manufacturing, except technical and scientific products	1,629	1,178	72.3%

SOC	Occupation	Total Direct Green Jobs	Direct Green Jobs in Core Area	Share of Core Area Direct Green Jobs by Occupation
Agricultural and Natural Resource Conservation			**6,306**	
37-3011	Landscaping and groundskeeping workers	2,990	2,377	79.5%
45-2092	Farmworkers and laborers, crop, nursery, and greenhouse	1,057	1,008	95.4%
53-7062	Laborers and freight, stock, and material movers, hand	1,269	523	41.2%
43-9061	Office clerks, general	1,307	466	35.7%
11-9141	Property, real estate, and community association managers	425	418	98.4%
Pollution Prevention and Environmental Cleanup			**5,870**	
37-2011	Janitors and cleaners, except maids and housekeeping cleaners	1,041	952	91.5%
37-3011	Landscaping and groundskeeping workers	2,990	597	20.0%
53-7062	Laborers and freight, stock, and material movers, hand	1,269	555	43.7%
11-1021	General and operations managers	811	446	55.0%
17-2081	Environmental engineers	457	427	93.4%
Renewable Energy Production			**2,429**	
51-8091	Chemical plant and system operators	280	280	100.0%
51-1011	First-line supervisors/managers of production and operating workers	918	248	27.0%
43-9061	Office clerks, general	1,307	247	18.9%
41-4011	Sales representatives, wholesale and manufacturing, technical and scientific products	369	200	54.2%
49-9042	Maintenance and repair workers, general	616	183	29.7%
Clean Transportation and Fuels			**1,348**	
51-4081	Multiple machine tool setters, operators, and tenders, metal and plastic	469	345	73.6%
53-3021	Bus drivers, transit and intercity	297	297	100.0%
49-3023	Automotive service technicians and mechanics	473	167	35.3%
17-2141	Mechanical engineers	873	140	16.0%
51-2092	Team assemblers	630	96	15.2%

Source: IBRC, using Indiana Green Jobs Survey data

2.4 Expectations about Future Trends

Expectations of employers regarding current and future green-related workforce needs are critical elements to understanding the development of the green economy. Accordingly, the survey asked employers about (1) expected future job gains in green occupations, (2) expected

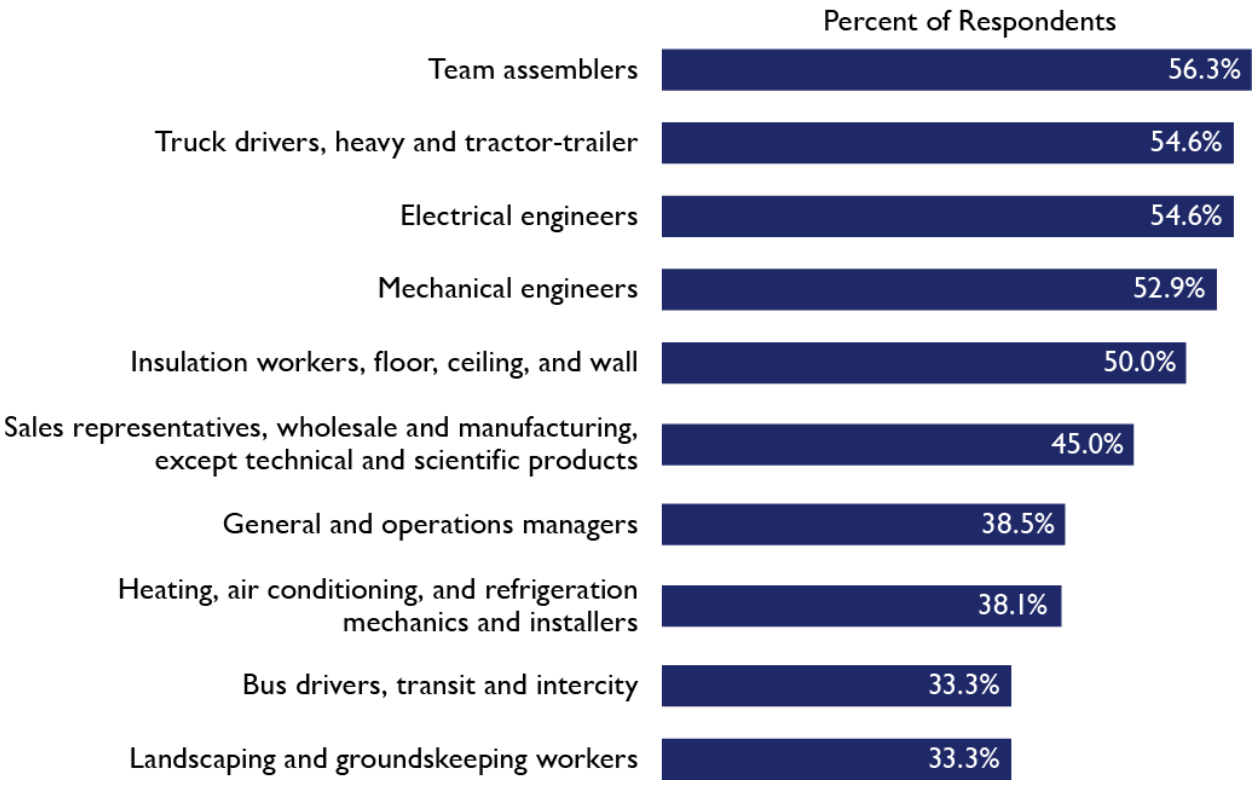
difficulty filling future green job vacancies, (3) whether occupations require unique skills when working on green projects, and (4) the potential use of formal versus informal training for existing and new green workers.

2.4.1 Hiring

Employers were asked to estimate their expectation for employment by 2012 for each current green occupation. **Figure 2** displays the occupations for which an above-average share of employers anticipate additional jobs in the next two years. This information does not represent actual employment forecasts but does provide clues of occupations with some potential for future short-term employment gains.

These growth occupations represent a broad range of skill levels. Future green jobs will demand various levels of skills and training. Some are mid- to lower-skilled occupations that require primarily on-the-job training, such as team assemblers; heating, air conditioning, refrigeration mechanics and installers; construction laborers; and landscaping and groundskeeping workers. Other green jobs with positive future employment prospects are higher-skilled occupations, such as engineers. These jobs often require a four-year degree and several years of relevant work experience.

Figure 2: Selected Green Occupations with Above-Average Percentage of Employers Indicating Likely Job Expansion in 2010-2012

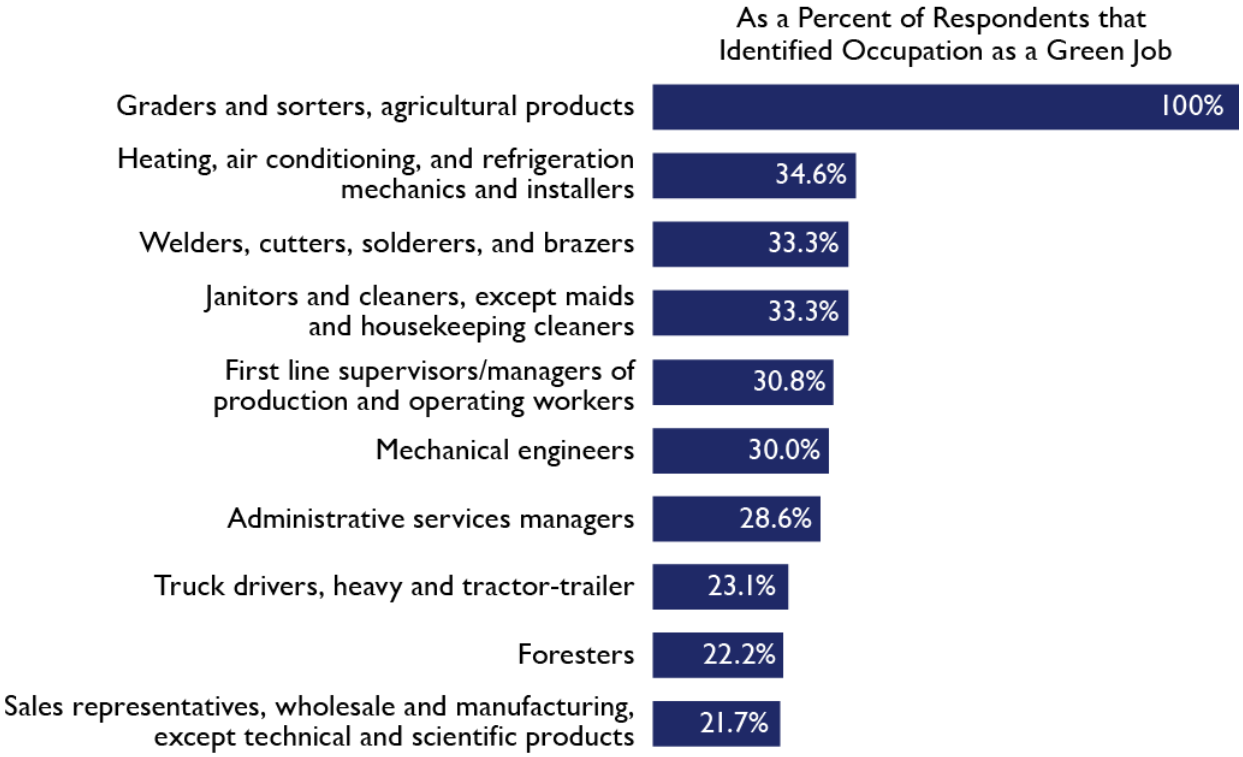


Source: IBRC, using Indiana Green Jobs Survey data

2.4.2 Filling Vacancies

Employers indicated on the survey the green occupations in which they anticipate difficulty in filling future job vacancies. While differences exist among industries, it is possible to identify specific occupations that employers believe will be especially hard to fill. **Figure 3** shows the percentage of employers that, having identified the occupation as a direct green job, expected recruitment difficulties in the future. With the exception of mechanical engineers and foresters, the occupations that employers anticipated difficulty in recruiting were those with low to medium levels of specialized skills and education.

Figure 3: Green Occupations Where Employers Anticipate Potential Recruiting Difficulties

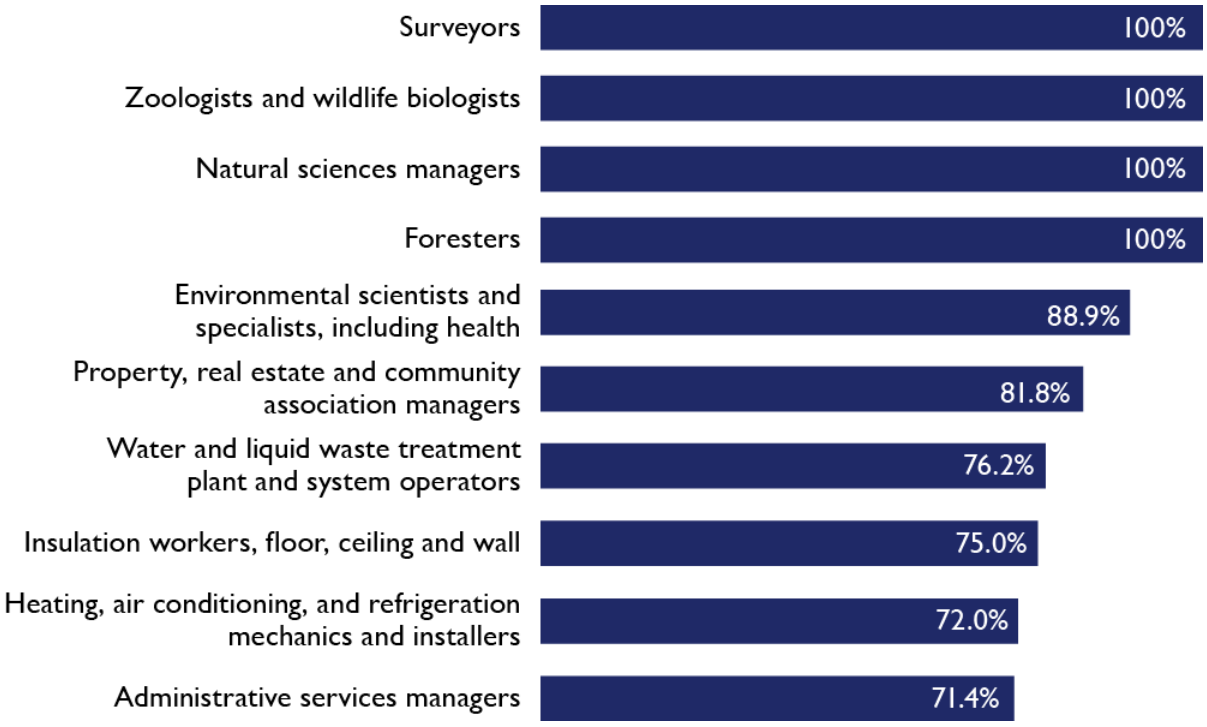


Source: IBRC, using Indiana Green Jobs Survey data

2.4.3 Unique Skills

Employers were also asked to identify occupations requiring unique skills when working on green projects or green business activities. As **Figure 4** shows, more than 70 percent of responding employers identified 10 occupations as requiring unique skills for green projects. This has implications for training programs, as individual green occupations will differ in their need for specialized training. Some occupations will require very skilled workers, but the skill sets used by those workers on a green project may be very similar to the skills they will use on other projects. This also has implications for incumbent workers who increasingly find themselves working on green projects, as well as potential new green workers hoping to transition from existing industries into the green economy.

Figure 4: Occupations that Require Unique Skills for Green-Related Projects



Source: IBRC, using Indiana Green Jobs Survey data

2.4.4 Training

In an attempt to measure the future training needs of employers and shed some light on the potential future green-related training capacity requirements in the state, the survey asked about the likely mix of training required for their green-related workforce. To keep the survey simple, employers indicated the proportions of these future green jobs requiring formal or informal-on-the-job training. Survey respondents expected that nearly 52 percent of their future green-related employee training would be conducted on the job, while only about 21 percent of respondents stated that their training needs would be formal. (Respondents were not required to answer the question or to ensure that the sum of their percentages equaled 100.)

2.5 Evaluating the Results

As noted earlier, the Indiana green jobs survey was part of a larger project conducted with Michigan and Ohio. While Ohio's survey results were not available at the time of this writing, making it impossible to compare or contrast the concentration and type of green jobs in Indiana with those in Ohio, it would be natural to compare Indiana's findings with Michigan's, especially considering that the Indiana research team borrowed heavily from Michigan's approach.

The percentages of jobs that are green are roughly half as large in Indiana as in Michigan. There are a couple of possible explanations for this difference—data collection timing and surveying both public and private establishments in Indiana being two obvious reasons. There are other considerations, however.

The structure of the economy is different between the two states. While both states are heavily dependent on the auto industry, the types of auto production in the two states differ. For example, there is considerably more automobile and component design, engineering and testing in Michigan than in Indiana.

This is reflected in the rankings of the five core areas in the two states, as **Table 6** shows. In Michigan, the clean transportation and fuels core area accounts for more than 40 percent of the green jobs in the state. In Indiana, that core area is less than 5 percent. In Michigan, engineers account for more than 40 percent of the jobs in the clean transportation and fuels core area. One can surmise that these Michigan engineers must be working to improve fuel efficiency or transform powertrains to electric. In contrast, the workers in clean transportation and fuels in Indiana tend to be in the trades, with engineers representing only 10 percent of the jobs in this core area.

Table 6: Summary of Indiana and Michigan Direct Green Jobs by Core Area

Core Area	Indiana Percentage of Direct Green Jobs	Michigan Percentage of Direct Green Jobs
Total Direct Green Jobs	**46,879**	**96,767**
Increasing Energy Efficiency	33.5%	23.0%
Agriculture and Natural Resource Conservation	22.0%	12.4%
Pollution Prevention and Environmental Cleanup	19.2%	12.8%
Renewable Energy Production	8.9%	9.1%
Clean Transportation and Fuels	4.8%	40.6%
Green Jobs Not Assigned to a Core Area	11.6%	2.1%

Source: IBRC, using Indiana Green Jobs Survey data; *Michigan Green Jobs Report* (2009)

The greatest proportion of green jobs in Indiana is in the core green area of increasing energy efficiency. In this core area, Indiana looks similar to Michigan. Many businesses hiring these green workers are in the construction trades, and the occupations involve installing or servicing heating and air conditioning or construction workers insulating floors, ceilings and walls.

Other differences between the states, however, are more of a puzzle, at least at first blush.

Table 7 presents a summary of the top Indiana and Michigan industries that generate green jobs. One might expect that the percentage of green jobs for a particular industry would not diverge so greatly between states. Staffing patterns—the mix of occupations reported at a particular establishment[4]—even within a NAICS-defined industry—can differ. But would they differ to such a degree that one industry in Indiana has several times the number of occupations engaged in core green activities as in Michigan, or vice versa? The survey results suggest that,

[4] Recall that an establishment is one location (an address), even if a company has many different types of operations—e.g., manufacturing, distribution, customer service, research and development—spread over many locations (addresses).

between states, either staffing patterns or the degree to which an occupation is green, or both, may differ significantly.[5]

Table 7: Top Indiana and Michigan Industries Generating Direct Green Jobs

NAICS	Industry	Indiana Green Jobs as a Percent of Industry Employment	Michigan Green Jobs as a Percent of Industry Employment
924	Administration of Environmental Quality Programs	62.8%	n/a
238	Specialty Trade Contractors	13.6%	9.6%
111	Crop Production	13.1%	22.0%
325	Chemical Manufacturing	6.6%	3.7%
423	Merchant Wholesalers, Durable Goods	6.4%	2.9%
236	Construction of Buildings	6.1%	10.4%
541	Professional, Scientific, and Technical Services	5.6%	9.2%
321	Wood Product Manufacturing	5.2%	10.2%
561	Administrative and Support Services	4.4%	1.0%
811	Repair and Maintenance	3.6%	8.1%
332	Fabricated Metal Product Manufacturing	3.0%	2.5%
336	Transportation Equipment Manufacturing	2.2%	14.6%
333	Machinery Manufacturing	1.9%	2.4%
221	Utilities	1.7%	12.7%
921	General Government Administration	0.8%	n/a

Source: IBRC, using Indiana Green Jobs Survey data; *Michigan Green Jobs Report* (2009)

Contrasting the results based on core area may provide some clues. When dominant green job *industries* are classified based on core area, the differences between Michigan and Indiana are less notable. Of the top five industries for each core area, the states share three. In both states, the specialty trade contractors industry is distributed across the same three core areas. Three core areas in both states share professional, scientific and technical services, and even the fact that this industry in Michigan, unlike in Indiana, is also in the core area of clean transportation and fuels makes sense. Michigan establishments in this core area are heavily auto related, but less so in Indiana.

When dominant green job *occupations* are classified based on core area, the differences between the states do appear to be substantial. There is no overlap among the top five occupations in the core area of renewable energy production. Three core areas share only one occupation. Only the core area of agriculture and natural resource conservation shares two occupations between the two states.

[5] Note that the establishments for design and engineering staff for the automakers will fall under NAICS 541, professional, scientific and technical services. The manufacturing establishments that produce parts and assemble vehicles fall under NAICS 336, transportation equipment manufacturing.

There is another, less sanguine, reason that the industry and occupation results between the states differ across core areas. In one case, the industry classification—the NAICS code—was already assigned to the establishment by third-party subject matter experts. On the other hand, for the occupation, the respondent, who may or may not be a subject matter expert, had to identify both the appropriate core area and the correct occupation.

Without a detailed analysis of each state's particular staffing patterns, the best one can do is offer a tentative conclusion: the differences between the states are a result of differences in the occupational mix between states, and the occupations in which Michigan is relatively more concentrated are more apt to be green-related.

2.6 Assessing the Survey

The green jobs survey offers some novel insights, but also comes with some major caveats, as with any new study conducted on such a scale. The survey provides a glimpse into a phenomenon that, until now, has remained virtually unexamined in the state of Indiana. The results from the survey enable us to draw some conclusions about the state's green economy. Having presented the results and conclusions above, attention now turns to the scope and limitations of the survey.

The survey was large. It involved a sample of 13,520 firms, more than half of which responded. In contrast to the Michigan Green Jobs Survey, the Indiana survey included public establishments—offices and activities associated with state and local governments—as well as private, whereas Michigan surveyed only private firms. The Indiana response rate (50.9 percent) was slightly higher than Michigan's (49.0 percent).

In addition to the overall validity of the survey's findings, geographical stratification shows that the results can be generalized to each of the state's workforce regions. Response rates across regions ranged from about 47 percent to 57 percent. The two regions with response rates below 50 percent (46.8 percent and 49.8 percent) were also the two largest regions in terms of sample size and number of responses. As a result, one can be confident that the survey's results reflect the state as a whole and as the sum of its geographical parts.

Employers had several response options: mail, Internet survey, fax or phone. Respondents determined whether a job was green or not based on their perspective of what constituted green. The possible prejudice of the research team or the call center staff who were engaged to encourage participation in the survey did not bias the results; neither the researchers nor the call center agents determined whether an employer's job or collection of jobs were green.

This undirected approach is a double-edged sword, however. It provides an estimate of green jobs that is a reflection of employers' evaluation of what their employees do. If the establishment classifies the job as green in terms of one of the five core areas listed in the survey, then green it is. On the other hand, this subjects the notion of green to a much wider interpretation than if trained researchers had individually evaluated each job or if the call center agents provided an employer with guidance regarding the relevant core area that applied to a green job. Given the

ambiguity of what green means, the hands-off approach is a net positive because it reflects how employers view themselves, their products and their labor force.

On the other hand, this may account for the fact that the percentage of Indiana's green jobs that were not assigned to a core area—11.6 percent—was more than five times greater than Michigan's. In one instance, a relatively large company—large enough to influence the final results after sample adjustments for non-response—indicated to a call agent that their several hundred employees were involved a specific core green activity and promised to complete the survey online. The firm entered the number of green jobs in the web-based survey, but failed to identify the core area and the researchers did not have the contact information for the person that completed the survey.

This may also account for the divergence in the percentage of green jobs by industry (as shown in **Table 7**). In Michigan, 14.6 percent of employment in transportation equipment manufacturing (NAICS 336) is green, whereas in Indiana, it is only 2.2 percent. An auto plant in Indiana responded to the survey indicating that a handful of engineers had green jobs at that establishment. If another person at the same plant had completed the survey, that person may have replied indicated that the entire payroll—engineers, assembly and machinists—were green because the plant produced "energy-efficient cars." The auto sector was not the only industry that produces curious differences. The utilities industry (NAICS 221) in Michigan recorded over seven times the percentage of green jobs in the industry's workforce as in Indiana. Compared to Michigan, more than four times as many administrative and support services jobs in Indiana were reported as green. Could there really be such differences in staffing patterns—the mix of occupations by industry—between the two states?

Thus, the survey has limitations. Consistent with the Michigan Green Jobs survey, the Indiana survey listed five core green areas, only one of which could apply to a given job. But the survey results suggest that, just as one industry can cut across several core areas—green jobs in the heavily green professional, scientific and technical services industry were evenly distributed among three core areas—one job or occupation may also involve several core areas. Allowing for workplace activities that not only increase energy efficiency but also mitigate pollution and environmental damage, for example, may be a step forward in future green jobs research.

The survey and accompanying materials instructed respondents to classify jobs into the core green areas, based on occupation and workplace activity. One could argue, however, that green core areas pertain more to the output of a particular good or service than to a job activity. This suggests that an establishment's industry will heavily determine the degree of green and the type of green, i.e., the core area. As a result, it may make more sense to measure green jobs based on the output of green goods and services. This would obviate the need for the expense of surveying establishments and reduce the reporting burden on businesses. The number of green jobs could be easily tallied based on statistical programs that are already in place, like the Quarterly Census of Employment and Wages conducted by the BLS and state Labor Market Information

departments. Indeed, other studies took this industry-output approach; one example is the study by the Pew Charitable Trusts.[6]

An even better approach would likely be a "green economy satellite account" produced by the U.S. Bureau of Economic Analysis (BEA), in collaboration with other federal statistical agencies such as the BLS and Census Bureau. BEA currently releases economic statistics for several satellite accounts. Such a satellite account would not only provide green employment estimates, but also measure the size of the green economy, something a green jobs survey cannot do.

The Travel and Tourism Satellite Account (TTSA), for example, measures the size of the travel and tourism "industry." Producing the TTSA requires some analytical gymnastics not unlike what is required to define and measure the green economy. A travel and tourism industry does not exist as such. Production defines an industry. Travel and tourism, on the other hand, is based on the consumer. On a weekend trip, a tourist will eat at a restaurant, sleep at a hotel, golf, rent a car and take a guided tour. In this example, the tourist consumed the output of five distinct industries with five distinct production processes.

The same experience and talent that BEA has gained developing the TTSA, the Transportation Satellite Account and the future Research and Development Satellite Account could also be applied to measuring the green economy. In this way, green economic activity—the dollar-value and the number of jobs—would be defined rigorously and measured consistently over time.

A green economy satellite account does not preclude an occupational survey, however. As robust and consistent as a green satellite account may be, it would miss those employees that are engaged in green activities internal to the firm. A satellite account, based as it is on input-output relationship, measures only inter-industry transactions. If, for example, Walmart hires a consulting firm to reduce packaging—thus reducing shipment weight and fuel costs and lower waste stream volume—it would register in the satellite account. But if Walmart hired staff to implement the same program, those green activities would not register. Thus, a strong case can be made to augment the Occupational Employment Statistics (OES) Survey to collect data on staff assigned to the greening of production and other green processes within the firm. In addition, because these occupations can be linked with educational and training needs, these data can help inform training programs that develop the skill and knowledge sets needed for the future. In fact, the OES survey panel fielded in the spring of 2011 did include a green goods and services supplement for the first time. Publication of results for the nation and states is expected in the spring of 2012.

2.7 Summary

The information in this chapter would not have been possible without the participation of thousands of employers representing over 6,800 establishments that took the time to respond to the Indiana Green Jobs Survey. This effort has provided the first broad-scale set of survey-based estimates ever produced about Indiana's current levels of green jobs by detailed industry and

[6] Pew Charitable Trusts, "The Clean Energy Economy: Repowering Jobs, Businesses and Investments across America," Pew Center on the States, June 2009, www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf.

occupation. However, the survey asked a limited number of questions and could not address some critical variables regarding the green workforce, such as recent employment trends, more details on industries and occupations, and key topics such as the wages, skills, and educational requirements for green-related jobs today and in the future.

To address those issues, the following chapter in this report supplements the information from the employer survey by incorporating existing sources of labor market information. The use of multiple information sources will not only provide the most comprehensive understanding of green jobs in Indiana, but an assessment of broader employment trends on an industry and an occupational level.

3. Green-Related Industries in the Indiana Economy

The information from the survey on green jobs is the first attempt to collect data directly from employers on the current number of green jobs in Indiana. In an effort to minimize the reporting burden on the companies participating in the survey, the survey did not address many issues of interest regarding green jobs and green industries:

- Are there significant employment trends among firms in the green economy or among industries that appear related to the green economy?
- Which green-related industries support the most jobs or are expected to grow? Which ones are the most selective in terms of the type of employees they hire or have more stable employment?
- Which green-related industry sectors pay above-average wages?

This chapter presents data and analysis on "green-related industries." These are industries identified by the research team as sectors most likely to generate green jobs. The purpose of this section is to highlight the economic characteristics of these industries such as wage levels, employment trends, employment concentration and competitive employment performance.

While the previous chapter was more focused on occupations (job titles and job activities), this chapter uses an industry-based conceptual foundation. It is important, therefore, to define this concept and distinguish it from the green jobs estimates generated by the employer survey.

3.1 Green-Related Industry Analysis: The Data

Examining the green economy via industry employment data has several advantages. The Quarterly Census of Employment and Wages (QCEW) program, which collects employment information on a NAICS-based classification system, provides a wealth of information on detailed industry employment levels and wages. After identifying green-related industries, researchers can track jobs and wages for the green economy using the regularly-published QCEW data.

The first step, however, is to define the term "green-related industry."

3.1.1 Green-Related Industry

A green-related industry is one that produces parts, components, products or services in the five core areas of renewable energy, energy efficiency, clean transportation and fuels, agriculture and natural resources, and pollution prevention and environmental cleanup.

Identifying green-related industries is not straightforward. This is primarily because the NAICS classification system is not specific enough to identify specific green sectors. There is no single NAICS code or set of codes to capture all firms involved in wind energy, solar energy or research

into alternative fuels, although the 2012 NAICS revision will provide some improved breakouts for alternative energy generation.

As a result, the research team included many green-related industries that might be only faintly green. Analyzing this set of green-related industries is important because many Indiana firms in these industry sectors may benefit from the growth of the green economy. That said, since many industries are only partially related to green activities, employment trends can be affected by many factors beyond the growth of the green economy. Thus, one should evaluate employment dynamics with caution.[7]

The construction industry offers a good example for the need for cautious interpretation. Construction involves many green jobs that are related to energy efficiency, but the recent housing market crash resulted in employment dropping precipitously. The automobile industry is another case in point. While engineers in the auto industry are increasingly focused on technology development to improve the fuel efficiency of vehicles, the sharp drop in jobs in the overall Indiana auto sector will obscure any job gains among green workers in the industry.

The research team used the list of six-digit NAICS industries identified as "green-related" in the Michigan Green Jobs Report for the Indiana analysis. The Michigan study conducted a comprehensive literature review and investigation to develop its list of green-related industries. Like the Indiana research team, Michigan consulted with a consortium of labor market research organizations in several other states on the topic of defining industries and occupations related to the green economy. Moreover, the Michigan research staff conducted a comprehensive review of the NAICS coding system for industries that appeared to be "green-related" and vetted their industry list with a team of state government and private industry representatives. Given Michigan's thorough green industry-identification process, the Indiana research team adopted the NAICS list produced by Michigan.

3.2 Employment in Indiana's Green Industry Clusters

Consistent with Michigan's analysis, green-related industries account for more than 7 percent of total jobs in Indiana. The research team aggregated the detailed industries into clusters. The five core areas from the survey were augmented with two additional categories: miscellaneous green manufacturing and engineering, testing and consulting services.

The seven clusters are:

- Agriculture and natural resource conservation
- Clean transportations and fuels
- Increasing energy efficiency
- Pollution prevention and environmental cleanup
- Renewable energy production

[7] Using the green satellite account (input-output approach) discussed in section 2.6 allows detailed industries (six-digit NAICS) to be sub-divided even further based on the percentage of an industry devoted to producing green products or services. In other words, the green satellite account approach would tease out the definitely green portion of an industry from the green-related industry.

- Engineering, testing and consulting services
- Miscellaneous green manufacturing

The miscellaneous green manufacturing cluster includes manufacturing industries that do not focus solely on one area of the green economy. One example is the measuring and controlling device manufacturing industry, which engages in the production of controlling and measuring devices that have a wide range of applications—from measuring output of renewable energy plants to monitoring factories with the goal of preventing pollution.

There is a large collection of business, professional, scientific and technical service companies engaged in the green economy. As the green jobs survey showed, this service industry appeared in three of the five core green activity areas. Thus, the research team followed the lead of the Michigan green jobs survey and created an engineering, testing and consulting services cluster that contains many industries providing professional services across the green economy.

The research team assigned 118 green-related industries into green clusters based on each industry's associated activities, products and services. **Table 8** displays the top five industries with the highest employment for each of the green-related clusters. Increasing energy efficiency was the largest cluster, accounting for almost 90,000 jobs, or 45.5 percent of total employment in Indiana's green-related industries, as **Figure 5** shows. The dominance of this cluster is due primarily to construction and related industries such as electrical and plumbing contractors. It is appropriate that construction accounts for such a large portion of this cluster, since current actions in energy efficiency to a large extent deal with updating building structures.

Clean transportation and fuels was the second largest core cluster in terms of employment, accounting for just under 20 percent of total green-related employment, or about 39,000 jobs overall. The clean transportation and fuels cluster is comprised of detailed industries primarily in auto manufacturing and mass transit. The majority of jobs in this sector are in industries devoted to the production of vehicle parts.

Engineering, testing and consulting services was the third largest green cluster with close to 23,000 workers, comprising 11.6 percent of total green-related employment. All the detailed industries within this green cluster provide specialized expertise, such as technical, research or legal advice, to a variety of private and public clients.

Pollution prevention and environmental cleanup took the fourth spot among green clusters, accounting for 8.8 percent of total green-related employment. A quarter of the jobs in this cluster were in construction industries.

Miscellaneous green manufacturing provided more than 13,000 jobs. This cluster includes manufacturing industries engaged in producing a diverse set of products, ranging from wood to organic chemicals.

Renewable energy production provided more than 10,000 jobs, or just over 5 percent of green-related employment. Another 2.4 percent of green-related jobs were contributed by the agriculture and natural resource conservation cluster. (It is important to note that the

employment data does not capture self-employed workers, which is a significant component in agriculture.)

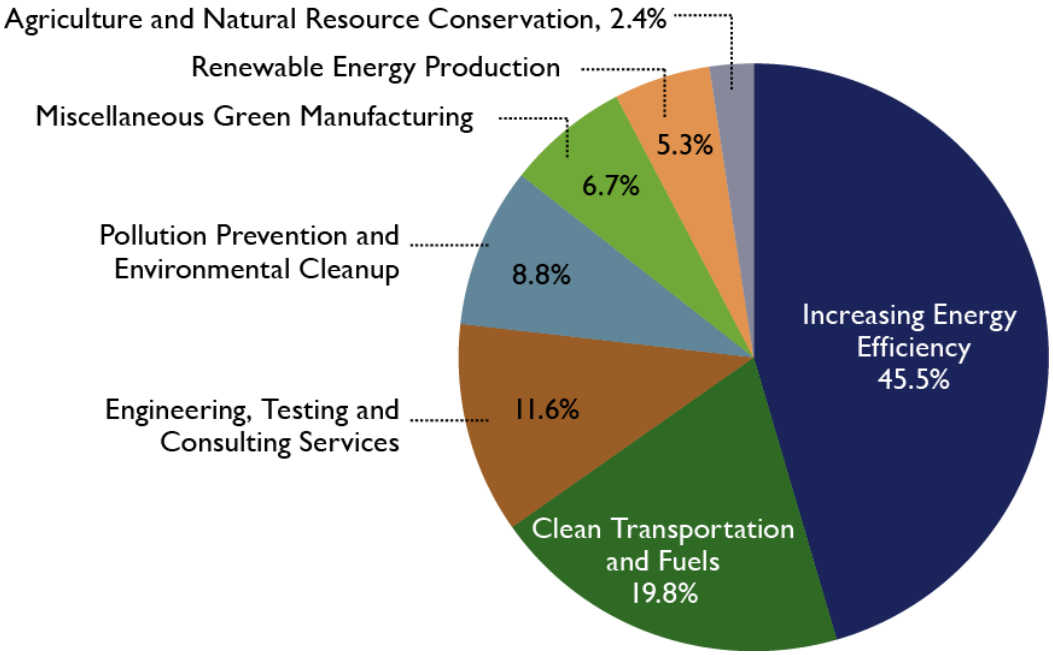
Table 8: Indiana Employment in Green-Related Industry Clusters, 2009

NAICS	Industry	2009 Employment	Share of Cluster	Share of Total Green-Related Employment
Increasing Energy Efficiency		**89,801**		**45.5%**
238222	Plumbing, Heating, and Air-Conditioning Contractors - Nonresidential	11,774	13.1%	6.0%
236220	Commercial and Institutional Building Construction	11,298	12.6%	5.7%
238212	Electrical Contractors and Other Wiring Installation Contractors - Nonresidential	9,739	10.8%	4.9%
238221	Plumbing, Heating, and Air-Conditioning Contractors - Residential	8,257	9.2%	4.2%
236210	Industrial Building Construction	6,013	6.7%	3.0%
Clean Transportation and Fuels		**39,134**		**19.8%**
336350	Motor Vehicle Transmission and Power Train Components	12,891	32.9%	6.5%
336399	All Other Motor Vehicle Parts Manufacturing	8,970	22.9%	4.5%
336412	Aircraft Engine and Engine Parts Manufacturing	6,014	15.4%	3.0%
336111	Automobile Manufacturing	3,970	10.1%	2.0%
336360	Motor Vehicle Seating and Interior Trim	3,007	7.7%	1.5%
Engineering, Testing and Consulting Services		**22,814**		**11.6%**
541330	Engineering Services	12,717	55.7%	6.4%
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)	2,402	10.5%	1.2%
541380	Testing Laboratories	2,318	10.2%	1.2%
541620	Environmental Consulting Services	1,231	5.4%	0.6%
541690	Other Technical Consulting Services	1,179	5.2%	0.6%
Pollution Prevention and Environmental Cleanup		**17,280**		**8.8%**
237110	Water and Sewer Line and Related Structures Construction	4,269	24.7%	2.2%
423930	Recyclable Materials Merchant Wholesalers	3,688	21.3%	1.9%
562111	Solid Waste Collection	3,107	18.0%	1.6%
238911	Site Preparation Contractors	1,705	9.9%	0.9%
562910	Remediation Services	1,338	7.7%	0.7%

NAICS	Industry	2009 Employment	Share of Cluster	Share of Total Green-Related Employment
Miscellaneous Green Manufacturing		**13,143**		**6.7%**
321920	Wood Container and Pallet Manufacturing	2,342	17.8%	1.2%
326113	Unlaminated Plastics Film and Sheet (Except Packaging)	2,083	15.8%	1.1%
335312	Motor and Generator Manufacturing	1,943	14.8%	1.0%
325211	Plastics Material and Resin Manufacturing	1,588	12.1%	0.8%
334513	Industrial Process Variable Instruments	1,247	9.5%	0.6%
Renewable Energy Production		**10,470**		**5.3%**
221122	Electric Power Distribution	2,849	27.2%	1.4%
221210	Natural Gas Distribution	2,035	19.4%	1.0%
221310	Water Supply and Irrigation Systems	1,901	18.2%	1.0%
237130	Power and Communication Line and Related Structures Construction	1,657	15.8%	0.8%
221121	Electric Bulk Power Transmission	1,390	13.3%	0.7%
Agriculture and Natural Resource Conservation		**4,778**		**2.4%**
111150	Corn Farming	2,601	54.4%	1.3%
111421	Nursery and Tree Production	684	14.3%	0.3%
813312	Environment, Conservation and Wildlife Organizations	443	9.3%	0.2%
712130	Zoos and Botanical Gardens	434	9.1%	0.2%
712190	Nature Parks and Other Similar Institutions	226	4.7%	0.1%
Total Green-Related Employment		**197,420**		

Source: IBRC, using QCEW data

Figure 5: Share of Green-Related Employment in Indiana by Cluster



Source: IBRC, using QCEW data

3.3 Cluster Analysis—Industry Location Quotients

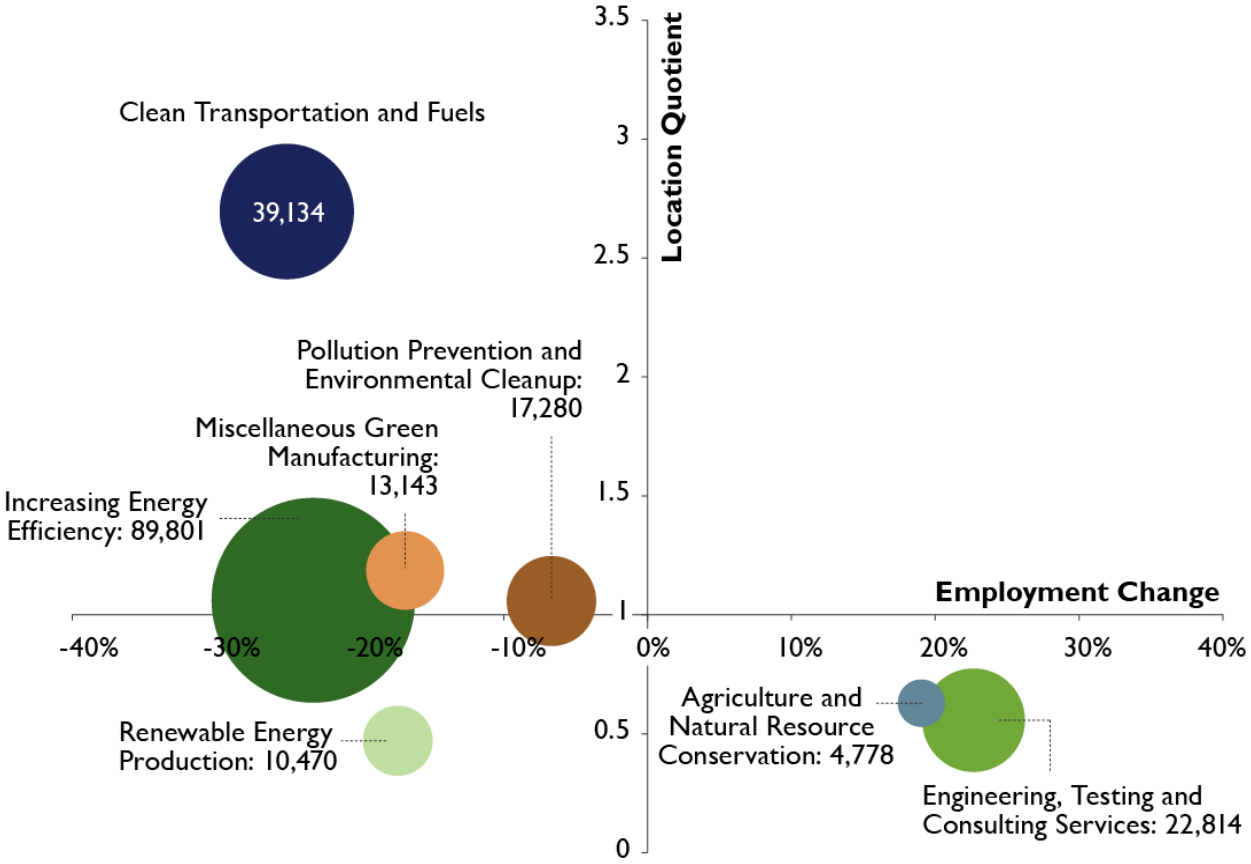
A relatively high share of Indiana's green industry employment is in the increasing energy efficiency cluster and a low share in the agriculture and natural resource conservation cluster. But how does this compare to the green industry employment balance in the country as a whole? Compared to the nation, or to the tri-state region, are these green cluster concentrations in Indiana especially high or low?

Researchers typically use the analytical tool of a location quotient (LQ) to put a state or region's industrial diversity and industrial activity into perspective. An LQ measures the relative concentration of an industry (or cluster of industries) in an area by dividing the share of the area's employment in that particular industry by the industry's share of employment in the national economy. A location quotient greater than 1.0 indicates that an area—a state or region—has a concentration of jobs above the national average in that industry.

Four out of Indiana's seven broad green-related industry clusters have location quotients greater than 1.0, as shown in the upper left-hand quadrant of **Figure 6**. Each of the four green clusters in which Indiana is concentrated experienced losses in employment from 2005 to 2009. In contrast, employment grew in engineering, testing and consulting services and agriculture and natural resource conservation, two clusters that have relatively low employment concentrations

in Indiana. These two "weak but strengthening" clusters appear in the lower right-hand quadrant of **Figure 6**.[8]

Figure 6: Indiana's Green Industry Cluster Concentration in 2009 and Employment Change, 2005 to 2009

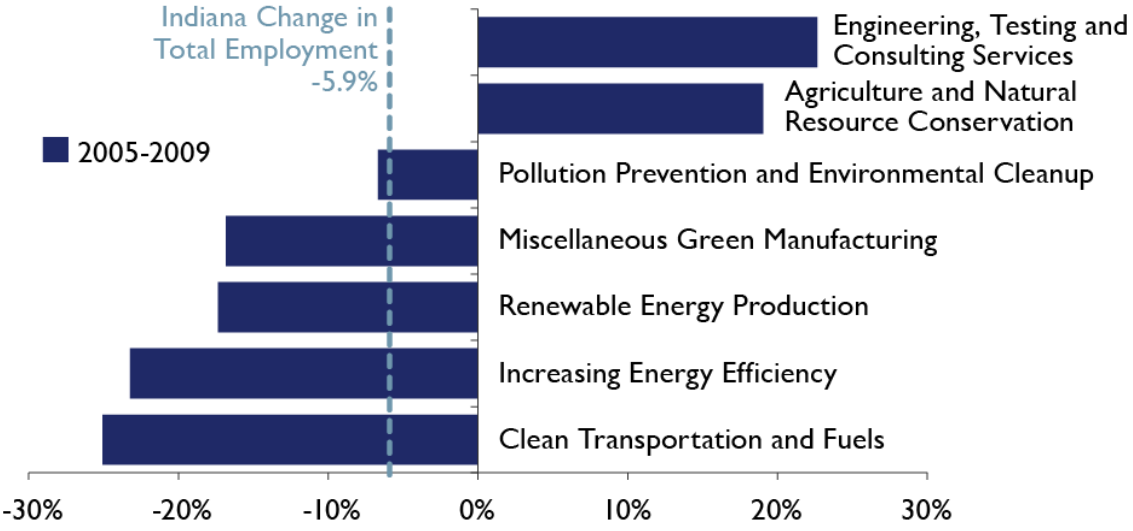


Note: The size of each bubble reflects green job employment in the cluster.
Source: IBRC, using QCEW data

Figure 7 shows the relative employment change of the seven green industry clusters in a different graphical format, in comparison to the change in overall employment during the same period.

[8] Clusters above the x-axis in this "bubble chart" are more highly concentrated in Indiana than in the nation as a whole; those below the x-axis are less concentrated. Clusters to the left of the y-axis are becoming less concentrated over time, while those to the right are becoming more concentrated.

Figure 7: Change in Employment for Green Industry Clusters, 2005 to 2009



Source: IBRC, using QCEW data

While grouping detailed industries into broad clusters of green products and services can be helpful to establish general trends, the performance of specific detailed industries within those clusters may be surprising. Like the Indiana economy as a whole, many green-related industries suffered job losses from 2005 to 2009. A handful of detailed green-related industries, however, are not only relatively highly concentrated in terms of jobs, but also managed to record employment growth from 2005 to 2009. As **Table 9** shows, Indiana has many jobs in aircraft engine and engine parts manufacturing. Indiana is also 3.5 times more concentrated in this industry than the nation as a whole and even eked out a slight increase in employment from 2005 to 2009.

In addition, employment in measuring and controlling devices manufacturing is highly concentrated in Indiana—almost double the share of the nation. Employment in this industry also grew an impressive 9 percent between 2005 and 2009.

Not all the jobs in these two industries, or the other high-growth, high-concentration detailed industries in **Table 9** are necessarily related to the green economy. That said, as green enterprises in the nation and the state expand, these Indiana firms, because of their relative strength and success, even in difficult economic times, may be well positioned to take advantage of the opportunities to become important links in the supply chain.

Table 9: Employment Concentration and Growth for Selected Indiana Industries, 2005 to 2009

NAICS	Industry	LQ	2009 Employment	Indiana % Change	U.S. % Change
221121	Electric Bulk Power Transmission	1.91	1,390	17%	1%
111150	Corn Farming	8.89	2,601	17%	29%
334519	Measuring and Controlling Devices	1.96	1,233	9%	2%

NAICS	Industry	LQ	2009 Employment	Indiana % Change	U.S. % Change
562998	All Other Miscellaneous Waste Management Services	1.25	330	8%	15%
238152	Glass and Glazing Contractors - Nonresidential	1.11	840	5%	9%
562111	Solid Waste Collection	1.26	3,107	3%	11%
236116	New Multi-Family Housing Construction (except Operative Builders)	1.08	544	3%	-20%
336412	Aircraft Engine and Engine Parts Manufacturing	3.54	6,014	1%	1%
334513	Industrial Process Variable Instruments	1.04	1,247	1%	-2%

Source: IBRC, using QCEW data

3.4 Job Change in Green-Related Industries

Indiana, like the rest of the tri-state region, has hemorrhaged jobs in manufacturing over the last few years. Between 2005 and 2009, total employment in Indiana declined 5.9 percent. Employment in the green-related industries has fallen even faster, at a rate of 17.3 percent. However, this is an imperfect gauge of the status of green-related employment because many of the job cuts in these industries had nothing to do with the green economy. These losses merely reflect that many green-related jobs are in the manufacturing and construction sectors where the Great Recession hit hardest. Both the auto sector and the housing market collapsed, and with them, employment.

Close to a majority of the job losses stemmed from the two green industry clusters of clean transportation and fuels (transportation equipment manufacturing) and increasing energy efficiency (construction industries). **Figure 7** graphically portrays these results in terms of percentage change in employment. But **Figure 7** also shows that jobs in two of the clusters have grown: the agriculture and natural resource conservation cluster by 19 percent and the engineering, testing and consulting services cluster by 22.7 percent.

Several specific green-related industries exhibited gains in employment between 2005 and 2009, the majority of which are in the aggregated professional services sector. Of the 10 detailed industries that grew in this time period, four were professional services. Sixty-five percent of the new jobs reported in **Table 10** were in four industries within professional, scientific and technical services (NAICS industry code 54). The other growing detailed industries reported in **Table 10** range widely from agriculture to construction to manufacturing to transportation.

Table 10: Employment Growth in Indiana's Detailed Green Industries, 2005 to 2009

NAICS	Industry	2005	2009	Numeric Change	Percent Change
541330	Engineering Services	11,397	12,717	1,320	11.6%

NAICS	Industry	2005	2009	Numeric Change	Percent Change
541690	Other Technical Consulting Services	666	1,179	513	77.0%
111150	Corn Farming	2,215	2,601	386	17.4%
541380	Testing Laboratories	2,018	2,318	300	14.9%
562910	Remediation Services	1,061	1,338	277	26.1%
221121	Electric Bulk Power Transmission	1,183	1,390	207	17.5%
541614	Process and Logistics Consulting Services	902	1,107	205	22.7%
325199	All Other Basic Organic Chemical Manufacturing	449	586	137	30.5%
485113	Bus Transit Systems	1,006	1,141	135	13.4%
221310	Water Supply and Irrigation Systems	1,793	1,901	108	6.0%

Source: IBRC, using QCEW data

3.5 Wages in Green-Related Industry Clusters

Green-related industries can be measured not only in terms of their direct employment, but also in terms of the compensation these jobs garner. Assuming a competitive labor market and wage structure, industry wages can provide a good deal of information about prospects for future growth as well as the size of the economic footprint an industry has on its regional economy in terms of disposable income and spending. Beyond the jobs associated with the businesses (industries) that supply inputs for any particular industry, above-average wages in an industry can have large ripple effects in the local and regional economy.

Table 11 presents the average annual industry wages (including overtime pay and bonuses) for Indiana's green-related industries from the QCEW program. These data reflect the wages earned by all workers in these industries, not just green-related workers. While the industries in the clusters employ a mix of occupations with higher, moderate and lower earning levels, the wage data for industries that tend to employ green workers show that, in general, these industries exceed the statewide average wage level.

As **Table 11** illustrates, the wages in green-related industry clusters are much higher on average than those in industries not associated with the green economy. In 2009, the renewable energy production cluster paid the highest wages per worker. Workers across a variety of occupations and industries in this cluster made roughly $64,300 per year on average, 68 percent higher than the overall private average of $38,270 for the state. One needs to be careful, however, not to ascribe the higher wages to the greenness of the jobs. As it happens, many of the industries with above-average wages are also unionized.

Aside from agriculture and natural resource conservation, all green-related industry clusters compensate their employees at above-average rates. Clean transportation and fuels industry wages closely followed the renewable energy production industry, with more than 1.5 times the average, driven primarily by payroll in vehicles and parts manufacturing. Only the agricultural

and natural resource conservation industry clusters lagged the state average, attributable in part, no doubt, to the seasonal and transient nature of the work.

Table 11: Green Industry Cluster Payroll and Average Wage in Indiana, 2009

Cluster	Total 2009 Wages	Average Annual Wage per Worker
Renewable Energy Production	$673,529,000	$64,329
Clean Transportation and Fuels	$2,365,953,000	$60,458
Engineering, Testing and Consulting Services	$1,364,216,000	$59,797
Miscellaneous Green Manufacturing	$659,028,000	$50,143
Increasing Energy Efficiency	$4,220,134,000	$46,994
Pollution Prevention and Environmental Cleanup	$794,563,000	$45,982
State of Indiana Total	**$103,532,794,000**	**$38,270**
Agriculture and Natural Resource Conservation	$158,330,000	$33,137

Source: IBRC, using QCEW data

3.6 Wages in Specific Green Industries

Grouping detailed industries into broad industry clusters is helpful for tracking general trends, but the QCEW data also provide detailed information on specific green and green-related industries. **Table 12** provides a look at the top 15 three-digit green-related NAICS industries. The industry ranking is based on the results from the green jobs survey, and the average-wage data comes from the QCEW (the average for each industry overall, not just green workers).

As **Table 12** indicates, green-related industries hold the potential for workers to earn more than the state average. Ten of the top 15 industries paid more than the Indiana annual average wage of $38,270, and five of them paid above $50,000 per year.

The best-paying green job industry is chemical manufacturing, averaging $95,527 in 2009. A distant second, but still well above the state average, was transportation equipment manufacturing ($57,399), followed by machinery manufacturing ($55,207) and professional, scientific and technical services ($53,504).

Table 12: Average Annual Wages per Worker in Indiana's Dominant Green Industries, 2009

NAICS	Industry	Number of Green Jobs	Share of Total Green Jobs	Average Annual Wage
238	Specialty Trade Contractors	10,411	22.2%	$44,173
561	Administrative and Support Services	5,826	12.4%	$25,645
541	Professional, Scientific, and Technical Services	5,322	11.4%	$53,504

NAICS	Industry	Number of Green Jobs	Share of Total Green Jobs	Average Annual Wage
423	Merchant Wholesalers, Durable Goods	4,483	9.6%	$52,806
924	Administration of Environmental Quality Programs	2,809	6.0%	$40,430
325	Chemical Manufacturing	1,947	4.2%	$95,527
236	Construction of Buildings	1,872	4.0%	$46,641
336	Transportation Equipment Manufacturing	1,709	3.6%	$57,399
332	Fabricated Metal Product Manufacturing	1,350	2.9%	$42,376
811	Repair and Maintenance	919	2.0%	$32,969
111	Crop Production	781	1.7%	$30,399
921	General Government Administration	704	1.5%	$35,209
333	Machinery Manufacturing	687	1.5%	$55,207
321	Wood Product Manufacturing	592	1.3%	$33,613
326	Plastics and Rubber Products Manufacturing	374	0.8%	$41,368
	Indiana Total: All Jobs in All Industries			**$38,270**

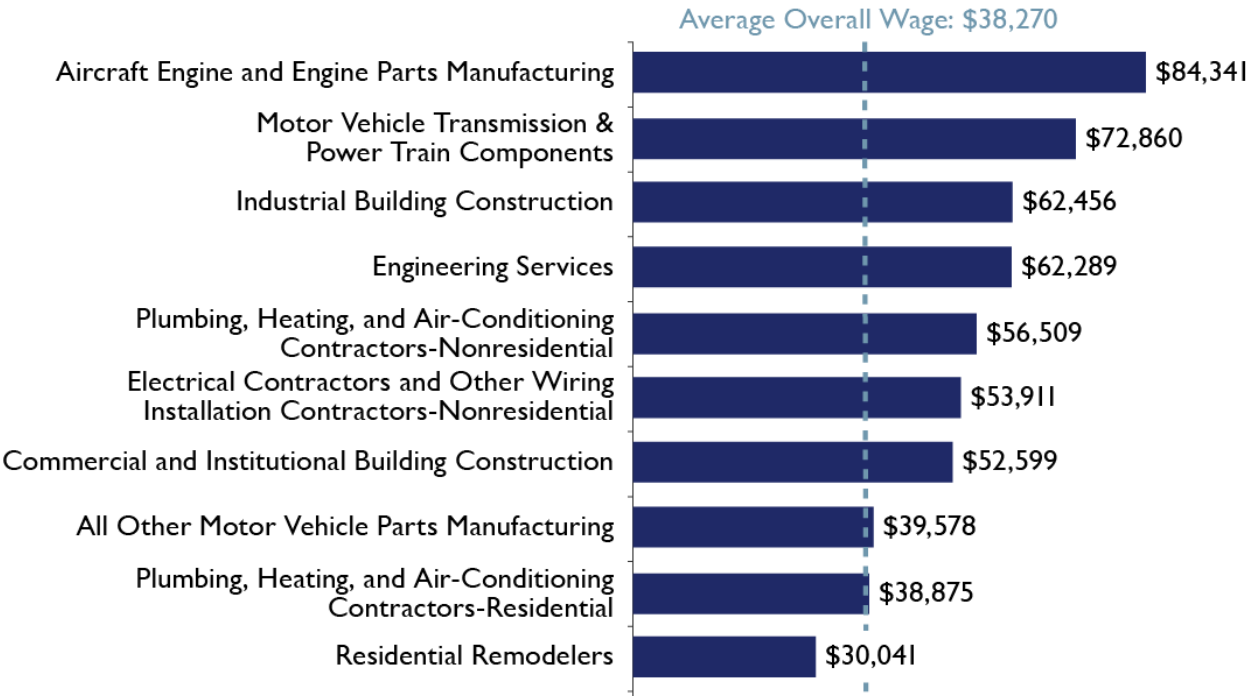
Source: IBRC, using QCEW data

Industries with a large number of green jobs that do not exceed the average Indiana worker's salary include administrative and support services ($25,645), which makes up 12.4 percent of the green jobs in the state, and crop production. It should be noted that administrative and support services includes temporary employment services, and these wages may not reflect full-time employment.

The industries in **Figure 8** provide even more industry detail than **Table 12**. These are the 10 largest green-related detailed (six-digit NAICS) industries in terms of aggregate employment (total jobs, but not necessarily green jobs). All but one of these detailed industries has an average annual wage in excess of the private industry average in the state. This is an important indicator. These dominant industries generate large numbers of job openings, but they also tend to pay above-average wages.

Industries such as aircraft engine and engine parts manufacturing and motor vehicle transmission and powertrain components—industries that are heavily unionized—pay particularly high average wages.

Figure 8: Indiana's Top 10 Green-Related Industries Average Annual Payroll per Worker



Source: IBRC, using QCEW data

3.7 Conclusion

The previous chapter reported the results of the green jobs survey in Indiana. The survey benchmarked the number of green jobs in the state and recorded employer perceptions and expectations for green job growth in the short term.

This chapter, using secondary data collected by state and national statistical agencies, explored recent trends in green employment. Employment in the auto and construction sectors, with the greatest concentrations of green jobs, has contracted sharply due to the massive restructuring of the auto industry sector and the effects of the Great Recession. Conversely, employment in many industries within the sector of professional, scientific and technical services was not only less sensitive to the economic downturn; it actually increased from 2005 to 2009.

The next chapter will explore the degree to which green employment will grow. It attempts to answer the question: what are the occupational prospects for the future? In keeping with the focus of the Driving Change research project, it presents the findings in terms of occupations in the auto sector first and then explores the "green and growing" occupations, as well as other growing occupations.

4. Green and Growing Occupations

For the displaced autoworker, finding the best occupation opportunity may be difficult, particularly with the skills they currently have. Workers may need help to identify and secure their next occupation. This chapter highlights the occupations of opportunity for these Hoosiers. The chapter starts by reporting demand for green automotive occupations, identifies the occupations poised for growth in Indiana—both green and non-green—and wraps up with a more regional focus, portraying how regional job opportunities may differ from statewide projections.

4.1 Green Automotive Occupations

Despite the increased focus on green jobs and greening the auto industry, not all occupations within the auto industry require new green skills. Engineers, technicians and technologists are most likely to face significant change in the skills required for their increasingly green jobs.[9] Production line workers, on the other hand, appear to need only minimal on-the-job training for their green jobs.

In order to gauge employment demand in Indiana, the research team used the Conference Board's Help Wanted Online (HWOL) database to capture the job postings in the fourth quarter of 2010. Using the HWOL data to measure the demand for labor is imprecise—a HWOL posting may represent a genuine opening at a company or it may be the result of a company wanting to research the regional talent pool or to develop a résumé bank. That said, despite its imprecision, it provides meaningful and almost "real-time" data on the relative strength of demand for particular occupations.

The research team used the HWOL data to gauge the relative strength of current employment demand by calculating the ratio of HWOL postings to the average 2009 employment.[10] For example, in the fourth quarter of 2010, there was one posting for every three industrial engineering jobs. As **Table 13** shows, engineers were in high demand relative to the number of engineers employed in 2009. Team assemblers, however, were not in great demand.

The HWOL job postings were matched with O*NET's classifications of green occupations, CAR's list of auto occupations, BLS' projected employment to 2018 and the 2009 Occupational Employment Survey data on employment and wages (also from BLS). The result of the matching among several databases yielded 19 green auto occupations, the top 15 of which are displayed in **Table 13**. One common theme of the top 15 is technology. One might say that technology is what makes these auto occupations green. Of the top 15 occupations, one third are engineers or technicians. The remainder are managers or production occupations. BLS does not expect all of

[9] For example, the focus panels conducted for Driving Change by the Center for Automotive Research indicated that future engineers will need to adopt a systems approach to engineering rather than focusing on a particular component of the automotive process.

[10] For example, if HWOL reports an occupation in Indiana had 25 postings and the total number of workers in that occupation is 100, the postings-to-employment ratio is 1:4. Thus, as Table 13 shows, the number of postings for mechanical engineers is a large proportion of all such engineers working in the state in 2009. In contrast, the postings for machinists represent a small proportion of those working in this occupation.

the top 15 green auto occupations to grow in the next 10 years. In addition, many are on the lower end of the wage spectrum.

Table 13: Indiana Top 15 Green Auto Occupation Postings and Expected Change to 2018

Rank	Description	HWOL Green Postings[a]	Total Employment 2009[b]	10-Year Expected Growth[c]	Postings-to-Employment Ratio[d]	Mean Wage[e]
1	Industrial Engineers	2,220	6,200	14.2%	1 : 3	$70,560
2	First-Line Supervisors/Managers of Production and Operating Workers	1,324	22,100	-5.2%	1 : 17	$54,730
3	Mechanical Engineers	1,170	7,290	6.0%	1 : 6	$70,550
4	Maintenance and Repair Workers, General	892	35,070	10.9%	1 : 39	$37,990
5	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	592	10,940	4.3%	1 : 18	$57,760
6	Electrical Engineers	411	2,640	1.7%	1 : 6	$75,750
7	Electronics Engineers, Except Computer	321	2,240	0.3%	1 : 7	$78,920
8	Inspectors, Testers, Sorters, Samplers, and Weighers	214	17,470	-3.6%	1 : 82	$33,670
9	Machinists	205	13,900	-4.6%	1 : 68	$38,700
10	Industrial Machinery Mechanics	185	8,780	7.3%	1 : 47	$46,980
11	Computer-Controlled Machine Tool Operators, Metal and Plastic	156	6,230	6.6%	1 : 40	$32,790
12	Industrial Engineering Technicians	141	2,100	6.6%	1 : 15	$51,350
13	Electrical and Electronic Equipment Assemblers	66	4,200	-14.7%	1 : 64	$25,220
14	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	56	11,610	-14.1%	1 : 207	$31,390
15	Team Assemblers	45	56,570	0.0%	1 : 1,257	$32,810

[a] Source: HWOL, Quarter 4, 2010; N=131,248; Green jobs comprised 22.1 percent of all posted occupations.
[b] Source: BLS/OES data
[c] Source: BLS; Projections from 2008 to 2018 are for the parent, six-digit SOC. HWOL and O*NET now report occupations at the eight-digit SOC level. As a result, those occupations listed in this table are at the more detailed, eight-digit SOC while the projection figures are for the parent six-digit SOC. Hence the projection is for a group of similar occupations and not the specific occupation listed in the table.
[d] Source: IBRC using HWOL and BLS/OES data
[e] Source: 2009 data from BLS

The research team wove labor force data together from several different sources, as mentioned above. While BLS may forecast the demand for occupations across a broad array of industries for the entire nation, projections for a specific sector may differ. As the auto industry transforms, so will the mix of occupations employed in the industry. In anticipation of these changes, the Center for Automotive Research (CAR) compiled a list of auto occupations that their researchers expect will grow in the auto sector in the future (see **Table 14**). A majority of these future occupations are engineers, technologists, and technicians who specialize in electricity. While standard auto occupations (e.g., industrial truck and tractor operators) still exist, the CAR occupation list emphasizes highly skilled occupations that will be needed as the industry transforms.

These CAR future auto industries were placed in the O*NET categories of green occupations. O*NET categorizes green jobs into three groups: green new and emerging, green increased demand, and green enhanced skills.

Green New and Emerging: Newly generated occupations resulting from the green economy and technologies. The output of the green economy and green technologies is sufficient to create the need for unique work and worker requirements. These are entirely novel occupations arising from the green economy, but could be an outgrowth of an existing occupation.

Green Increased Demand: Occupations that increased in demand due to the green economy and technologies. Expanding green economic output simply increases the employment demand for an existing occupation. It does not entail significant changes in the work and worker requirements. The work context may change, but the tasks themselves do not. An example is the increased demand for heating and ventilation installers that replace the energy-efficient furnaces and air conditioning units more frequently because these units are not as durable as the older furnaces.

Green Enhanced Skills: The requirements of green economic output and technologies change an existing occupation. The change may be reflected in the necessary skills, knowledge or credentials to execute the occupation's purpose. This effect may or may not result in an increase in employment demand for the occupation. Architecture is such a field. The occupation now requires increased knowledge about energy-efficient materials and construction, as well as skills associated with integrating green technology into the aesthetic design of buildings. The essential purpose of the occupation remains the same, but tasks, skills, knowledge and external elements (such as credentials) have expanded.

Table 14: Future Auto Occupations by Green Category

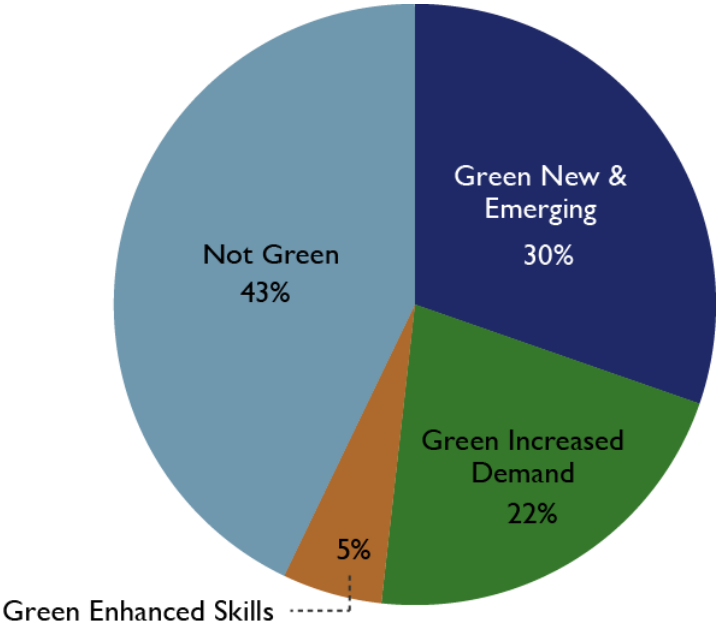
No Green Category	New and Emerging	Increased Demand	Enhanced Skills
• Quality Control Systems Managers • Computer hardware engineers • Product Safety Engineers • Materials engineers • Drafters, all other • Rolling machine setters, operators, and tenders, metal and plastic • Model makers, metal and plastic • Patternmakers, metal and plastic • Civil engineering technicians • Non-Destructive Testing Specialists • Urban and regional planners • Foundry mold and coremakers • Plating and coating machine setters, operators, and tenders, metal and plastic • Metal workers and plastic workers, all other • Electrical and electronics repairers, powerhouse, substation, and relay • Electronic equipment installers and repairers, motor vehicles • Automotive body and related repairers • Automotive glass installers and repairers • Bus and truck	• Biofuels Production Managers • Biochemical Engineers • Validation Engineers • Manufacturing Engineers • Mechatronics Engineers • Microsystems Engineers • Photonics Engineers • Nanosystems Engineers • Automotive Engineering Technicians • Electrical Engineering Technologists • Electronics Engineering Technologists • Manufacturing Engineering Technologists • Mechanical Engineering Technologists • Fuel Cell Technicians • Nanotechnology Engineering Technologists • Nanotechnology Engineering Technicians • Electromechanical Engineering Technologists	• Stationary engineers and boiler operators • Industrial truck and tractor operators • Chemical technicians • Commercial and industrial designers • Electricians • Millwrights • Electrical power-line installers and repairers • Helpers--installation, maintenance, and repair workers • Power distributors and dispatchers • Power plant operators • Chemists • Materials scientists • Chemical engineers	• Environmental engineers • Environmental engineering technicians

No Green Category	New and Emerging	Increased Demand	Enhanced Skills
mechanics and diesel engine specialists			

Source: IBRC, using Center for Automotive Research and O*NET data

The distribution of the future auto occupations list suggests the emergence of several types of green occupations (see **Figure 9**). Over half of the occupations are green (57 percent), with the bulk of them considered new and emerging occupations that have unique worker requirements.

Figure 9: Potential Future Auto Occupations



Source: IBRC, using Center for Automotive Research and O*NET data

4.2 Green and Growing Occupations

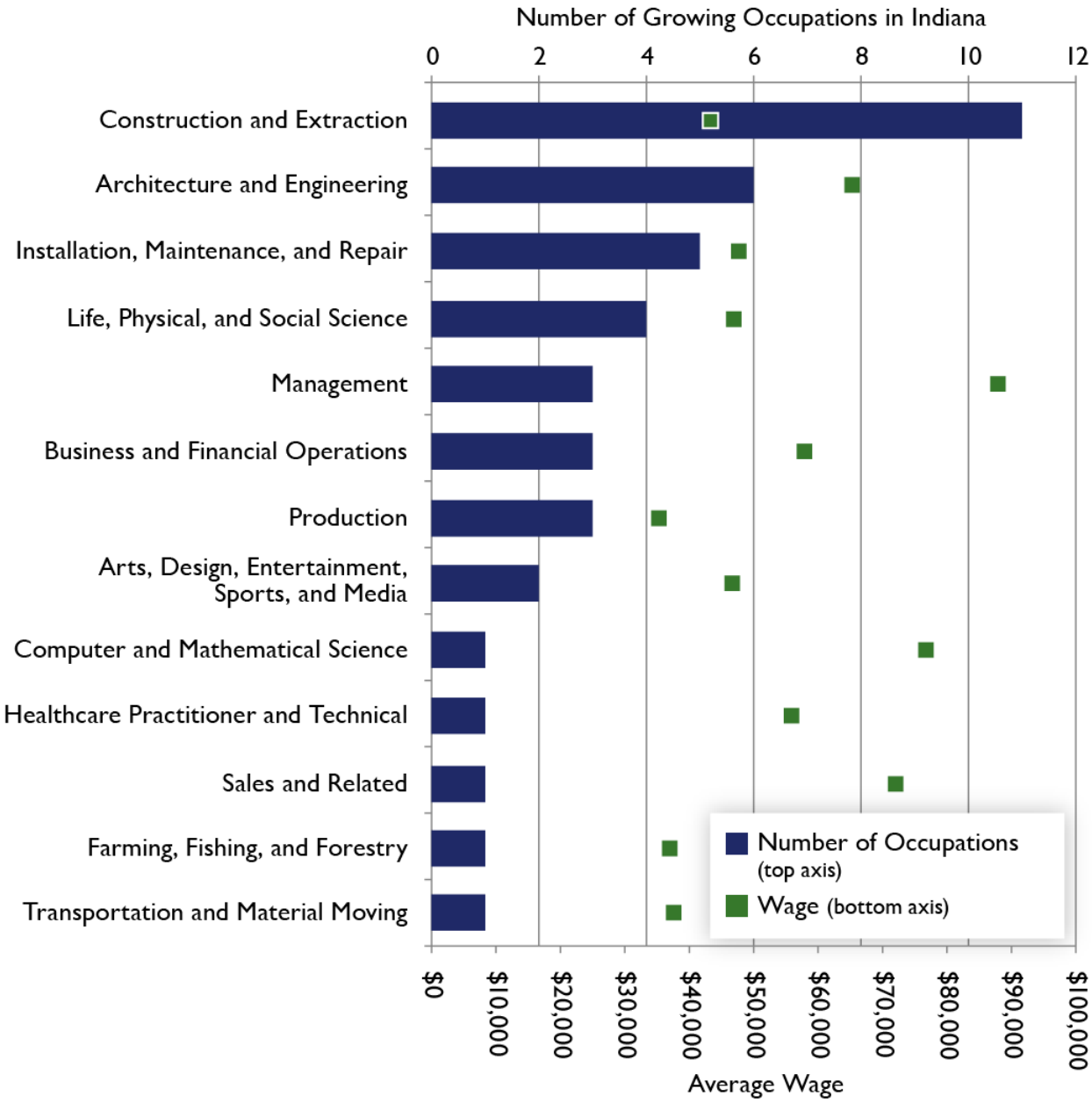
While the auto sector has recently made a soft rebound and is hiring rather than laying off workers, given the general employment trends in the sector, a displaced autoworker may be well advised to look for employment outside of the auto industry. The logical choice is to turn to Indiana's listing of high-wage/high-demand occupations and the regional listing of the Hoosier Hot 50 occupations.

For simplicity, high-wage/high-demand occupations will be called "growing" occupations. While the autoworker may not place emphasis on whether the occupation is considered a green occupation, green was the theme for the Driving Change project so the research team differentiated between green and non-green growing opportunities.

Figure 10 presents a general picture of the job families that are green and growing in Indiana. It shows the relative distribution of the green and growing occupations in Indiana. Of the 256 unique growing occupations within Indiana, only 42 occupations are green. Those green

occupations are concentrated in the construction and extraction family of occupations (SOC 47.0000) and the architecture and engineering family of occupations (SOC 17.0000). Of all the green and growing occupations, the management occupations (SOC 11.0000) had the highest average wage followed by computer and mathematical science occupations (SOC 15.0000).

Figure 10: Distribution of Indiana Green and Growing Occupations by Broad Occupation Categories§



§ Number of six-digit SOC occupations with broad job families (two-digit SOC categories)
Note: The wage average is not weighted by headcount in each detailed six-digit SOC.
Source: IBRC, using IDWD OES data

Table 15 shows Indiana's top 15 green and growing occupations. While some readers may be surprised that truck drivers top the list of green jobs or that a public relations specialist is considered a green job, recall that Driving Change researchers used O*NET green definitions.[11]

Six of the 15 occupations listed are auto-related, indicating the importance of this sector to the state's economy. Additionally, one occupation—electricians—is also a future auto-related occupation. However, the data are insufficient to determine whether the auto industry is the source of the demand for electricians in Indiana.

Several of the occupations listed in the top 15 are in high demand, including industrial and mechanical engineers, wholesale and manufacturing sales representatives of technical and scientific products, marketing managers, and engineering managers. These high-demand occupations also have high compensation levels, an approximate average of $84,300 versus $62,059 for all 15 occupations. However, the 10-year average expected growth is less for the high-demand occupations (9.7 percent) than the top 15 average of 13.3 percent.

Table 15: Indiana's Top 15 Green and Growing Occupation Postings and Expected Growth to 2018

Rank	Description	HWOL Postings[a]	Total Employment 2009[b]	10-Year Expected Growth[c]	Postings-to-Employment Ratio[d]	Mean Wage[e]
1	Truck Drivers, Heavy and Tractor-Trailer	4,371	52,830	13.0%	1 : 12	$38,880
2	Industrial Engineers	2,220	6,200	14.2%	1 : 3	$70,560
3	Mechanical Engineers	1,170	7,290	6.0%	1 : 6	$70,550
4	Sales Representative, Wholesale and Manufacturing, Technical/Scientific Product	1,056	7,110	9.7%	1 : 7	$79,890
5	Maintenance and Repair Workers, General	892	35,070	10.9%	1 : 39	$37,990
6	Marketing Managers	863	2,260	12.5%	1 : 3	$100,880
7	First-line Supervisors/Managers of Mechanics/Installers/ Repairers	592	10,940	4.3%	1 : 18	$57,760
8	Engineering Managers	401	3,400	6.2%	1 : 8	$99,490
9	Training and Development Specialists	314	4,480	23.3%	1 : 14	$50,260
10	Public Relations Specialists	292	4,590	24.0%	1 : 16	$45,800
11	Electricians	215	12,680	11.9%	1 : 59	$52,450

[11] For more information on O*NET's rationale for classifying an occupation as green, please consult their website at www.onetcenter.org/green.html.

12	Comp. Software Engineers, Systems Software	203	3,340	30.4%	1 : 16	$77,910
13	Industrial Machinery Mechanics	185	8,780	7.3%	1 : 47	$46,980
14	Financial Analysts	157	2,240	19.8%	1 : 14	$68,690
15	Computer-Controlled Machine Tool Operators, Metal/Plastic	156	6,230	6.6%	1 : 40	$32,790

[a] Source: HWOL, Quarter 4, 2010; N=24,595; Green jobs comprised 22.3 percent of all posted occupations in Indiana.
[b] Source: BLS/OES data
[c] Source: BLS; Projections from 2008 to 2018 are for the parent, six-digit SOC. HWOL and O*NET now report occupations at the eight-digit SOC level. As a result, those occupations listed in this table are at the more detailed, eight-digit SOC while the projection figures are for the parent six-digit SOC. Hence the projection is for a group of similar occupations and not the specific occupation listed in the table.
[d] Source: IBRC using HWOL and BLS/OES data
[e] Source: 2009 data from BLS

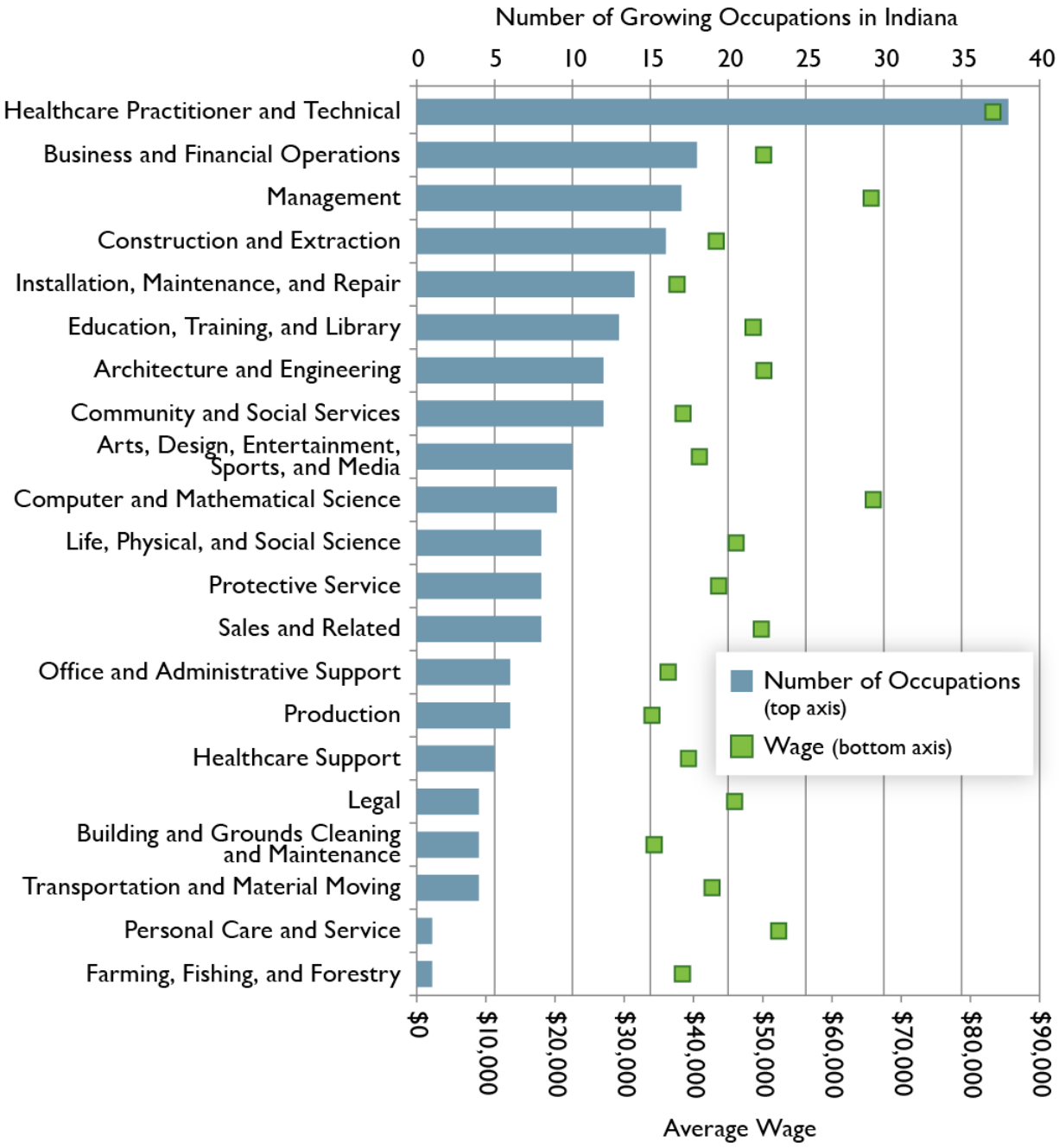
4.3 Other Growing Occupations

Not all growing occupations in Indiana are green. In fact, the majority (84 percent) of the growing occupations are non-green.

Figure 11 presents a general picture of the job families that are not green but are growing in Indiana. It shows the relative distribution of those growing occupations in Indiana by broad job families. The job family of healthcare practitioners and technical occupations (SOC 29.000) and the business and financial operations job family (SOC 13.0000) topped the list. The healthcare and technical occupations category also has the highest mean wage in Indiana, thus making this an attractive field to enter.

On balance, however, because so many of the green occupations are in the STEM disciplines and management positions that require a higher level of education, a green job, on average, has a wage premium. The average wage differential for a green (as defined by O*NET) and growing occupation, compared to a non-green growing occupation, is $7,700.

Figure 11: Distribution of Indiana Growing Non-Green Occupations within Broad Occupation Categories§



§ Number of six-digit SOC occupations with broad job families (two-digit SOC categories)
Note: The wage average is not weighted by headcount in each detailed six-digit SOC.
Source: IBRC, using IDWD OES data

Nearly half of Indiana's top 15 non-green and growing occupations were healthcare practitioner and technical occupations (see **Table 16**). Within Indiana, these occupations are in high demand today and are expected to grow for many years to come. Of the 211 occupations that are growing, but not considered green by O*NET, 40 did not have any HWOL postings in the fourth

quarter of 2010. This may be a result of delayed demand for these occupations, or they may have been particularly hard-hit by the recession and have yet to rebound. The average wage of the top growing occupations was $59,300 and the average expected growth was 17.2 percent.

Table 16: Indiana Non-Green Growing Occupation Postings and Expected Growth to 2018

Rank	Description	HWOL Postings[a]	Total Employment 2009[b]	10-Year Expected Growth[c]	Ratio of Postings to Jobs[d]	Mean Wage[e]
1	Occupational Therapists	3,681	2,390	30.9%	1 : 1	$67,980
2	Registered Nurses	2,966	57,880	22.3%	1 : 20	$57,910
3	Speech-Language Pathologists	2,710	2,070	22.5%	1 : 1	$65,160
4	Physical Therapists	2,315	4,170	30.6%	1 : 2	$69,340
5	Executive Secretaries and Administrative Assistants	1,920	21,830	11.2%	1 : 11	$38,670
6	First-Line Supervisors/Managers of Office and Administrative Support	1,657	24,910	9.3%	1 : 15	$47,270
7	Medical and Health Services Managers	1,537	6,960	15.9%	1 : 5	$78,290
8	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	1,516	31,160	4.0%	1 : 21	$57,880
9	Computer Systems Analysts	1,433	7,380	17.2%	1 : 5	$70,030
10	Computer Support Specialists	1,427	8,740	7.7%	1 : 6	$40,630
11	Sales Managers	1,138	5,800	11.4%	1 : 5	$93,780
12	Sales Representatives, Services, All Other	1,110	10,290	13.2%	1 : 9	$52,400
13	Occupational Therapist Assistants	1,085	790	30.3%	1 : 1	$49,430
14	Insurance Sales Agents	981	6,550	9.0%	1 : 7	$62,440
15	Licensed Practical and Licensed Vocational Nurses	920	20,610	22.8%	1 : 22	$37,920

[a] Source: HWOL, Quarter 4, 2010; N=24,595; Non-green jobs comprised 77.7 percent of all Indiana postings.
[b] Source: BLS/OES data
[c] Source: BLS; Projections from 2008 to 2018 are for the parent, six-digit SOC. HWOL and O*NET now report occupations at the eight-digit SOC level. As a result, those occupations listed in this table are at the more detailed, eight-digit SOC while the projection figures are for the parent six-digit SOC. Hence the projection is for a group of similar occupations and not the specific occupation listed in the table.
[d] Source: IBRC using HWOL and BLS/OES data
[e] Source: 2009 data from BLS

4.4 The Geographic Dimensions of Labor Demand

While using a state's listing of growing occupations can be very useful in determining the careers with the greatest expected opportunities, it can be misleading if the jobs are highly clustered in one region of the state. Because the relevant occupations of opportunity are based on commuting distance, this section highlights how a smaller region's opportunities compare with statewide data on growing occupations.

The Indiana Department of Workforce Development (IDWD) generates the list of high wage/high demand jobs for each of the state's 11 economic growth regions (EGRs). This enables a job seeker to identify the growing occupations in her or his region. While the most recent job growth projections were used—the period from 2008 to 2018—IDWD generated these forecasts before the full brunt of the recession was felt in the labor markets and, as a result, one should evaluate the forecasts with caution.

Table 17 highlights the top 15 growing occupations for EGR 9—the Columbus, Ind., area. This region has several different growing occupations than the statewide projections. Only three occupations overlap between the state and EGR 9. The region has several occupations that do not appear to be in high demand in the state—that is, with high ratios of statewide HWOL postings to jobs—but are expected to grow in the region over the next 10 years. An example of this is construction laborers, which is high on the list for EGR 9, possibly reflecting better prospects for construction projects in the region than in the state. In contrast, at the state level, there is neither strong current demand nor is it considered a growing occupation.

Table 17: Top 15 Growing Occupations for EGR 9 in Indiana, 2008-2018

Rank	Description	Projected 2009 Employment[a]	10-Year Expected Growth[b]	Percentage of Total IN Jobs in Region[c]	Postings-to-Employment Ratio[d]	Mean Wage[e]
1	Construction Laborers*	713	22.8%	1.9%	1 : 122	$35,537
2	Registered Nurses	1,862	22.9%	3.2%	1 : 20	$53,995
3	Truck Drivers, Heavy and Tractor-Trailer*	3,119	14.3%	8.0%	1 : 12	$35,244
4	Licensed Practical and Licensed Vocational Nurses	1,164	22.1%	3.1%	1 : 22	$35,555
5	Industrial Engineers*	530	12.2%	0.8%	1 : 3	$76,163
6	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	547	20.0%	0.9%	1 : 41	$49,171
7	Operating Engineers and Other Construction Equipment Operators*	479	16.1%	1.0%	1 : 415	$37,848

8	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	275	36.2%	0.6%	1 : 2,475	$41,390
9	Human Resources, Training, and Labor Relations Specialists	526	16.0%	3.7%	1 : 19	$38,257
10	Computer Software Engineers	361	28.2%	3.8%	1 : 9	$68,240
11	Industrial Truck and Tractor Operators*	1,483	8.2%	4.6%	1 : 116	$30,079
12	Carpenters	1,243	11.0%	3.0%	1 : 132	$35,632
13	Maintenance and Repair Workers, General*	1,730	6.1%	4.6%	1 : 39	$35,674
14	Primary & Secondary School Teachers	3,778	15.4%	4.6%	1 : 134	$45,624
15	Postsecondary Teachers	866	16.3%	2.8%	1 : 28	$57,394

* Indicates that the occupation is a green occupation
[a] Source: Indiana Department of Workforce Development. Data was given for 2008 and projected to 2018. Calculating the average annual growth rate, the research team projected the 2009 employment figure for further analysis.
[b] Source: Indiana Department of Workforce Development for 2008-2018
[c] Source: BLS/OES data for Indiana. The projected 2009 employment figure for EGR 9 was divided by the entire state to produce percentages.
[d] Source: IBRC using HWOL and BLS/OES data. Data reflect the statewide ratio of postings to jobs.
[e] Source: 2009 data from the Indiana Department of Workforce Development

4.5 Conclusion

While the auto sector is hiring again and has recalled some workers, it is not hiring at levels sufficient to reemploy all those who were displaced as a result of the economic whirlwinds of the last several years. Where will a majority of the unemployed find jobs, given that being recalled may not be a realistic option?

This chapter attempted to answer that question. It presented the occupations of opportunity today and the occupational prospects for the future. In keeping with the focus of the Driving Change research project, findings in terms of occupations in the auto sector were reported first and then occupations that are both green and growing, as well as other growing occupations that are not green. Finally, because labor force needs are dependent upon the types of industries located in a region, the chapter highlighted a specific region in Indiana to show that the occupations of opportunity may differ significantly across regions in a state.

The following chapter rounds out the report. Given that many displaced workers may be seeking jobs outside their traditional fields, they may also need to retrain and retool. To address this need, the Driving Change project assembled data on education and training programs in the tri-state region and linked those programs and credentials with the green and/or growing occupations in the tri-state region. This training database provides a person interested in a particular occupation with the training options in his or her area.

5. Finding Work—Resources to Target Opportunities

One of the Driving Change project goals was to develop a resource to help displaced workers plot a path, in some cases a green path, to a new future. As a result, the Driving Change website also provides a web-based resource—the Tri-State Training Program Database—to look up educational, training and vocational programs for green and/or growing occupations. Based on their targeted occupation, users can find all the relevant postsecondary schools offering programs for that occupation within their selected geographic boundary.

This site is useful not only to workers seeking change, but education and workforce development policymakers may also find this site useful because the data present the relative concentration or scarcity of educational programs at a highly granular geographic level. For economic development practitioners who may be trying to cultivate the growth of firms or attract new investment, it may expose a region's training weak spots. If a region does not have a specially trained workforce, what educational programs are nearby to fill the gap?

An astute user of the Driving Change training program website would notice an interesting, but hardly surprising, phenomenon. In the tri-state region, there are no educational programs supporting new and emerging green jobs as defined by O*NET. This most likely means new and emerging occupations are so new, and the landscape is changing so rapidly, that there is not sufficient information to make the links between educational and technical programs and the characteristics and requirements of those jobs.

For the dislocated worker, the question of how to move from old job A to new job B is far from academic. Training dollars are of little use in workforce development efforts if they fail to move an individual closer to re-employment in a career with a future. The Tri-State Training Program Database—combined with the new pathway cluster analysis developed for the Driving Change project and the estimated time to transition to a new occupation—can help dislocated workers make decisions about which new occupations make the most sense for them.[12]

These resources, tools and analysis will be online and free of charge, helping today's displaced workers in the tri-state region find suitable employment, but also serving as a foundation for expanding the workforce development toolkit in the future.

The Tri-State Training Program Database is available at
www.drivingworkforcechange.org/database.asp

[12] Details about these resources are presented in a companion report, *Navigating Change: Exploring New Career Pathways in an Evolving Labor Market*, available at www.drivingworkforcechange.org/skillsgap.asp.

6. Conclusion

Structural and cyclical economic forces have had a devastating effect on the labor force across the entire economy and the auto sector especially. The tri-state region lost jobs as early as five years ago due to auto industry restructuring and, more recently, hemorrhaged jobs due to the Great Recession. Where will these displaced workers find jobs?

Many economists, workforce analysts and policymakers have asserted that the burgeoning green economy may provide new job opportunities. The economic potential of the green economy has been an increasingly high-profile topic across the nation. There is great interest in obtaining information about the quantity and characteristics of jobs produced by the green economy, especially as green jobs have been seen as a potential source of employment for dislocated workers. Will the green economy have the capacity to absorb those workers?

This report—as a product of the Driving Change project—has tried to answer that question, and more.

First, it presented the results of the green job survey that measured the number of green jobs in Indiana. The survey results are reported, both in terms of the industries that have the greatest concentrations of green jobs and the types of occupations that are more likely to be green. The survey also asked employers about the training needs for their green jobs and their short-term expectations for green jobs in the future.

Given that green jobs in the Hoosier state currently comprise 1.7 percent of the total workforce, the number of green jobs will be insufficient to absorb the many displaced workers, at least in the near future. The industries with the greatest concentrations of green jobs in Indiana are manufacturing and construction, both under considerable stress at present. Finally, the survey revealed that most green jobs do not require any formal training; on-the-job training is sufficient. While not specifically addressed in the survey, it appears that the jobs that are the most green—the STEM disciplines—do indeed have special and additional requirements.

Second, the report presented a brief track record of green jobs to assess the degree to which the green sector is a viable alternative for displaced workers. The two sectors that have the greatest concentration of green jobs—construction and manufacturing—are sensitive to economic cycles and were particularly hard hit in the Great Recession. While, on average, there is a green job wage premium compared to jobs that are not green, this premium appears to be attributed to the level of education needed for those jobs and the fact that many of the greener industries are also more unionized. Finally, two of seven green industry clusters flourished despite strong economic headwinds. Both the agriculture and natural resource conservation and the engineering, testing and consulting service industry clusters enjoyed employment growth even during the recession. On the other hand, five green industry clusters lost jobs at a greater rate than the statewide average.

Third, the report presented the green and growing occupations that are in demand today and that have the brightest prospects for the future. Organized around the themes of jobs in the automobile sector, the green economy and other growing occupations, the occupations presented in Chapter 4 represent the brightest career options for displaced workers. The chapter also emphasizes that work opportunities can vary region to region. Thus, workers contemplating a change in occupation would be well advised to research which types of jobs are in greater demand in their region before committing to a new educational or vocational program.

Finally, the report describes a web-based resource to find the educational programs in a region that match the occupations a person may be considering.

As stated earlier, this research and report are part the Driving Change research project. The research consortium not only chronicled the auto industry and auto supply chain transformation and assessed the potential of green jobs for displaced autoworkers, it also conducted a skills gap analysis to help determine the required training needed to compete for occupations with a bright future.

How does one transition to the occupations that are most aligned with a worker's knowledge, skills and traits and have the brightest prospects for the future? And, after targeting a new occupation to transition to, how does one prepare? A separate companion report is devoted to answering these questions. *Navigating Change: Exploring New Career Pathways in an Evolving Labor Market* presents, in detail, the findings and resources of the occupation cluster analysis and skills gap analysis. It is the hope of the Driving Change consortium that these companion reports will provide displaced workers useful analysis and resources to plot a path to a brighter—and greener—future.

Appendix A: Green Jobs Survey Methodology

Sample Selection

Staff from the U.S. Bureau of Labor Statistics (BLS) assisted the IBRC research team by randomly selecting 13,520 establishments to form a representative sample of Indiana firms by industry, employment size class and region. The BLS conducts many similar surveys annually, and they used their Job Vacancy Survey system software to draw the sample. The IBRC research team provided BLS with the following sample specifications:

- Establishment Ownership
  - Private, Federal, State and Local ("firms" is shorthand for all ownership types)
- Industry
  - All industries, except 46 categories excluded by the Michigan Green Jobs Survey (see **Table A-1**)
- Strata
  - Employment Class Size Definitions: 0-4, 5-9, 10-19, 20-49, 50-99, 100-249 and 250+
  - Industry classification: three-digit categories of the North American Industrial Classification System (NAICS)
  - Geographic boundaries: Indiana's 11 economic growth regions, plus an "unclassified" category for establishments in unspecified regions
- Allocation Method
  - Sample Size: 13,520
  - Establishment list: 2009 quarter 2, Quarterly Census of Employment and Wages (QCEW) employment
  - Minimum number of sample units per stratum: 3
  - Maximum number of sample units per stratum: 10,000
  - Certainty for inclusion: if employment class size exceeds 250
  - Expected response rate: 50 percent

Survey Distribution and Data Collection

The Indiana Green Jobs Survey closely followed the design of the Michigan Green Jobs Survey. Respondents could reply by various modes: a paper survey returned by self-addressed stamped envelope, by fax, by an online version of the paper survey or, in a limited number of cases, by phone.

The research team tested the survey instrument and follow-up calling protocol by means of a pilot survey of 498 establishments in March 2010. Even with the most recent establishment address list available, address accuracy was an overwhelming problem. Some firms did not

accept mail at individual locations; others had closed or moved. Subsequent surveys were mailed to company headquarters with clear requests for information pertaining only to a particular establishment location.

Each survey packet contained a letter from the Commissioner of the Indiana Department of Workforce Development encouraging participation, a survey, a description about the five core areas for green jobs and instruction on how to use the online survey option (see Appendix B). The survey team used both a pre-survey postcard and two follow-up postcards to encourage firms to participate. Using mail-based surveys and follow-up would have resulted in a response rate far below 50 percent.

The research team also engaged a survey call center to follow-up with all firms that did not participate. Every day, the research staff alerted the call center about who had responded over the course of the last day so that no firm that had completed the survey would be called. Toward the close of survey, as the response rate approached the targeted 50 percent, the research team assessed the response rate by stratum in order to focus on contacting establishments within industries and regions that had the lower response rates. The final response rates by industry are described in **Table A-2**.

Survey Analysis

Coding Occupations

The survey requested the number of occupations at the establishment involved in core green areas. It did not expect or request a formal occupation code for activities. In order to align the job titles from the survey with job titles in the Standard Occupational Classification System (SOC), a team from the Indiana Department of Workforce Development prepared an automated system that was able to easily match about two-thirds of the survey responses. The team then developed a second interactive Excel file that looked up submitted job titles that required an analyst's judgment. Finally, for the difficult cases, job titles with no matches or multiple matches were resolved by using the Occupational Employment Survey (OES) staffing matrix by industry and county which would indicate the likelihood of different SOC occupations by code. The team also made use of the green job classifications indicated by the respondent to gauge the job's function. If all else failed, the team would investigate the specific staffing matrix of a particular establishment based on their most recently submitted OES survey (if available) and match occupations with similar reported numbers.

Estimating Green Jobs

Analysts took several steps to use the survey results to estimate the total number of green jobs. If firms had a large number of green jobs, analysts removed those firms for additional inspections because those respondents may have reported for multiple establishments. Then researchers calculated the raw average number of green jobs for each of 2,998 strata—that is the combination of region by industry by employment size class. Analysts also removed extreme outliers for each stratum—the threshold of the upper 0.1 percent of the distribution or 3.09

standard deviations above the mean (one-tailed distribution)—for further inspection and, possibly, for verification with the respondents. Based on these results, analysts calculated the sample weight (w) for each firm based on the equivalent number of actual firms of similar industry, region and size across the state.

Finally, based on the BLS Job Vacancy Survey methodology, analysts applied a non-response adjustment factor for each stratum ($NRAF_s$). This factor accounts for firms that did not respond to the survey by dividing the weighted sum of viable employment—employment of all firms in the sample's stratum—by the weighted sum of the usable employment—the employment of all firms that responded to the survey in that sample's stratum. This can be represented by the following formula:

$$NRAF_s = \frac{\sum w_s \times viableEmp_s}{\sum w_s \times usableEmp_s}$$

After adjusting the total green jobs by stratum with the non-response factor, analysts estimated the average number of green jobs by stratum using the sample weight of each stratum.

Total green jobs per stratum are the product of the average green jobs for each firm (per stratum) and the number of firms in that stratum. Summing all strata derives the total number of green jobs in the state.

Table A-1: NAICS Codes Excluded from Scope of Indiana and Michigan Green Jobs Employer Surveys

NAICS	Industry Title
114	Fishing, Hunting, Trapping
21	Mining
312	Beverage & Tobacco Manufacturing
316	Leather Product Manufacturing
324	Petroleum & Coal Product Manufacturing
3343	Audio & Video Equipment Manufacturing
3346	Manufacturing & Reproduction of Magnetic & Optical Media
3362	Motor Vehicle Body Manufacturing
4231	Motor Vehicle Wholesalers
4232	Furniture Wholesalers
4234	Commercial Equipment Wholesalers
4235	Metal & Mineral Wholesalers
424	Nondurable Goods Wholesalers
44	Retail Trade
45	Retail Trade
481	Air Transportation
483	Water Transportation

NAICS	Industry Title
484	Truck Transportation
4861	Pipeline Transportation of Crude Oil
487	Scenic Transportation
488	Support Services for Transportation
491	Postal Service
492	Courier Services
512	Motion Pictures
515	Broadcasting
521	Central Banks
524	Insurance
525	Funds & Trusts
531	Real Estate
532	Rental & Leasing
5412	Accounting Services
5418	Advertising Services
5419	Other Professional Services
5614	Business Support Services
5615	Travel Services
5616	Security Services
5619	Other Support Services
61	Educational Services
62	Health Care Services
711	Performing Arts Services
713	Amusement & Recreation Services
72	Accommodation & Food Services
812	Personal Care Services
8131	Religious Organizations
8134	Civic & Social Organizations
814	Private Households

Table A-2: Response Rates to Indiana Green Jobs Survey by Industry

Industry (Three-Digit NAICS)	Industry Completion Rate	Industry Completions	Industry Sample
111-Crop Production	49.66	73	147
112-Animal Production	44.85	61	136
113-Forestry and Logging	48.65	18	37
115-Support Activities for Agriculture and Forestry	63.41	52	82

Industry (Three-Digit NAICS)	Industry Completion Rate	Industry Completions	Industry Sample
221-Utilities	34.45	72	209
236-Construction of Buildings	52.95	251	474
237-Heavy and Civil Engineering Construction	54.17	130	240
238-Specialty Trade Contractors	56.18	673	1198
311-Food Manufacturing	49.82	136	273
313-Textile Mills	72.22	13	18
314-Textile Product Mills	67.37	64	95
315-Apparel Manufacturing	45.95	17	37
321-Wood Product Manufacturing	52.21	118	226
322-Paper Manufacturing	40.41	59	146
323-Printing and Related Support Activities	64.98	141	217
325-Chemical Manufacturing	37.56	74	197
326-Plastics and Rubber Products Manufacturing	55.59	184	331
327-Nonmetallic Mineral Product Manufacturing	52.13	98	188
331-Primary Metal Manufacturing	42.78	80	187
332-Fabricated Metal Product Manufacturing	58.00	319	550
333-Machinery Manufacturing	59.87	179	299
334-Computer and Electronic Product Manufacturing	53.47	77	144
335-Elec. Equip., Appliance and Component Manufacturing	54.55	54	99
336-Transportation Equipment Manufacturing	49.84	160	321
337-Furniture and Related Product Manufacturing	58.60	126	215
339-Miscellaneous Manufacturing	60.25	144	239
423-Merchant Wholesalers, Durable Goods	53.17	335	630
425-Wholesale Electrical Markets and Agents/Brokers	49.00	98	200
482-Rail Transportation	100.00	1	1
485-Transit and Ground Passenger Transport	56.98	98	172
486-Pipeline Transportation	5.13	2	39
493-Warehousing and Storage	46.41	97	209
511-Publishing Industries	52.88	101	191
517-Telecommunications	26.99	61	226
518-Internet Serv, Web Search, and Data Process	41.38	24	58
519-Other Information Services	70.52	122	173
522-Credit Intermediation and Related Activities	54.29	323	595
523-Securities, Comm and Other Fin Invest and Related	42.39	78	184

Industry (Three-Digit NAICS)	Industry Completion Rate	Industry Completions	Industry Sample
533-Lessors of Nonfinancial Intangibles (except Copyright)	39.13	9	23
541-Professional, Scientific, and Technical Services	54.05	561	1038
551-Management of Companies and Enterprises	47.76	149	312
561-Administrative and Support Services	44.67	448	1003
562-Waste Management and Remediation Service	40.00	70	175
712-Museums, Historical Sites, and Similar Institution	56.00	42	75
811-Repair and Maintenance	57.24	265	463
813-Religious, Grantmaking, Civic, Prof., and Similar	53.36	127	238
921-General Government Admin	60.25	244	405
922-Justice, Public Order and Safety Activities	53.42	86	161
923-Admin of Human Resource Programs	31.32	57	182
924-Admin of Environmental Quality Programs	51.94	67	129
925-Admin of Housing, Urban Plan., and Comm. Dev	71.88	23	32
926-Admin of Economic Programs	2.46	5	203
927-Space Research and Technology	0.00	0	1
928-National Security and International Affairs	1.49	1	67
999-Unassigned	46.67	14	30

Appendix B: Survey Materials

INDIANA WORKFORCE DEVELOPMENT
AND ITS WorkOne CENTERS

April 23, 2010

Dear Employer:

The U.S Department of Labor is requiring the Indiana Department of Workforce Development to count the number of green jobs in Indiana. **I'm asking you to help by participating in a survey** to identify jobs that produce goods or services related to any of the following five green initiatives (the enclosed sheet provides specific definitions of green-related sectors and employment):

Producing renewable energy	Agriculture and natural resource conservation
Increasing energy efficiency	Pollution prevention and environmental cleanup
Clean transportation and fuels	

Please direct this survey to a manager who understands the work activities of your personnel at this location, such as your operations manager or human resources manager. There are four options for completing the survey:

1. Online at www.hoosierdata.in.gov/greenjobs (the easiest method)
2. Return the survey form in the enclosed pre-paid reply envelope to our research partners at Indiana University
3. Fax it to 877-240-1449
4. Over the phone at 800-343-8981

Even if you do not have any green-related jobs at your location, please return the survey after completing sections 1 and 2.

To ensure that your information is included, please complete the survey by May 14, 2010.

Please rest assured that your survey responses will be treated confidentially. No individual responses will be reported, and your organization's identity will not be linked to responses. If you have any questions about the survey, please email us with "green jobs" in the subject line at lmidata@dwd.in.gov or call us at 800-343-8981.

By counting the green jobs we have today and developing a strategy to help workers prepare for new technologies and production, we can accelerate the growth of this growing industry and create a brighter future for Indiana. Your participation in this survey is an important step in that direction. Thank you so much for your time and attention.

Sincerely,

Teresa Voors
Commissioner
Indiana Department of Workforce Development

Mitchell E. Daniels, Jr., *Governor*
Teresa L. Voors, *Commissioner*
10 North Senate Avenue
Indianapolis, IN 46204-2277
www.workforce.IN.gov
Phone: 317.232.7670
Fax: 317.233.4793
An Economic Development Partner

STATE OF INDIANA GREEN JOBS SURVEY

INDIANA WORKFORCE DEVELOPMENT AND ITS WorkOne CENTERS

ABOUT THE SURVEY

The State of Indiana is striving to transform its economy and its labor force by developing new industry sectors such as energy efficiency, renewable energy and other "green-related" industries.

The Indiana Department of Workforce Development (IDWD) is conducting this survey to determine the number of jobs that existed in these industries in 2009. This survey will help IDWD benchmark the number and types of "green jobs" and measure the growth of the green economy.

The survey will identify jobs that produce goods or services related to any of the five following core green-related activities:

1. Producing renewable energy
2. Increasing energy efficiency
3. Clean transportation and fuels
4. Agriculture and natural resource conservation
5. Pollution prevention and environmental cleanup

Please see the enclosed handout that gives specific definitions of these sectors and examples of green-related jobs in each sector.

If your organization conducts green-related business activities that produce goods or supply services related to any of these five core areas, please complete this entire survey. **If not,** simply fill out section 1 and section 2. For your convenience, the survey may be completed online, or you may return this form using the enclosed postage-paid envelope.

DIRECTIONS AND SURVEY RESPONSE OPTIONS

- Please direct this survey to your operations manager or human resources department
- Please answer questions with regard only to the specific establishment (or location) printed below
- If you are at a location other than that printed in the lower left-hand corner of the survey, please call us at **800-343-8981**
- You can complete the survey in the following ways:
  - Online at **www.hoosierdata.in.gov/greenjobs**, or
  - Return the survey in the enclosed postage-paid envelope, or
  - Fax both sides to **877-240-1449**, or
  - Provide your responses by phone toll-free at **800-343-8981**
- If you have any questions, email us with "green jobs" in the subject line at **Lmidata@dwd.in.gov** or call us at **800-343-8981**
- All information will be treated confidentially
- To ensure your information is included, please respond by **May 14, 2010**

SECTION 1

Did you or any of your staff work to provide goods or services in any of the above five core green-related areas in 2009?

_____Yes Please complete Sections 2-3 on this page and sections 4-5 on the reverse side.

_____No Please provide us with the contact information in Section 2, and submit the survey as directed above.

SECTION 2

Please provide the following information for the person completing this survey.

Your name: _____

Title: _____

Telephone (incl. area code): _____

Email: _____

Date: _____

SECTION 3

Please report for the Indiana business location shown in the lower left-hand corner of this form:

On average, how many employees did you have at this location in 2009? _____

Of these:

How many were employees whose primary function was the production of green-related products and services? _____

How many were employees who held administrative or clerical support jobs for your green-related business activities? _____

How many were engaged in business functions unrelated to your green business activities? _____

Thank you for participating!

IDWD Green Jobs Survey Project
Center for Survey Research
Eigenmann 2-South
Indiana University
2931 E 10th St.
Bloomington, IN 47408-9956

Concerning your location in **Survey No.**

STATE OF INDIANA GREEN JOBS SURVEY

Total Number of Workers in Indiana and Job Titles Related to Five Core Areas		Core Areas for Green Jobs					Additional Information				
SECTION 4 **Total number of workers in Indiana and job titles related to five core areas.** • Please enter the average number of workers in 2009 for each job title and the core area they worked in. • Please estimate how many employees had one of the listed five core areas as their primary focus. Choose only one core area per employee. For employees responsible for more than one core area, choose the one that accounted for the most time on the job. • Exclude consultants, outside contractors, vendors and other not considered employees of your organization.		1 Reproducing Renewable Energy	2 Increasing Energy Efficiency	3 Clean Transportation and Fuels	4 Agriculture and Natural Resource Conservation	5 Pollution Prevention and Environmental Cleanup	Total number of workers you expect to employ in this occupation in two years (By year 2012)	Do you anticipate difficulty in recruiting future qualified workers for this green-related occupation?		Are there any unique skills required for this occupation when working on "green-related" projects?	
Job Title Related to Core Area	**Total Number of Workers**	**Number of Workers in this Core Area**					**Number of Workers**	**Yes**	**No**	**Yes**	**No**
Example: Civil Engineer	3	2				1					
If more space is needed, please photocopy this page, or call **800-343-8981** for additional copies.											

SECTION 5: EMPLOYEE TRAINING

Some green-related employees may require job-specific training. Please estimate what percentage of employee training for your green-related workers will be:

Formal training provided by community colleges or outside training providers _____ %

Informal training of staff on the job _____ %

INDIANA WORKFORCE DEVELOPMENT AND ITS WorkOne CENTERS

STATE OF INDIANA GREEN JOBS SURVEY

INDIANA WORKFORCE DEVELOPMENT AND ITS WorkOne CENTERS

We have supplied this enclosure to provide additional guidance on the definition of green jobs.

If you have any questions about how to respond to the survey, please call us at **800-343-8981**.

Are you part of a multi-location organization or firm?

This survey is intended to collect information for only the establishment (or location) that is listed in the lower left-hand corner of the survey. Many organizations have several locations. Organizations that have several locations may have a home or regional office where the payroll or human resource functions are located. In some cases, this central location may be the only entity that is able to report information for branch locations.

If you are at an address (or location) other than that printed in the lower left-hand corner of the survey, or have received several surveys at a central office, please call us at 800-343-8981 before completing the survey. On the other hand, if you are located at the address shown on this survey then please complete the survey using any of the response options listed in the directions.

GREEN JOB DEFINITIONS

The green economy is comprised of businesses that offer products or services related to renewable energy, increased energy efficiency, clean transportation and fuels, agriculture and natural resource conservation and pollution prevention or environmental cleanup. Green jobs include primary occupations engaged in the production of green-related products or services and support jobs created by green-related revenue.

POTENTIAL CORE GREEN-RELATED ACTIVITIES

Producing Renewable Energy

Renewable energy is energy generated from sustainable, natural resources that can be naturally regenerated in the short-term, such as:

- Sunlight (solar)
- Wind
- Water (hydro)
- Geothermal heat
- Biomass (wood and wood waste, agricultural and energy crops and associated residues, animal waste, municipal solid waste, food products and processing waste)

Related businesses include those:

- Producing renewable energy
- Firms that make or supply parts or equipment used in energy collection and distribution, such as solar panels or wind turbines
- Conducting research and development on renewable energy technologies, or providing consulting assistance to renewable energy providers

Increasing Energy Efficiency

Energy efficiency encompasses all changes that result in a reduction of the energy used for a given energy service (i.e. space heating, lighting, etc.) or level of activity.

Examples include businesses involved with:

- Insulation of residential and commercial buildings

STATE OF INDIANA GREEN JOBS SURVEY

Increasing Energy Efficiency (continued)

- Retrofitting homes to reduce energy consumption
- "Green" building design or implementing LEED standards
- Downsizing or upgrading of HVAC, lighting and other energy systems in buildings, which reduces energy demand
- Production of energy efficient household appliances, such as a refrigerator or dryer
- Providing engineering, consulting or research services on operations, materials or technologies that improve energy efficiency

Clean Transportation and Fuels

Clean transportation refers to the research, development and production of new technologies for energy storage and alternative fuels, as well as the engineering of improved fuel efficiencies and emissions reductions. Examples of these activities include:

- Advanced batteries
- Fuel cells
- Electric and hybrid vehicles
- Alternative fuels
- Public transit
- Activities related to meeting fuel efficiency standards and more

Agriculture and Natural Resource Conservation

Agriculture and natural resource conservation refers to products or services designed to help conserve, maintain and improve natural resources and the environment

Low carbon agriculture consists of agricultural technologies that produce energy with little or no CO^2 emissions, and can also include other conservation practices that help remove CO^2 or related emissions from the atmosphere. Examples include:

- No-till conservation tillage
- Organic farming
- Community supported agriculture
- Methane capture in animal and/or food waste management
- Planting trees or grasses
- Natural resource conservation includes businesses involved with:
- Forest and land management
- Water conservation
- Environmental consulting services
- Environment, conservation and wildlife organizations

Pollution Prevention and Environmental Cleanup

Pollution prevention refers to products that are designed to have minimal adverse impacts on human health and the environment, and services that eliminate or reduce the amount or toxicity of potentially harmful substances at their source. Examples include:

- Controlling industrial and commercial emissions
- Water treatment
- Recycling center operation
- Waste treatment
- Environmental cleanup consists of businesses that provide services or products related to:
    - Environmental remediation
    - Brownfield redevelopment
    - Hazardous waste cleanup
    - Wetlands restoration