

# 2009 WASHINGTON STATE GREEN ECONOMY JOBS



Employment Security Department  
Karen T. Lee, Commissioner

Labor Market and Economic Analysis  
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**Washington State  
Employment Security Department**

Labor Market and Economic Analysis



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Washington Community Action Partnership

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Washington State Labor Council

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# Executive Summary

In 2008, the Washington State Legislature directed the Employment Security Department to conduct a survey to determine how many “green jobs” existed in the state. That initial survey looked only at private-sector firms that seemed most likely to have green jobs.

In 2009, the Legislature requested a follow-up survey to see if the number of green jobs had changed. Employment Security also was directed to expand the survey to include the public sector and additional private-sector industries.

This report presents the findings of the 2009 Green Jobs Survey, which provides the most comprehensive look yet at private- and public-sector green jobs in Washington state. It also provides further evidence that, rather than a separate green economy, the existing economy is becoming increasingly green.

## Methodology

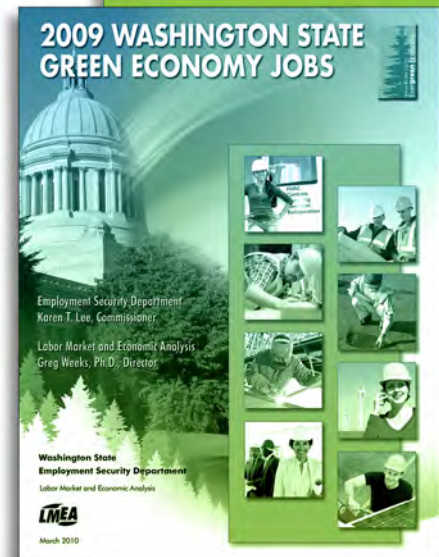
The 2009 survey repeated the use of 2008’s scientifically rigorous survey and sampling process, and used the same definitions. Green jobs are defined as those where employees are directly and predominantly engaged in at least one of the four green-economy core areas:

- ◆ Increasing energy efficiency
- ◆ Producing renewable energy
- ◆ Preventing and reducing environmental pollution
- ◆ Providing mitigation or cleanup of environmental pollution

More than 13,000 employers responded to the 2009 survey, a 70 percent response rate.

## How Many Green Jobs are There?

An estimated 76,137 private-sector green jobs and an additional 23,182 public-sector green jobs were identified in the 2009 survey. Altogether, the survey identified 99,319 green jobs in Washington in 2009. This amounted to 3.3 percent of total employment covered by unemployment insurance in Washington state, up from 1.6 percent in 2008. The data suggest that green jobs are more prevalent across the entire economy and exist in more industries than previously anticipated.





Studies in Washington state and across the nation have identified *no new* industries and only a *few new* occupations that are uniquely “green” such as wind turbine technicians and solar panel installers.

In 2009, the construction industry had more green jobs than any other, with 29,410, primarily in the core area of “increasing energy efficiency.”



## What’s Responsible for the Increase?

The number of private-sector green jobs was substantially higher than the 2008 survey results, which estimated 47,194 green jobs. This result was unexpected by researchers in part because of the weak condition of the economy during both years. Additional analysis of the results revealed that among the private-sector industries that were surveyed in 2008 and again in 2009, the number of green jobs grew by 32.4 percent (15,100). Moreover, almost half of this increase was due to the expanded number of industries and firms included in the survey. It should also be noted that most of the growth among industries that were surveyed in both 2008 and 2009 occurred in firms that did not report having green jobs in the 2008 survey. Possible reasons include greater awareness among employers about what constitutes a green job, new hiring, and changes in the types of products or services offered by employers.

Many factors may account for the differences between the 2008 and 2009 survey results. Therefore, caution should be exercised in drawing conclusions about the nature and extent of green job growth based on these comparisons.

## Green Industries and Occupations

So far, green-economy studies in Washington state and across the nation have identified no new industries and only a few new occupations that are uniquely “green” such as wind turbine technicians and solar panel installers. For the most part, environmentally-friendly activities and responsibilities are being added to existing jobs.

In 2009, the construction industry had more green jobs than any other, with 29,410 (38.6 percent), primarily in the core area of “increasing energy efficiency.” The agriculture industry was second, with 12,027 green jobs, most in the core area of “preventing and reducing environmental pollution.” Major industries least likely to have green jobs were finance and insurance; and real estate, rental, and leasing.

The most common green occupation in 2009 was agricultural workers, followed by electricians.

There were considerable differences between the public and private sectors. More than two-thirds of all public-sector jobs fell within the “preventing and reducing environmental pollution” core area, while the private sector was somewhat more evenly split between “increasing energy efficiency” (44.3 percent) and “preventing and reducing environmental pollution” (39.9 percent).



## The Four Core Areas

The overall findings across the four core areas show that, in 2009:

*Preventing and reducing environmental pollution* accounted for 46 percent (46,004) of all positions, compared to 33.2 percent in 2008. This core area had the largest employment in agriculture-related industries and occupations, followed by positions in some skilled trades and construction-related industries, and in other scientific-technical occupations.

*Increasing energy efficiency* was the second-largest core area, accounting for 38.9 percent (38,894) of all green positions, compared to 52.9 percent in 2008. Construction-related industries and occupations accounted for most of the employment in energy efficiency, followed by professional and technical services industries, such as architecture and engineering.

*Providing mitigation or cleanup of environmental pollution* accounted for 11.6 percent (11,617) of all positions, compared to 9.5 percent in 2008. Most of these positions were in the professional and technical services industries and in occupations such as environmental engineers and some public-sector service occupations.

*Producing renewable energy* represented 3.5 percent (3,464) of all positions, up slightly from 4.3 percent in 2008. Construction-related industries and occupations, as well as professional and technical services occupations, accounted for the majority of all positions in this core area.

Because some green jobs were allocated to multiple core areas, the number of positions by core area may exceed the number of green jobs.

## Geographical Differences

Among Washington's 12 workforce development areas (WDA), the Benton-Franklin region had the most green jobs (8.2 percent) as a percentage of its overall employment. Snohomish County had the lowest percentage, at 2.1 percent. King County had the largest number (32,857) and percentage (33.1 percent) of green jobs for all of Washington, although green jobs comprised only 2.7 percent of the county's total employment.



The “preventing and reducing environmental pollution” core area had the largest employment in agriculture-related industries and occupations.



Construction-related industries and occupations accounted for most of the employment in “energy efficiency.”

WASHINGTON STATE WORKFORCE DEVELOPMENT AREAS





**Based on secondary data sources, total average earnings for all green jobs in Washington were tabulated at more than \$5.1 billion in 2009.**

**Median annual earnings are generally highest for professional or technical occupations that require long-term, post-secondary education or degrees.**



## Earnings and Education

This report incorporates data from other sources that were not collected as part of the Green Jobs Survey, such as earnings and educational requirements. Based on these secondary data sources, total average earnings for all green jobs in Washington were tabulated at more than \$5.1 billion in 2009.

Median annual earnings are generally highest for professional or technical occupations that require long-term, post-secondary education or degrees, such as managers and engineers. As a group, skilled trades occupations related to the construction industry represented the largest employment in green jobs, with median annual earnings that range from approximately \$40,000 to \$55,000.

Among the 25 occupations with the largest number of green jobs, the most commonly required education/training level is at the mid-level, which requires one to four years of postsecondary coursework and/or on-the-job training. Occupations requiring this level of training include electricians, carpenters, and managers.

## Conclusions

The overall findings suggest that the number of green jobs identified by employers is growing, and that green jobs exist in some form in virtually all industries across the state, although concentrations vary. Most of the growth appears to be in existing occupations, and the majority of employers continue to use traditional job titles to describe green jobs.



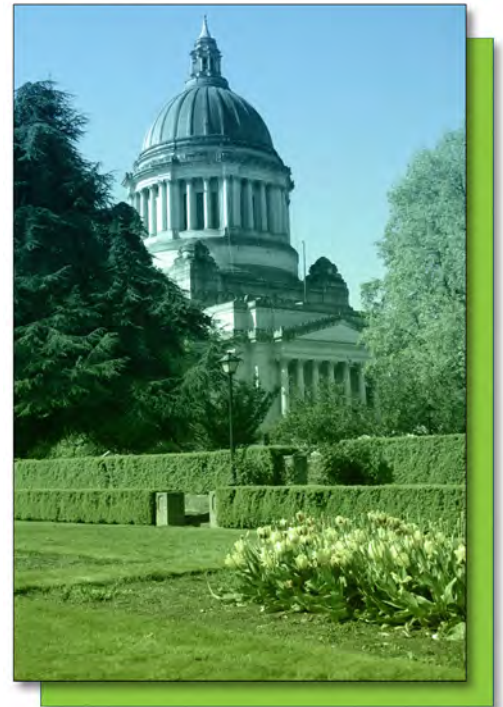
# Introduction

This report presents the findings of an employment survey of private- and public-sector employers in Washington state. The goal of the survey is to identify the number and type of green-economy industries and employment in Washington, and to compare the results to the baseline survey data collected from private-sector employers in 2008, in order to track industry and job growth in the state's emerging green economy. In the 2009 survey, data on public-sector green jobs was also collected, and those results are included.

The study was requested by the state Legislature as specified in Engrossed Second Substitute House Bill 2227 (E2SHB 2227), which passed during the 2009 legislative session.<sup>1</sup> The overall intent of the bill is to identify strategic green industries in the state and to support programs to train workers in green-economy industries and jobs. The bill establishes the *Evergreen Jobs Act* and directs the Evergreen Jobs Leadership Team to focus on specific goals and activities, including the coordination of proposals for federal stimulus funding. E2SHB 2227 also calls for the development of 15,000 new green-economy jobs by 2020.

E2SHB 2227 directs the Employment Security Department, in consultation with the Commerce Department, the Workforce Training and Education Coordinating Board, and the leadership team, to “conduct additional labor market research on a biennial basis to determine the current number of private- and public-sector green jobs and projected job growth in the state's green economy.” E2SHB 2227 also directs the Department to “conduct and update labor market research on current and projected recruitment and skill requirements of private- and public-sector green-economy employers, the wage and benefits ranges of jobs within green-economy industries, and the education and training requirements of entry-level and incumbent workers in those industries.”

The bill also calls for research to define which family-sustaining wage and benefits ranges within green-economy industries will be considered middle- or high-wage occupations, and to identify occupations that are part of career pathways to those occupations. Some topics will be covered in subsequent research projects, in consultation with the partners named in E2SHB 2227.



The overall intent of the bill is to identify strategic green industries in the state and to support programs to train workers in green-economy industries and jobs.



The results of Washington's green-economy jobs research, in combination with findings from other research activities specified in E2SHB 2227, will be used to guide the planning, strategy development, and investments to support future growth of Washington state's green economy.

## Defining Green-Economy Jobs

The *2008 Washington State Green-Economy Jobs* study was the first state agency-led survey of green-economy jobs of its kind in the nation. Extensive background research and survey design discussions with study advisors led to the development of core definitions for green-economy industries and jobs that provided a basis for a rigorous scientific survey design and sampling procedure.<sup>2</sup> These definitions have been subsequently adopted and used, in whole or in part, by several other states and research studies.<sup>3</sup> It was determined by the research team that these same foundational definitions should be continued for the 2009 study. They include:

The *green economy* is rooted in the development and use of products and services that promote environmental protection and clean energy. It is composed of industries and businesses engaged in four core areas:

- ◆ Increasing energy efficiency
- ◆ Producing renewable energy
- ◆ Preventing and reducing environmental pollution
- ◆ Providing mitigation or cleanup of environmental pollution

*Green jobs* are those jobs that promote environmental protection and clean energy.

## The Context for Green-Economy Jobs

Most definitions of a green economy express the idea that the goals of environmental protection and economic development are complementary and interdependent.<sup>4</sup> Clean energy – which encompasses new technologies, renewable energy, energy efficiency, and the policies and practices that support them – is typically at the core of most green-economy definitions, and emphasizes the development of environmentally-friendly, sustainable energy sources that reduce our dependence on fossil fuels and foreign oil.

Growing a clean-energy future is also central to Washington's broader economic development strategy which includes attracting, retaining, and supporting growth among green-economy employers. From basic research and development and the commercialization of new technologies, to new business startups and the expansion of businesses that provide products and services, growing the state's green economy is viewed as central to generating new, good-paying jobs for Washington citizens.<sup>5</sup> New job creation among green-economy employers can also serve to expand employment opportunities for economically-disadvantaged populations, providing pathways out of poverty.<sup>6</sup> New and improved education and training opportunities will help prepare the state's current and future workforce for success, and ensure the competitiveness of green-economy businesses, industries, and the state as a whole.



Growing a clean-energy future is central to Washington's broader economic development strategy.

## Methodology

The study definitions, survey research design, and sampling procedures developed for the *2008 Washington State Green-Economy Jobs* study established solid baseline metrics for the current study. Comparing employer composition and employment between 2008 and 2009 provided some measures of change over the one-year



period. Replicating and improving upon the original survey design and sampling procedures helps ensure that the results provide valid and reliable indicators of green-economy job growth. The 2009 study also sampled public-sector employers in order to estimate green jobs in government and thus to provide a more comprehensive analysis of green-economy jobs and employment across the state's economy.

Consistent with the 2008 study, the survey sought to measure only *direct* jobs identified as green by employers, rather than attempting to measure some combination of direct and secondary (i.e., indirect or induced) employment. This conservative approach may ultimately understate the total economic impact of green-economy employment. However, choosing a conservative measurement approach can also reduce measurement error due to incorrect assumptions or various statistical values often used as employment “multipliers” to estimate total economic outcomes. Many of these secondary jobs are central to advancing the state's green economy: school teachers and many retail and administrative support occupations play important supporting roles; however, in many cases these jobs do not relate directly to green-economy products or services. Review of the data collected for this study identified a number of indirect green jobs, including jobs that did not appear to meet the strict green-job definition. These were further investigated through follow-up data collection, analyses, and interviews with employers. Those that were determined to be indirect jobs or that clearly did not meet the definition were excluded from the final database. Occupations that could not be clearly confirmed as indirect or not meeting the definition were retained.

The survey occurred in three stages, replicating the approach used for the 2008 survey. First, the design team identified industries where concentrations of green jobs were expected, based on reviews of past research and input from industry and other experts. The research team also included surveying all other industries in order to identify green jobs across the entire economy, including government.

In the second stage, the study then relied on a printed survey that was mailed by the Employment Security Department in early August 2009 to a random sample of 21,664 employers statewide. The primary goal was to determine how many workers are employed in a green job as previously defined and included in the preface to the survey.<sup>7</sup> The survey asked employers to identify how many of their employees hold green jobs, and whether this employment was full time or part time. Where employees performed work in more than one core area, employers were asked to identify the one core area that accounted for the most time on the job.<sup>8</sup>

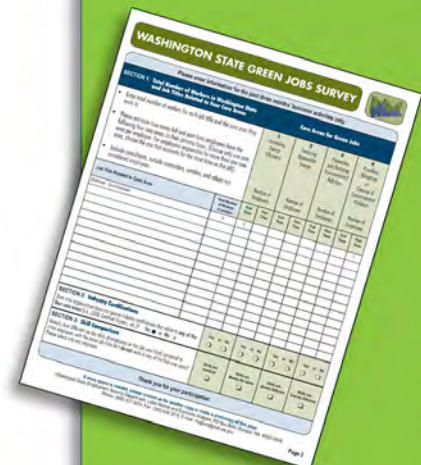
Employers were also asked to name the job titles of employees who hold jobs related to the four core areas, and whether their organization held any special industry certifications related to



The survey sought to measure only direct jobs identified as green by employers.



The 2009 Green Jobs Survey replicated the approach used for the 2008 survey.





Employers were also asked about jobs related to the four core areas and any special industry certifications they hold.

these core areas. The employers were then asked to identify how different the skills of employees who work in the jobs they listed are compared to other employees with the same job titles, but who don't work in any of the four core areas.

The third stage was a survey of the non-respondent employers in order to adjust for the effects of response bias. The results of the second and third stages were combined to produce the non-biased estimate of green jobs in Washington state.

Following completion of the survey process, existing data on industry and occupational forecasts and wages, and education and skill requirements, were linked to the survey findings to enable further analyses of green-economy characteristics, employment, and projected growth.

Participation: 13,457 employers contacted chose to participate in the survey. This represents a participation rate of nearly 70 percent.

Nearly 23 percent of the 13,457 employers who responded to the survey reported that their business activity is engaged in one or more type of core area, and that they had employees who were responsible for producing goods or providing services that support these core areas and the related goals. The survey results were subsequently weighted to represent the relative distribution of green jobs across the broader population of employers, which enabled the computation of estimates of the number of green-economy industries, employers, and employment, by occupation.

For further explanation on the selection of these industries and the methods used in the study, please refer to the methodology section in *Appendix 3*.

## Study Results

The survey results are presented as a series of tables with accompanying narrative that describes the main findings for each table. Private-sector survey findings are presented first, followed by the findings for the public sector. Additional findings for both private- and public-sector employers, employment, and secondary analyses linked to green jobs are also included. The conclusions and implications section summarizes and integrates the survey findings and offers recommendations for future research.

## Green Jobs in Washington State

The *2008 Washington State Green-Economy Jobs* study estimated that 47,194 private-sector green jobs exist in Washington's economy. For 2009, the scope of the original study was expanded to examine both private- and public-sector employment. The current total estimate for Washington is 99,319 private- and public-sector green jobs. This total number includes both full-time and part-time employment in green jobs. For further explanation on the selection of these industries, response rate, and the methods used in the study, please refer to the methodology section in *Appendices 2 and 3*.

It is important to note that the 2008 estimate cannot be reliably compared to the estimate for 2009. This is because the 2009 survey sample included both private- and public-sector employers, and because of differences in the sample populations of employers used in the two surveys. Therefore, while the reported numbers of green jobs show an increase in private-sector green jobs between the two years, technical differences in sample populations and related measurement error prevent us from stating with statistical confidence that there are differences in the overall number of private-sector green jobs between 2008 and 2009. Later in this report, however, we compare employment changes in green jobs among industry sectors that were in the surveys for both years, and those measures of employment in green jobs are statistically reliable.

## Private- and Public-Sector Positions by Core Area

*Table 1* shows the distribution of private- and public-sector positions for each core area for 2009. Since some employers reported that some jobs had responsibilities in more than one core area, they are reported in the table as positions rather than as individual green jobs.

The distribution of green jobs between private- and public-sector employers (government) across the four core areas is also depicted in *Table 1*. The largest number of positions in the private sector is in increasing energy efficiency, with over 34,000 positions, followed by positions in preventing and reducing environmental pollution (30,622). On a percentage basis, the private sector accounts for 91 percent of all positions in producing renewable energy. The narrowest difference in employment between the private and public sectors is in the preventing and reducing environmental pollution core area, where public-sector employment accounts for one-third of all positions. In fact, more than two-thirds of all public-sector positions are related to preventing and reducing environmental pollution.

**Table 1**

Private- and Public-Sector Positions by Core Area, 2009

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

CORE AREA	PRIVATE SECTOR		PUBLIC SECTOR		PERCENT OF PRIVATE AND PUBLIC SECTOR POSITIONS
	POSITIONS	PERCENT OF CORE AREA	POSITIONS	PERCENT OF CORE AREA	
Increasing Energy Efficiency	34,035	87.5%	4,859	12.5%	38.9%
Producing Renewable Energy	3,166	91.4%	298	8.6%	3.5%
Preventing and Reducing Environmental Pollution	30,622	66.6%	15,382	33.4%	46.0%
Providing Mitigation or Cleanup of Environmental Pollution	8,928	76.9%	2,689	23.1%	11.6%

**Note:** Employers may have reported more than one core area for some green jobs, so the sum of positions across core areas may exceed the number of green jobs.

## Distribution of Green Jobs by Workforce Development Area (WDA)

Private- and public-sector green jobs combined represent about 3.3 percent of all total covered employment in Washington. The map depicted in *Figure 1* shows green jobs as a percentage of total covered employment in each of Washington's 12 WDAs. Also included, in brackets, is the total number of private- and public-sector green jobs for each WDA.

As shown in *Figure 1*, a number of differences exist among the WDAs in the proportion of green jobs compared to total covered employment. Summary descriptions for some of the leading WDAs are included below:

- ◆ The Benton-Franklin WDA has the highest proportion of green jobs, at 8.2 percent of total covered employment (8,671).

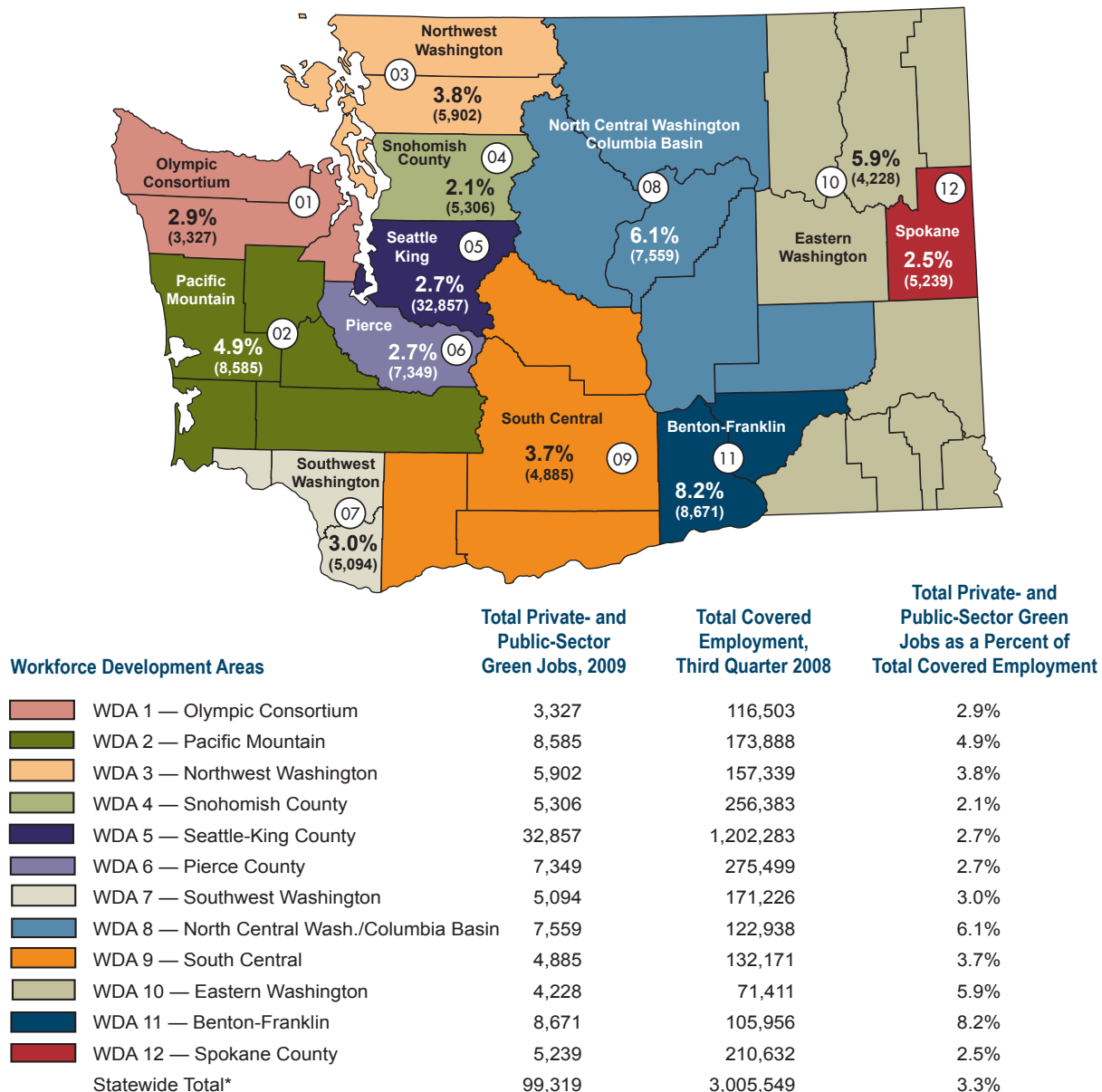
- ◆ The North Central Washington WDA (6.1 percent) and Eastern Washington WDA (5.9 percent) have the next-largest proportions of green jobs, with 7,559 and 4,228, respectively.
- ◆ Among WDAs with the largest total number of green jobs, Seattle-King County leads with 32,857 jobs. Seattle-King County also accounts for one-third of all green jobs in the state; however these jobs account for just 2.7 percent of total covered employment in the county.
- ◆ The second-largest total number of green jobs is in the Benton-Franklin WDA (8,671), followed by the Pacific Mountain WDA (8,585).

Additional information on the distribution of positions by core area for each WDA can be found in *Appendix 1*.

### Figure 1

Employment and Percent of Private- and Public-Sector Green Jobs by Workforce Development Area (WDA), 2009

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009



Note: \*Totals for Workforce Development Areas will not equal the statewide total because some firms report in more than one Workforce Development Area.



## 2009 Private-Sector Employment

In order to simplify the presentation of the survey results, the key findings for private-sector green jobs are presented separately from the public-sector findings; those results are presented later in this report.

### Private-Sector Positions by Core Area

Table 2 depicts private-sector full- and part-time positions for each core area. Since some employers reported that some jobs had responsibilities in more than one core area, they are reported in the table as positions rather than as individual green jobs. The table shows that increasing energy efficiency accounts for 44.3 percent of all private-sector green positions in the state, followed by preventing and reducing environmental pollution (39.9 percent), providing mitigation or cleanup of environmental pollution (11.6 percent), and producing renewable energy at 4.1 percent.

The table also shows that while the majority of private-sector positions are full time, between 25 and 35 percent of the jobs within each core area are identified as part time. Some of the more notable differences in part-time employment are summarized below:

- ◆ On a percentage basis, the proportion of part-time positions in producing renewable energy (35 percent) is the highest among the four core areas.
- ◆ Preventing and reducing environmental pollution has the largest total number of part-time positions among the core areas (9,240), and the second-largest proportion of part-time employment (30 percent) behind producing renewable energy.
- ◆ In increasing energy efficiency, nearly 26 percent of employment is part time, which accounts for over 8,700 positions.

**Table 2**

Private-Sector Full- and Part-Time Positions by Core Area

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

	INCREASING ENERGY EFFICIENCY		PRODUCING RENEWABLE ENERGY		PREVENTING AND REDUCING ENVIRONMENTAL POLLUTION		PROVIDING MITIGATION OR CLEANUP OF ENVIRONMENTAL POLLUTION	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Full Time	25,321	74.4%	2,056	64.9%	21,382	69.8%	6,382	71.5%
Part Time	8,714	25.6%	1,110	35.1%	9,240	30.2%	2,546	28.5%
Full Time and Part Time	34,035	100.0%	3,166	100.0%	30,622	100.0%	8,928	100.0%
Percent of All Private-Sector Positions		44.3%		4.1%		39.9%		11.6%

### Private-Sector Green Jobs by Industry

Although the private sector accounts for more than three-quarters of all green jobs, these jobs represent a small proportion of the state's total covered employment. In fact, all private-sector green jobs combined account for just 3.1 percent of private-sector total covered employment across the state.

Within the private sector, *Table 3* shows that the largest proportions of green jobs are in industries associated with construction; agriculture; professional services; and administrative, support, and waste management. This overall trend is consistent with the findings from the 2008 survey. Summary descriptions for these top industries include:

- ◆ Construction is the leading industry, comprising nearly 39 percent of all green jobs. *Table 3* shows that construction also represents the largest proportion of green jobs as a percent of statewide total covered employment in this industry (15.2 percent).
- ◆ Agriculture is the second-largest industry reporting green jobs (15.8 percent). These green jobs represent nearly 11 percent of statewide total covered employment in agriculture.
- ◆ While the utilities industry accounts for a small number of green jobs (461), they represent 9.3 percent of statewide total covered employment in this industry.
- ◆ Professional services is the next-largest industry (10,914), with over 14 percent of all reported green jobs. These green jobs represent 6.8 percent of statewide total covered employment in this industry.
- ◆ The administrative, support, and waste management industry is the fifth largest (9,414), reporting over 12 percent of green jobs, which represents 6.3 percent of all statewide total covered employment in this industry.

The table also shows that some industries – most notably finance and insurance; retail trade; and real estate, rental, and leasing – reported very small numbers of green jobs, two of which represent less than one-tenth of one percent of all statewide total covered employment in these industries.

**Table 3**

Private-Sector Green Jobs by Industry, 2009

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

INDUSTRIES	PRIVATE-SECTOR GREEN JOBS	PERCENT OF ALL PRIVATE-SECTOR GREEN JOBS	INDUSTRY EMPLOYMENT REPORTED THIRD QUARTER 2008	PRIVATE-SECTOR GREEN JOBS AS A PERCENT OF ALL INDUSTRY EMPLOYMENT
Agriculture	12,027	15.8%	110,871	10.8%
Utilities	461	0.6%	4,947	9.3%
Construction	29,410	38.6%	193,846	15.2%
Manufacturing	5,739	7.5%	293,102	2.0%
Wholesale Trade	4,494	5.9%	127,531	3.5%
Retail Trade	125	0.2%	321,709	0.0%
Transportation and Warehousing	1,708	2.2%	86,236	2.0%
Information	363	0.5%	106,612	0.3%
Finance and Insurance	19	0.0%	98,893	0.0%
Real Estate, Rental, and Leasing	46	0.1%	50,259	0.1%
Professional Services	10,914	14.3%	161,180	6.8%
Administrative, Support, and Waste Management	9,414	12.4%	148,907	6.3%
Other Services (except Public Administration)	1,419	1.9%	120,261	1.2%
<b>Total Private-Sector Green Jobs</b>	<b>76,137</b>	<b>100.0%</b>	<b>2,494,886</b>	<b>3.1%</b>
<b>Total Private- and Public-Sector Green Jobs</b>	<b>99,319</b>		<b>3,005,549</b>	<b>3.3%</b>

Note: The estimate of green jobs in this table is not comparable to the estimates in table 5.

## Private-Sector Occupations by Core Area

As part of the survey, employers were asked to provide the name of all job titles for employees who have primary responsibility for one of the four core areas shown in *Table 1*. The intent was to document the number and range of occupations, and to identify any new job titles that employers may have created related specifically to the four core areas.

Analysis of the raw job titles provided by employers shows that with very few exceptions, employers did not identify new job titles that could be explicitly linked to a new class of green occupations. Similar to the 2008 findings, employers who reported that they produce goods or provide services that support any of the core areas appear to be relying primarily on traditional occupational titles to categorize or describe the jobs of their employees.

*Table 4* shows the top 25 private-sector occupations (based on Standard Occupational Classification (SOC) codes), with the largest number of green jobs, and the percentage of all green jobs that each occupation represents. The table also shows the distribution of positions within the occupations across the four core areas.

These top 25 occupations represent over 72 percent of all private-sector green jobs. Although green jobs represent many different types of occupations, the largest employment counts are concentrated in a small number of related occupations. Indeed, the first 11 occupations listed in the table collectively account for nearly 50 percent of all green jobs. These leading occupations represent mostly skilled trades and technical jobs that are directly related to the development or creation of green-related goods or services. Administrative, management or other support-related jobs are identified, but total employment in these occupations is small by comparison.

*Table 4* shows that agricultural workers, all other, comprise the single largest occupational group with 9.6 percent of all green jobs. This occupational group also represented the largest total number of positions (6,640) within any core area (preventing and reducing environmental pollution). Electricians comprise the second-largest occupational group with just over seven percent of all green jobs, and represent the second-largest number of positions (5,203) within any core area (increasing energy efficiency). A similar pattern can be observed for carpenters, which comprise the third-largest percent (6.5) of all green jobs.

Electricians and carpenters were among a number of leading occupations that directly support the construction industry. Indeed, a large proportion of the top 25 occupations is either directly or indirectly related to construction. Combined, the eight largest occupations named in the table that are directly related to construction account for 27 percent of all private-sector green jobs.<sup>9</sup>



With very few exceptions, employers did not identify new job titles that could be explicitly linked to a new class of green occupations.



Indeed, a large proportion of the top 25 occupations is either directly or indirectly related to construction.



**Table 4**

Top 25 Private-Sector Occupations by Core Area

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

OCCUPATIONS	PRIVATE-SECTOR POSITIONS WITHIN THE TOP 25 OCCUPATIONS				PERCENT OF ALL PRIVATE-SECTOR GREEN JOBS**
	INCREASING ENERGY EFFICIENCY	PRODUCING RENEWABLE ENERGY	PREVENTING AND REDUCING ENVIRONMENTAL POLLUTION	PROVIDING MITIGATION OR CLEANUP OF ENVIRONMENTAL POLLUTION	
Agricultural Workers, All Other*	190	64	6,640	638	9.6%
Electricians	5,203	155	130	4	7.1%
Carpenters	4,474	20	465	73	6.5%
Construction Laborers	1,902	48	1,401	442	5.0%
Heating, Air Cond., and Refrigeration Mech. and Installers	2,916	33	44	-	3.9%
Truck Drivers, Heavy and Tractor-Trailer	212	45	1,799	570	3.5%
Architects, except Landscape and Naval	1,960	19	267	38	2.9%
Civil Engineers	1,081	132	862	248	2.9%
Maintenance and Repair Workers, General	194	13	1,924	91	2.9%
Managers, All Other*	1,173	279	414	162	2.6%
Production Workers, All Other*	878	37	870	183	2.6%
Painters, Construction and Maintenance	22	-	1,790	39	2.4%
Packers and Packagers, Hand	-	-	1,674	-	2.2%
Environmental Engineers	29	32	379	1,151	2.1%
Roofers	1,144	44	224	123	1.8%
Plumbers, Pipefitters, and Steamfitters	924	33	386	28	1.8%
Electrical Engineers	1,122	103	74	4	1.7%
Engineers, All Other*	86	262	33	10	1.7%
Operating Engineers and Other Construction Equip. Oprs.	125	115	764	252	1.6%
Landscaping and Groundskeeping Workers	363	5	578	180	1.4%
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	41	8	922	133	1.4%
Mechanical Engineers	593	89	310	57	1.3%
Electrical Power-Line Installers and Repairers	820	166	4	-	1.3%
Farm, Ranch, and Other Agricultural Managers	1	-	911	23	1.2%
Insulation Workers, Floor, Ceiling, and Wall	797	-	-	-	1.0%
<b>Percent of Private-Sector Positions within the Top 25 Occupations</b>	<b>77.12%</b>	<b>53.73%</b>	<b>74.66%</b>	<b>49.82%</b>	
<b>Percent of Private-Sector Green Jobs within the Top 25 Occupations</b>					<b>72.35%</b>

Notes: \*Occupational titles ending with "All Other" are considered residual and combine occupations which don't fit into other detailed codes.

\*\* This column shows the occupational distribution of the unduplicated 76,137 private-sector green jobs among these top 25 occupations.

## Green Job Growth, 2008 to 2009

The survey developed for the 2008 study served as the model for the 2009 survey, thus allowing some data comparisons between 2008 and 2009. As noted earlier, technical differences in sample populations and related measurement error prevent us from stating with statistical confidence that there are differences in the



overall number of private-sector green jobs between 2008 and 2009. However, by matching survey responses by industries, it is possible to compare employment changes in green jobs between comparable industries for both years. Since not all detailed industries are comparable between the two surveys, the numbers available for comparative analysis are smaller than the total reported numbers in 2008 and 2009, and therefore use of the results should be treated with caution.

*Table 5* shows that the changes in employment numbers and percentages in some industries between 2008 and 2009 vary considerably. Overall, firms in these industries reported a 32 percent increase in the number of green jobs between the two years, a difference of more than 15,100. It should be noted that in some cases, such as finance and insurance, the percentage change is large, but the difference represents a small change in total covered employment.

The construction industry experienced the largest total increase in green jobs (6,165), growing by nearly 30 percent between the two years. This increase may be due to some combination of new hiring for green construction projects, increased part-time employment, or to employers who are increasing their percentage of green-related construction projects, including new construction and renovation of existing structures to make them more energy efficient. Professional services, an industry that includes a diverse range of professional and technical companies and employment such as engineering, architectural, legal, and accounting services, saw the second-largest increase in green jobs among all industries (3,367), representing growth in this industry of over 45 percent.

Growth in green jobs was next largest in manufacturing; administrative, support, and waste management; and agriculture, respectively. In terms of percentage increases, manufacturing also shows a substantial increase (120 percent) in the number of green jobs during the reporting period. The only industry to report a decline in the number of green jobs between the two years was utilities, where employment fell by 31 percent.

**Table 5**

Change in Private-Sector Green Jobs by Comparable Industries, 2008 to 2009\*

Source: Washington State Green Jobs Surveys, Employment Security Department, Labor Market and Economic Analysis, 2008 and 2009

INDUSTRIES	GREEN JOBS		CHANGE	
	2009	2008	NUMBER	PERCENT
Agriculture	11,896	10,539	1,357	12.9%
Utilities	461	671	-210	-31.4%
Construction	27,517	21,352	6,165	28.9%
Manufacturing	5,211	2,368	2,843	120.1%
Wholesale Trade	900	832	68	8.2%
Retail Trade	125	70	55	78.8%
Finance and Insurance	13	2	11	531.3%
Professional Services	10,823	7,456	3,367	45.2%
Administrative, Support, and Waste Management	4,354	2,913	1,442	49.5%
Other Services (except Public Administration)	476	470	6	1.2%
<b>Total Private-Sector Green Jobs</b>	<b>61,775</b>	<b>46,673</b>	<b>15,103</b>	<b>32.4%</b>

**Note:** \*The analysis uses only data from detailed-level six-digit North American Industry Classification System (NAICS) industries that are present in both 2008 and 2009 surveys.

### Green Jobs by Top 25 Private-Sector Occupations, 2008 to 2009

An additional comparison of 2008 with 2009 was conducted to determine the differences in employment by occupation. Since the sample data for both years are not directly comparable by occupation, *Table 6* presents these differences by comparing the relative rank of the top 25 occupations. The table shows that with em-

ployment of 7,292, agricultural workers, all other, represented the largest number of green jobs in 2009, thus it ranks first among all occupations. In 2008, however, the same occupation was ranked fifth. Electricians ranked second in green jobs for both years.

Table 6 shows that with a few exceptions, the patterns of ranking among the occupations with the largest number of green jobs for both years are fairly similar. This suggests that the overall distribution among these top occupations has remained fairly consistent between 2008 and 2009. In some cases the relative rankings of some occupations, such as painters, engineers, all other, and landscaping and groundskeeping workers, have shifted considerably.



The overall distribution among these top occupations has remained fairly consistent between 2008 and 2009.

**Table 6**

Top 25 Private-Sector Occupations, 2009 Rank Compared to 2008 Rank

Source: Washington State Green Jobs Surveys, Employment Security Department, Labor Market and Economic Analysis, 2008 and 2009

2009 TOP 25 PRIVATE-SECTOR OCCUPATIONS			2008 RANK
OCCUPATIONS	PRIVATE-SECTOR GREEN JOBS	RANK	
Agricultural Workers, All Other*	7,292	1	5
Electricians	5,432	2	2
Carpenters	4,945	3	4
Construction Laborers	3,770	4	3
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	2,962	5	6
Truck Drivers, Heavy and Tractor-Trailer	2,657	6	15
Architects, except Landscape and Naval	2,206	7	9
Civil Engineers	2,193	8	7
Maintenance and Repair Workers, General	2,183	9	35
Managers, All Other*	1,967	10	24
Production Workers, All Other*	1,942	11	13
Painters, Construction and Maintenance	1,850	12	118
Packers and Packagers, Hand	1,674	13	30
Environmental Engineers	1,596	14	46
Roofers	1,380	15	12
Plumbers, Pipefitters, and Steamfitters	1,346	16	8
Electrical Engineers	1,301	17	20
Engineers, All Other*	1,258	18	181
Operating Engineers and Other Construction Equipment Operators	1,230	19	39
Landscaping and Groundskeeping Workers	1,090	20	199
Farmworkers and Laborers, Crop, Nursery, and Greenhouse	1,089	21	1
Mechanical Engineers	997	22	10
Electrical Power-Line Installers and Repairers	990	23	28
Farm, Ranch, and Other Agricultural Managers	938	24	66
Insulation Workers, Floor, Ceiling, and Wall	797	25	18
<b>Total Private-Sector Green Jobs within Top 25 Occupations</b>	<b>55,085</b>		
<b>Total All Private-Sector Occupations</b>	<b>76,137</b>		
<b>Total Private- and Public-Sector Green Jobs</b>	<b>99,319</b>		

Note: \*Occupational titles ending with "All Other" are considered residual and combine occupations which don't fit into other detailed codes.

## 2009 Public-Sector Employment

2009 was the first year for which public-sector (government) green jobs data were collected. The survey instrument was identical for both the private- and public-sector data in the 2009 study; however government represents a single NAICS industry sector. Nevertheless, analysis of these data revealed several key findings that add to our knowledge of the characteristics of public-sector green jobs. The main findings are presented below.

### Public-Sector Positions by Core Area

Table 7 shows full- and part-time position percentages for each core area. Since some employers reported that some jobs had responsibilities in more than one core area, they are reported in the table as positions rather than individual green jobs. The table shows that preventing and reducing environmental pollution accounts for more positions than any other core area. It was followed by increasing energy efficiency (21 percent), providing mitigation or cleanup of environmental pollution (12 percent), and producing renewable energy at just one percent.

The table also shows that while the majority of public-sector positions are full time, the relative proportion of full- and part-time employment among the four core areas varies widely. Some of the more notable differences are summarized below:

- ◆ On a percentage basis, the proportion of part-time positions in increasing energy efficiency (62 percent) is the highest among the four core areas; increasing energy efficiency also has the largest number of part-time positions (3,018) among all core areas.
- ◆ Producing renewable energy, which represents a small total number of public-sector positions, has the second-largest proportion of part-time positions at 49 percent.
- ◆ While the differences in total positions between preventing and reducing environmental pollution and providing mitigation or cleanup of environmental pollution are quite large, the proportion of part-time positions in the two core areas is nearly identical (16 percent).

**Table 7**

Public-Sector Full- and Part-Time Positions by Core Area

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

	INCREASING ENERGY EFFICIENCY		PRODUCING RENEWABLE ENERGY		PREVENTING AND REDUCING ENVIRONMENTAL POLLUTION		PROVIDING MITIGATION OR CLEANUP OF ENVIRONMENTAL POLLUTION	
	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT	NUMBER	PERCENT
Full Time	1,841	37.9%	153	51.2%	12,907	83.9%	2,268	84.4%
Part Time	3,018	62.1%	146	48.8%	2,475	16.1%	420	15.6%
Full Time and Part Time	4,859	100.0%	298	100.0%	15,382	100.0%	2,689	100.0%
Percent of All Public-Sector Positions		20.9%		1.3%		66.2%		11.6%

## Top 25 Public-Sector Occupations, 2009

*Table 8* shows the top 25 occupations with the largest number of green jobs, and the percentage of all public-sector green jobs that each occupation represents. The occupational titles identified as green jobs reflect many of those we would expect to find within the public sector. Many of these occupations relate to the provision of professional and technical services that are associated with supporting clean energy, energy efficiency, and environmental protection, while others are associated with services such as public transportation that reduce overall energy use and pollution.

**Table 8**

Top 25 Occupations for Public-Sector Green Jobs

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

OCCUPATIONS	TOTAL PUBLIC-SECTOR GREEN JOBS	PERCENT OF ALL PUBLIC-SECTOR GREEN JOBS
Bus Drivers, Transit and Intercity	4,626	20.0%
Civil Engineers	3,579	15.4%
Bus Drivers, School	1,731	7.5%
Environmental Scientists and Specialists, Including Health	1,631	7.0%
Maintenance and Repair Workers, General	1,099	4.7%
Urban and Regional Planners	1,067	4.6%
Water and Liquid Waste Treatment Plant Operators	768	3.3%
Sailors and Marine Oilers	640	2.8%
Environmental Science and Protection Technicians	598	2.6%
General and Operations Managers	567	2.4%
Environmental Engineers	461	2.0%
Zoologists and Wildlife Biologists	446	1.9%
Construction and Building Inspectors	368	1.6%
Civil Engineering Technicians	342	1.5%
Bus and Truck Mechanics and Diesel Engine Specialists	307	1.3%
Laborers and Freight, Stock, and Material Movers, Hand	301	1.3%
Farm, Ranch, and Other Agricultural Managers	268	1.2%
Computer Support Specialists	265	1.1%
Forest and Conservation Technicians	241	1.0%
Occupational Health and Safety Specialists	237	1.0%
Conservation Scientists	216	0.9%
Operating Engineers and Other Construction Equipment Operators	206	0.9%
Refuse and Recyclable Material Collectors	188	0.8%
Agricultural Inspectors	156	0.7%
Private Detectives and Investigators	153	0.7%
<b>Total Public-Sector Green Jobs within Top 25 Occupations</b>	<b>20,462</b>	<b>88.3%</b>
<b>Total All Public-Sector Green Jobs</b>	<b>23,182</b>	

These top 25 occupations represent over 88 percent of all public-sector green jobs. *Table 8* shows that many different scientific, technical, and skilled occupations are represented. Although there is a range of occupational titles, the largest number of green jobs is concentrated in a small number of occupations. Indeed, the



first seven occupations listed in the table together account for more than 14,500 green jobs and 63 percent of all public-sector green jobs. The table shows that bus drivers, transit and intercity, comprise the occupation with the largest number of green jobs, representing 20 percent of all public-sector green jobs. As a group, transportation-related employment is even larger: when employment in the three top occupations related to public transportation is combined, these occupations represent over 6,600 green jobs and 29 percent of all public-sector green jobs.

## Secondary Analyses

An additional analysis of green jobs was conducted by integrating available data on earnings, education, and experience requirements for the top 25 occupations with the largest number of green jobs. As noted earlier, the top 25 private- and public-sector occupations account for large percentages of total green jobs. The research team decided that matching green job estimates to existing median earnings by occupation,<sup>10</sup> and to educational and experience requirements, would enhance survey response rates by reducing the burden on employers to provide more detailed information. Results for survey questions regarding a comparison of green job skills and employer identification of industry certifications are presented later in the report.

### 2009 Green Occupations and Earnings

*Table 9* shows the distribution of statewide median annual earnings for the top 25 occupations with private- and public-sector green jobs. The large employment numbers and associated earnings for these occupations suggest that green jobs provide considerable economic benefits to citizens and the state. Indeed, an estimate based on the top 25 leading occupations alone shows that these top green jobs account for over \$3.5 billion in average annual earnings. Estimating earnings for all green jobs combined shows that employment in green jobs accounts for over \$5.1 billion in average annual earnings.

As depicted in *Table 9*, median annual earnings are generally highest for professional or technical occupations that require long-term, post-secondary education and degrees. Managers, all other, command the highest median earnings among all occupations (\$102,417). Engineers and architects account for the second-highest earnings level among the top 25 occupations (approximately \$71,000 to \$85,000), respectively.

The next tier of earnings includes a variety of skilled-trades jobs (e.g., carpenters, electricians, and operating engineers). As a group, skilled-trades occupations related to the construction industry represent the largest employment in green jobs, with median annual earnings that range from approximately \$40,000 to \$55,000.



Evidence suggests that green jobs provide considerable economic benefits to Washington state and its citizens.



Estimating earnings for all green jobs combined shows that employment in green jobs accounts for over \$5.1 billion in average annual earnings.



As might be expected, lower earnings are generally associated with less-skilled occupations that do not require long-term preparation, such as general laborers and production workers. These occupations have median annual earnings of approximately \$25,000 to \$35,000. Hand packers and packagers have the lowest median earnings among all occupational groups at just over \$20,000 per year.

**Table 9**

Statewide Median Annual Earnings\*\* for the Top 25 Occupations with Private- and Public-Sector Green Jobs, 2009

Source: Occupational Employment Statistics (OES) Survey and the Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

OCCUPATIONS	MEDIAN ANNUAL EARNINGS**	PRIVATE- AND PUBLIC-SECTOR GREEN JOBS WITHIN OCCUPATIONS
Agricultural Workers, All Other*	\$34,922	7,292
Civil Engineers	\$75,362	5,772
Electricians	\$56,961	5,467
Carpenters	\$47,037	4,963
Bus Drivers, Transit and Intercity	\$43,491	4,626
Construction Laborers	\$33,309	3,812
Maintenance and Repair Workers, General	\$38,430	3,282
Heating, Air Conditioning, and Refrigeration Mechanics and Installers	\$49,747	3,012
Truck Drivers, Heavy and Tractor-Trailer	\$40,909	2,659
Architects, except Landscape and Naval	\$71,228	2,232
Environmental Scientists and Specialists, including Health	\$61,649	2,222
Environmental Engineers	\$78,251	2,057
Managers, All Other*	\$102,417	2,020
Production Workers, All Other*	\$26,809	1,983
Painters, Construction and Maintenance	\$33,354	1,851
Bus Drivers, School	\$34,697	1,731
Packers and Packagers, Hand	\$20,342	1,674
Operating Engineers and Other Construction Equipment Operators	\$54,132	1,436
Roofers	\$42,518	1,380
Plumbers, Pipefitters, and Steamfitters	\$53,230	1,377
Electrical Engineers	\$82,524	1,333
Engineers, All Other*	\$94,362	1,262
Farm, Ranch, and Other Agricultural Managers	\$70,231	1,206
Urban and Regional Planners	\$64,466	1,148
Retail Salespersons	#N/A	1,106
<b>Total of Private- and Public-Sector Green Jobs within Top 25 Occupations</b>		<b>66,901</b>
<b>Total of All Other Private- and Public-Sector Green Jobs within all Occupations</b>		<b>32,418</b>
<b>Total of All Private- and Public-Sector Green Jobs</b>		<b>99,319</b>

Notes: \*Occupational titles ending with "All Other" are considered residual and combine occupations which don't fit into other detailed codes.

\*\*The earnings data are derived from all occupations, not just occupations with green jobs. Estimated total wages for the top 25 occupations with green jobs are \$3,519 billion dollars and for all occupations with green jobs are \$5,133 billion dollars. N/A - Data are not available

## Education and Experience Requirements for Green Occupations

As with earnings, the education and experience requirements for entry into many green jobs vary considerably, depending on the type of occupation and the work performed. As shown in *Table 10*, among the top 25 occupations, the level of education and length of training required is highest for professional and technical occupations: engineers, architects, urban and regional planners, and some management occupations generally require a four-year degree or higher.

**Table 10**

Education and Work Experience Requirements by Level of Preparation for the Top 25 Private- and Public-Sector Occupations  
*Source:* Bureau of Labor Statistics and Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

OCCUPATIONS	EDUCATION AND EXPERIENCE REQUIREMENTS	NUMBER OF PRIVATE- AND PUBLIC-SECTOR GREEN JOBS
	Long Preparation	
Civil Engineers	e.g., Bachelor's Degree or higher	5,772
Architects, except Landscape and Naval		2,232
Environmental Scientists and Specialists, Including Health		2,222
Environmental Engineers		2,057
Electrical Engineers		1,333
Engineers, All Other*		1,262
Farm, Ranch, and Other Agricultural Managers		1,206
Urban and Regional Planners		1,148
Subtotal		17,231
	Mid-Level Preparation	
Electricians	>1 year, <4 years, includes on-the-job training, classes, or combination	5,467
Carpenters		4,963
Maintenance and Repair Workers, General		3,282
Heating, Air Conditioning, and Refrigeration Mechanics and Installers		3,012
Managers, All Other*		2,020
Plumbers, Pipefitters, and Steamfitters		1,377
Subtotal		20,120
	Short Preparation	
Bus Drivers, Transit and Intercity	1 to 12 months, on-the-job training, classes, or combination	4,626
Construction Laborers		3,812
Truck Drivers, Heavy and Tractor-Trailer		2,659
Production Workers, All Other*		1,983
Painters, Construction and Maintenance		1,851
Operating Engineers and Other Construction Equipment Operators		1,436
Roofers		1,380
Subtotal		17,746
	Little Preparation	
Agricultural Workers, All Other*	<1 month, usually on-the-job training	7,292
Bus Drivers, School		1,731
Packers and Packagers, Hand		1,674
Retail Salespersons		1,106
Subtotal		11,803
Total Private- and Public-Sector Green Jobs within Top 25 Occupations		66,901
All Other Private- and Public-Sector Green Jobs within all Occupations		32,418
Total Private- and Public-Sector Green Jobs		99,319

**Notes:** \*Occupational titles ending with "All Other" are considered residual and combine occupations which don't fit into other detailed codes.  
 SOC code 452099 "Agricultural Workers, All Other" is not available in the economic data so the equivalent agricultural codes 452092 Farmworkers and Laborers, Crop, Nursery, and Greenhouse, and 459093 Farmworkers, Farm and Ranch Animals have been used.



Extensive on-the-job training with supplemental coursework is a requirement of registered apprenticeship programs.

Green jobs requiring mid-level preparation include a range of skilled-trades occupations, many of which entail considerable preparation through a combination of classes and on-the-job training that can take up to four years to complete. Extensive on-the-job training with supplemental coursework is a requirement of registered apprenticeship programs. Of the top 25 occupations listed in *Table 10*, more than 20,000 of all green jobs are represented by occupations requiring mid-level preparation, and the majority of these jobs are related to the construction industry. Short preparation of up to 12 months is required for a range of other construction and production-related jobs, and typically combines limited coursework with on-the-job training.

Finally, agriculture-related laborer occupations, hand packers and packagers, and school bus drivers are among the top 25 occupations that require preparation of less than one month, typically through on-the-job training.

## Skill Differences between Green Jobs and Other Jobs

For 2009, an additional survey question was added to better understand how employers view the skills required of employees who work in green jobs. The question asked employers to rate how different the skills are between employees identified as working in green jobs from those who do not work in green jobs. Employers were asked to select only one of four main response categories (*Appendix 6*).

*Table 11* shows the results by percentage for each possible response category. Among employers who responded to the question, the table shows that for all industries, almost 56 percent of employers reported that the skills of employees in green jobs are identical to those of employees who do not work in green jobs. More than 32 percent reported that the skills of employees in green jobs are mostly the same as employees who do not work in green jobs. Only a small percent of employers indicated that the skills of workers in green jobs were either mostly different (7.5 percent) or entirely different (4.1 percent) from employees who did not hold green jobs.

Employer-response patterns to the skills question by industry yielded a number of interesting results. The more notable findings are summarized below:

- ◆ Among the agriculture, construction, manufacturing, wholesale trade, and public administration public-sector industries, a large proportion of employers (between 56 and 72 percent) indicated that the skills of employees in green jobs are ‘identical’ to those of employees who do not work in green jobs. Additionally, between 18 to 32 percent of other respondents in these industries said that these green skills are ‘mostly’ the same.
- ◆ In general, employers in highly-diversified industries such as professional services, administrative, and other services, were less likely than employers in construction or goods-producing industries to report that the skills of workers in green jobs are ‘identical’ to those in non-green jobs. Employers in diverse industries did report that the skills of employees in green jobs are ‘mostly’ the same as employees in non-green jobs, but the degree to which skill differences exist is not as pronounced as for construction or other production-focused industries.



- ◆ For the information industry, 60 percent of employers indicated that the skills of workers in green jobs were ‘mostly’ different from those who do not hold green jobs.
- ◆ Twenty percent of employers comprising the administrative, support, and waste management industry reported that the skills of employees in green jobs were ‘entirely’ different from those who were not in green jobs.

**Table 11**

Industry Private- and Public-Sector Green Jobs by Skill Level, 2009

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

INDUSTRIES	DEGREE OF SKILL SIMILARITY BETWEEN GREEN AND NON-GREEN JOBS								TOTAL PRIVATE- AND PUBLIC-SECTOR GREEN JOBS WITH VALID RESPONSE
	SKILLS ARE IDENTICAL	PERCENT	SKILLS ARE MOSTLY THE SAME	PERCENT	SKILLS ARE MOSTLY DIFFERENT	PERCENT	SKILLS ARE ENTIRELY DIFFERENT	PERCENT	
Agriculture	6,110	64.2%	3,040	32.0%	345	3.6%	17	0.2%	9,512
Utilities	5	3.4%	61	40.9%	81	54.3%	2	1.4%	149
Construction	15,860	63.6%	6,948	27.9%	1,829	7.3%	287	1.2%	24,925
Manufacturing	3,084	70.8%	1,015	23.3%	169	3.9%	90	2.1%	4,359
Wholesale Trade	2,246	56.3%	1,095	27.4%	452	11.3%	198	5.0%	3,991
Retail Trade	10	19.9%	17	34.5%	22	45.6%	-	0.0%	49
Transportation and Warehousing	459	41.9%	223	20.4%	411	37.5%	3	0.2%	1,096
Information	44	14.2%	79	25.4%	188	60.4%	-	0.0%	311
Finance and Insurance	5	27.6%	10	52.7%	1	6.1%	3	13.7%	19
Real Estate, Rental, and Leasing	12	31.2%	26	65.1%	1	3.7%	-	0.0%	40
Professional Services	2,922	33.6%	4,930	56.7%	500	5.7%	344	4.0%	8,696
Admin., Support, and Waste Mgmt.	2,152	26.3%	3,646	44.6%	730	8.9%	1,655	20.2%	8,183
Other Services	589	46.8%	493	39.2%	160	12.7%	17	1.4%	1,260
Public Administration	6,266	72.3%	1,640	18.9%	478	5.5%	288	3.3%	8,673
<b>Total Private- and Public-Sector Green Jobs with Valid Response</b>	<b>39,765</b>	<b>55.8%</b>	<b>23,223</b>	<b>32.6%</b>	<b>5,368</b>	<b>7.5%</b>	<b>2,904</b>	<b>4.1%</b>	<b>71,261</b>

**Note:** \*These totals will not add up to total jobs shown elsewhere, as jobs without a valid response to the skills questions are not included.

## Industry Certifications

The study also sought to learn about employment in green jobs by asking employers to indicate if they held any special industry certifications that relate to any of the four core areas, such as LEED (Leadership in Energy and Environmental Design) or Certified Organics. However, employers were not asked to list the names of specific certifications held by their organizations or by individual employees, and a number of firms in each industry reported holding certifications in more than one core area.

Table 12 is based on the actual number of firms that completed the 2009 survey who reported that they have green jobs. The table shows that for all 3,002 firms reporting green jobs, almost 30 percent had one or more green-industry certification. Among the industries in which a *substantial* number of green jobs were reported, professional services had the highest percent of firms with certifications (45 percent), while wholesale trade, and transportation and warehousing, had the lowest (16 percent).

**Table 12**

Private- and Public-Sector Firms with Certifications by Industry

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

INDUSTRIES	FIRMS REPORTING GREEN JOBS	TOTAL FIRMS REPORTING CERTIFICATIONS	PERCENT OF ALL FIRMS CERTIFIED
Agriculture	260	92	35.4%
Utilities	12	3	25.0%
Construction	878	253	28.8%
Manufacturing	204	40	19.6%
Wholesale Trade	157	25	15.9%
Retail Trade	10	2	20.0%
Transportation and Warehousing	95	15	15.8%
Information	16	2	12.5%
Finance and Insurance	5	0	0.0%
Real Estate, Rental, and Leasing	11	5	45.5%
Professional Services	517	232	44.9%
Administrative, Support, and Waste Management	319	94	29.5%
Other Services	162	47	29.0%
Public Administration	356	83	23.3%
<b>Total Private- and Public-Sector Firms with Green Job Certifications</b>	<b>3,002*</b>	<b>893</b>	<b>29.7%</b>

**Note:** \*This represents the number of firms which reported having at least one green job. It is a raw number and not a weighted estimate.

## Conclusions and Implications

The goal of this study was to identify the number and type of green jobs that exist in Washington state, and to expand the analyses to include public-sector employment in green jobs. The study design enabled some comparative analyses that track employment changes in the state's emerging green economy. The scope of the study is limited to assessing the current composition and trends in green-economy employment among private- and public-sector organizations. Supplemental analyses incorporate existing data on earnings, education, and experience requirements, and additional analyses are performed on survey data regarding green job skills and industry certifications. The research design model provides a statistically-sound method for data collection, analysis, and reporting, and this model incorporated topics that were determined to be important to develop a deeper understanding of Washington's green economy. The primary findings of this research are summarized and discussed below.

### Green-Economy Employment

The 2009 study estimates the state's total employment in green jobs at 99,319. More than three quarters of all green jobs (76,137) exist in the private sector, while 23,182 are in the public sector. Compared to all covered employment, green jobs account for only about 3.3 percent of statewide total employment covered by unemployment insurance. The overall green-jobs estimate should be regarded as conservative for several reasons: first, employers were asked to identify only direct jobs in one or more core area; the counts exclude consultants, outside contractors, vendors/suppliers, and others not considered regular employees.

Second, reviews of the data by the research team were conducted to cull out jobs that were not directly tied to producing goods or providing services that support the goals of the four core areas. Finally, the data for public-sector employment was restricted to a single NAICS industry, which limited the analysis of public-sector green jobs.

## Green Job Profiles

The overall findings by core area show that private- and public-sector positions related to preventing or reducing environmental pollution account for the most employment across the four core areas. This core area has the most positions in agriculture-related industries and occupations, followed by positions in some skilled trades and construction-related industries and other scientific-technical occupations.

Increasing energy efficiency is the second-largest number of positions by core area. Construction-related industries and occupations account for the majority of these positions in the increasing energy efficiency core area, followed by professional and technical services industries such as architecture and engineering.

Employment in providing mitigation or cleanup of environmental pollution is the third largest of all core areas. Most of these positions are in professional and technical services industries and occupations such as environmental engineer, and some public-sector service occupations.

Producing renewable energy represents the smallest of the four core areas in terms of positions. Construction-related industries and occupations and professional and technical services occupations account for the majority of all positions in this core area.

## Core Area Summaries

### Increasing Energy Efficiency

The private sector accounts for 87 percent of total (private and public sectors combined) positions in this core area. Among private-sector employers, increasing energy efficiency represents the largest core area with 44 percent of all positions. The largest employment in this core area is associated with occupations that directly or indirectly support the construction industry as a whole. More than 38 percent of private-sector green jobs are in construction, and a large proportion of the top occupations in the increasing energy efficiency core area are related to construction. Among public-sector employers, the large proportion of part-time positions (62 percent) reported



The overall findings show that positions related to *preventing or reducing environmental pollution* account for the most employment across the four core areas.



More than 38 percent of private-sector green jobs are in construction, and a large proportion of the top occupations in the *increasing energy efficiency* core area are related to construction.







Even though construction has experienced a significant contraction in employment since the recession, it remains a significant player in the state's overall economy.



Technical occupations such as electrician, electrical engineer, electrical power line installers, and a number of construction-related occupations comprise a number of the green jobs in renewable energy.



by public-sector employers in this core area also suggests that some employers are assigning a portion of employees' time to perform energy efficiency-related work.

The large number of positions in the increasing energy efficiency core area is likely related to the fact that energy efficiency products and services are represented in a wide variety of industries, supporting employment in a range of occupational groups.<sup>11</sup> These products and services also have strong markets and historical connections within residential, commercial, and industrial construction. Thus, it seems reasonable to expect that the majority of construction firms would identify employees engaged in green construction activities primarily within the context of energy efficiency. Even though construction has experienced a significant contraction in employment since the recession, it remains a significant player in the state's overall economy. In 2008 construction accounted for around six percent of all covered employment and 6.7 percent of total wages.<sup>12</sup>

## Producing Renewable Energy

Renewables represent a fast-growing energy sector that has great potential for new business growth and employment in Washington. However, only 4.5 percent of energy generation currently comes from non-hydro renewable sources such as wind, solar, or biomass.<sup>13</sup> Similarly, the green jobs data collected for this report show that producing renewable energy represents the smallest number of positions among the four core areas: just 4.1 percent of all positions (3,166) are in the producing renewable energy core area. Private-sector employment in producing renewable energy accounts for more than 91 percent of all renewable energy positions (*Tables 1 and 2*).<sup>14</sup>

The largest numbers of jobs are in managerial, professional, and technical occupations that would likely be associated with the planning, design, and construction of renewable energy equipment and facilities. Technical occupations such as electrician, electrical engineer, electrical power line installers, and a number of construction-related occupations comprise a number of the green jobs in renewable energy. These results also seem logical, since the bulk of employment associated with most renewable projects relates to the manufacturing of component parts (for wind turbines and solar panels, for instance) and especially for the design and construction of renewable energy facilities. Once erected, most renewable energy facilities operate with a relatively small number of operations and maintenance employees, and these services are often provided by outside contractors. The proportion of part-time positions is higher for renewable energy than for any other private-sector core area (35 percent). One possible reason may be that some firms depend heavily on part-time employees for this work, or that workers divide their time among other, non-renewable projects.



## Preventing and Reducing Environmental Pollution

This core area accounts for the largest number of positions (46,004) among the four core areas, and represents 46 percent of all positions across the four core areas. This result is notable for its overall contribution to total green jobs, a portion of which is due to over 15,300 public-sector positions. The public sector alone accounts for a third of all positions in this core area, and 66 percent of total public-sector positions identified in the study. The largest of the public-sector occupations are in civil engineering, public transportation (three different occupations), environmental sciences, maintenance and repair, and urban and regional planning. These occupations combined account for 59 percent of all public-sector green jobs. For the private sector, agriculture-related occupations comprise the largest number of green jobs in this core area, followed by several construction-related occupations, and others such as truck drivers and maintenance and repair workers.

The predominance of agriculture-related positions in this core area was also noted in the 2008 report. By identifying agriculture-related employment in the context of preventing or reducing environmental pollution, it may be that employers are relating the work of employees – which include farmworkers, laborers, and others in natural resource-based support jobs such as forestry – with organic farming and sustainable practices that use less harmful chemicals and fertilizers, or environmentally-friendly harvesting methods. These sustainable practices also help control animal waste and runoff, prevent soil depletion and erosion, and protect waterways and animal habitat. In this respect, the work of these employees likely contributes to positive outcomes for the environment and more efficient use of available resources.

## Providing Mitigation or Cleanup of Environmental Pollution

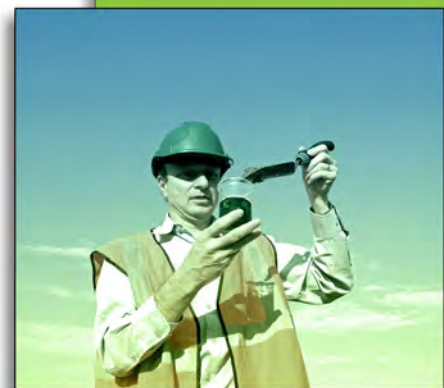
This core area accounts for the third largest number of positions (4,483), but is less than 12 percent of all private- and public-sector positions. In the private sector, environmental engineers represent the largest number of green jobs (1,151). This occupation alone accounts for nearly 13 percent of all positions in this core area. Construction laborers, truck drivers, civil engineers, and operating engineers also account for a considerable number of green jobs in mitigation or cleanup. Agriculture-related occupations also account for around 10 percent of all positions in this core area. While public-sector employment in this core area represents just 12 percent of all public-sector positions, many of these occupations include environmental and civil engineering, and scientific and related technical green jobs. For both the private and public sectors, these occupations represent those that we might logically expect to see associated with work aimed at providing mitigation or cleanup of environmental pollution.



*The public sector alone accounts for a third of all positions in the preventing and reducing environmental pollution core area.*



*Providing mitigation or cleanup of environmental pollution accounts for the third largest number of positions, but is less than 12 percent of all private- and public-sector positions.*



## Growth in Green Jobs, 2008 to 2009



In terms of percentage increases, manufacturing shows a substantial increase in green jobs during the reporting period.



The state had record job losses and unemployment, therefore, the increase in green jobs is unlikely due to new hiring, but could be explained by demand for new or expanded green product lines and services.



By matching survey responses from private-sector employers by industries, it was possible to analyze employment changes between comparable industries for both years (*Table 5*). Overall, firms in these industries reported that the number of green jobs grew by 32 percent between 2008 and 2009, a difference of more than 15,100. All but one industry (utilities) showed an increase in the number of green jobs between the two years. The construction industry experienced the largest total increase in the number of green jobs (6,165), growing by 29 percent. Professional services, an extremely diverse industry that includes a broad range of professional and technical companies and employment, shows the second-largest increase in green jobs among all industries (3,367) with growth of over 45 percent. The increase in green jobs is next-largest in manufacturing (2,843), administrative, support, and waste management (1,442), and agriculture (1,357), respectively. In terms of percentage increases, manufacturing also shows a substantial increase (120 percent) in green jobs during the reporting period.

The overall increase in green jobs can be due to many factors, and the survey findings cannot confirm the causes of these increases; further research would be needed to identify and verify these factors. And, since the survey focused on the number of jobs employers identified as green jobs, and not the number of 'new' jobs created, we do not know what proportion of the increase in green jobs is attributed to new hiring. In light of the weakened overall economic climate and state employment trends, however, it seems unlikely that a large proportion of the increase in green jobs is due to new hiring. At the time of the survey the state was experiencing record job losses and rising unemployment.<sup>15</sup>

One possible explanation is that even without new hiring, companies are continuing to evolve and develop new or expanded green product lines and services that respond to new markets and consumer demand. In the construction industry, for instance, there is evidence that the market for green-certified construction projects nationally and in Washington is continuing to expand.<sup>16</sup> Continued growth in green projects will boost the overall proportion of green construction work, even as the market for new construction remains depressed. The weak market for new construction may also have caused some firms to pursue projects aimed at retrofitting and weatherizing existing structures to increase energy efficiency, and these activities are green by definition.

Federal and state policies and regulations, investments and tax incentives, and other initiatives that support environmental protection, clean energy technologies, and energy conservation can also influence the extent to which companies expand their proportion of green business activities and the work of employees. Although the survey did not attempt to measure what proportion of companies' products or services



are green, it seems logical to expect that firms that already have new products or services – or who are developing new ones – would associate those outputs with green jobs.

Another partial explanation may be tied to greater awareness among employers about what constitutes green products and services, and how they contribute to the ‘greening’ of the Washington economy. As employers become more attuned to business opportunities associated with emerging green markets, they may become more aware of how their existing products, services, and employees contribute to environmental protection or clean energy. They may also move to enhance or reposition their products and services to meet these market opportunities. Employers who identify themselves in this way would reasonably associate the work of employees with green jobs. As previously noted, additional research would be needed to confirm whether these or other factors are associated with the increase in green jobs.

## Green Job Characteristics

### Leading Green Industries and Occupations – Construction and Agriculture

Over three-quarters (77 percent) of all green jobs exist in the private sector, and over 62 percent of these jobs are represented by just four broad industries (agriculture; construction; professional services; and administrative, support, and waste management), with construction representing the single largest proportion of private-sector green jobs at 39 percent. The prominence of construction is in part a reflection of its status as a major source of employment in Washington’s economy. Similarly, the distribution of occupations is also heavily represented in construction, with the eight largest construction-related occupations representing 27 percent of all private-sector green jobs. The timing of the survey and the fact that seasonal employment fluctuations are common in the construction and agriculture industries may help explain, in part, the prevalence of green jobs in the results.<sup>17</sup> However, the continued downturn in construction-related business activity and the emerging economic recession may also have moderated employers’ reports for this study.

### Earnings, Education, and Experience

Several secondary analyses were conducted by integrating existing data on earnings, education, and experience requirements for the leading occupations identified in the study. Since these data are not collected directly from employers who participated in the survey, these findings should be viewed as approximations of the actual earnings available in these jobs, including the education and skill requirements of employers.



As employers become attuned to business opportunities associated with green markets, they may become more aware of how their business contributes.



Over three-quarters of all green jobs exist in the private sector, and over 62 percent of these jobs are represented by just four broad industries.





As might be expected, earnings are highest for professional or technical occupations including managers and engineers that require long-term, post-secondary education and degrees.



The results suggest that most employers believe that there are few differences in the skill sets required of employees in green jobs compared to those who are not.



Estimates of earnings suggest that employment in the reported green occupations accounts for over \$5.1 billion in average annual earnings. As might be expected, earnings are highest for professional or technical occupations including managers and engineers that require long-term, post-secondary education and degrees. A variety of skilled trades occupations requiring significant post-secondary education and training or apprenticeships command median annual earnings that range from around \$40,000 to \$55,000. Lower earnings of between \$25,000 and \$35,000 are associated with less-skilled occupations that require only short-term or minimal training, such as general laborers and production workers. Even lower earnings are associated with other low-skilled jobs such as hand packers and packagers.

## Green Job Skills

Similar to the findings described in the *2008 Washington State Green-Economy Jobs* study, an analysis of private-sector job titles reported by employers shows that there were few new or unique job titles identified by employers that were not already reflected in the existing national Standard Occupational Classification (SOC) system. Some public-sector employers did list job titles (such as environmental engineer, or conservation scientist) that can be directly associated with some of the core areas, while the jobs named by other public-sector employers were fairly generic (i.e., computer support specialist). Thus, with the exception of some public-sector employers, the results suggest that the majority of employers have retained traditional occupational titles, or that the fundamental work performed by employees in these green jobs has not changed substantially such that employers believe new occupational titles are necessary.

The 2008 findings led the research team to add a new question to the 2009 survey to examine employer perspectives on the skills of employees who hold green jobs. Employers were asked to rate how different the job skills are between employees identified as working in green jobs from those who do not work in green jobs. Almost 56 percent of all employers who responded reported that the skills of employees in green jobs are 'identical' to those who do not work in green jobs. More than 32 percent reported that the skills of employees in green jobs are 'mostly the same' as employees who do not work in green jobs. Only a small percent of employers indicated that the skills of workers in green jobs are either mostly different (7.5 percent) or entirely different (4.1 percent) from those who did not hold green jobs. The results suggest that most employers believe that there are relatively few differences in the skill sets required of employees who are employed in green jobs compared to those who are not. Further investigation would be needed to identify the specific skills and distinctions by industry or occupation.



Employer responses by industry yielded a number of interesting results, but the overall trend is that employers in construction or goods-producing industries such as agriculture or manufacturing are more likely than employers in service-related industries (i.e., professional services, administrative, and other services) to report that the skills of employees in green jobs are identical to employees who do not work in green jobs. For instance, 60 percent of information industry employers who responded to the survey report that the skills of employees in green jobs are ‘mostly different’ than those who are not. Although more research is needed to explain these differences, a partial answer may be linked to whether the type of product, service, or work context in some industries and occupations requires technical skills or processes that are so highly specialized that the jobs are truly unique. A related factor may be whether the knowledge required of some professional or services-related occupations is not readily transferrable between green and non-green occupations of the same type.

## Industry Certifications

The study also sought to learn about employment in green jobs by asking employers to indicate if they held any special industry certifications that relate to any of the four core areas, such as LEED (Leadership in Energy and Environmental Design) or Certified Organics. However, employers were not asked to list the names of specific certifications held by their organizations or by individual employees, and a number of firms in each industry reported holding certifications in more than one core area.

Of the 3,002 private- and public-sector firms who reported that they have green jobs, almost 30 percent had one or more green-industry certification. There is some variation among industries. However in some industries the total number of firms reporting certifications is relatively small. Among industries with many firms reporting, the percentage of firms with certifications ranged from a low of approximately 16 percent in wholesale trade, to a high of nearly 45 percent of firms in the professional services industry. In 2008, 36 percent of employers who reported green jobs had one or more green-industry certification. Although the overall proportion of firms with green certifications appears to be fairly similar between the two years, due to differences in sample populations, these statistics are not directly comparable.

## Future Research

The study design establishes a reliable scientific research foundation identifying green-economy employment in Washington state. The study includes the collection of additional data on public-sector green jobs and skills that have expanded our understanding about the scope of green-economy employment and job characteristics. As with any research project of this kind, future efforts to identify and measure green jobs can be improved. The following enhancements are recommended:

- ◆ Repeat the Green Jobs Survey every two to three years in order to assess growth in private- and public-sector green jobs.
- ◆ Conduct detailed analyses of targeted industries and occupations to determine key growth factors, employment projections, and to define the education and skill standards required of current and emerging green occupations.
- ◆ Expand analyses of green-economy industries and occupations to address the potential effects of predicted labor shortages due to retirements and population trends on the industries and occupations that support green-economy growth.<sup>18</sup>
- ◆ Conduct an analysis to estimate the total economic impact of green-industry growth and employment on Washington state’s economy.

# Endnotes

1. See: Engrossed Second Substitute House Bill 2227, as passed in the 2009 legislative session with a partial veto, at: <http://apps.leg.wa.gov/documents/billdocs/2009-10/Pdf/Bills/Session%20Law%202009/2227-S2.SL.pdf>
2. Reviews of existing research on green-economy jobs show a wide variation in research results among different reports, often due to differences in the key definitions, assumptions, and analytical models employed by researchers. For a review of research on green-economy jobs and research methods, see the *2008 Washington State Green Economy Jobs* final report, available at: [http://www.workforceexplorer.com/admin/uploadedPublications/9463\\_Green\\_Jobs\\_Report\\_2008\\_WEXVersion.pdf](http://www.workforceexplorer.com/admin/uploadedPublications/9463_Green_Jobs_Report_2008_WEXVersion.pdf)
3. The state of Oregon used Washington state's four core area definitions and added a fifth core area regarding support jobs such as education. Other states, including California, Colorado, Michigan, and Tennessee, use renewable energy and energy efficiency as part of their definitions regarding green-economy jobs.
4. See: Bezdek, R. (2008). "Environmental protection, the economy, and jobs." In: Encyclopedia of Earth, Eds. Cutler J. Cleveland (Washington, D.C.: Environmental Information Coalition, National Council for Science and the Environment). September 14:  
[http://www.eoearth.org/article/Environmental\\_protection,\\_the\\_economy,\\_and\\_jobs](http://www.eoearth.org/article/Environmental_protection,_the_economy,_and_jobs)  
  
See also: White, A. and Walsh, J. (2008). "Greener Pathways: Jobs and workforce development in the clean energy economy." Madison, WI: Center on Wisconsin Strategy, University of Wisconsin-Madison.
5. See: "Washington State's Green Economy: A Strategic Framework, Discussion Draft." Olympia, WA: Department of Commerce (CTED), 2009 (January).
6. See: "Green-Collar Jobs in America's Cities: Building Pathways out of Poverty and Careers in the Clean Energy Economy." Washington, D.C.: The Apollo Alliance and Green for All, 2008. Also: "Green Jobs: Towards decent work in a sustainable, low-carbon world." Amherst, MA: Center for American Progress and the Political Economy Research Institute, University of Massachusetts, Amherst (September).
7. A copy of the survey instrument can be found in *Appendix 6*.
8. For example, professional architects may spend a portion of their time – whether part time or full time – working on specific projects that may be considered 'green.' For example, an architect may be engaged in designing LEED-certified (highly energy efficient) new buildings, or providing designs for renovating existing buildings to incorporate energy-efficient materials such as insulation, roofing, or energy-efficient heating and cooling systems. These same individuals may also work on non-green projects as well.
9. The eight largest occupations named in *Table 4* that are directly related to construction are electricians; carpenters; construction laborers; painters, construction, and maintenance; roofers; plumbers, pipefitters, and steamfitters; operating engineers and other construction equipment operators; and insulation workers, floor, ceiling, and wall.
10. The median earnings are taken from the periodic Occupational Employment Survey conducted by the Employment Security Department, Labor Market and Economic Analysis, in cooperation with the U.S. Bureau of Labor Statistics.

11. See: The Size of the U.S. Energy Efficiency Market: Generating a More Complete Picture, Karen Ehrhardt-Martinez and John A. “Skip” Laitner, for the American Council for an Energy Efficient Economy (ACEEE), May 2008. See also: Hardcastle, A. & Waterman-Hoey, S. (2009). Energy Efficiency Industry Trends and Workforce Development in Washington State: Phase I. Olympia, WA: Washington State University, Extension Energy Program.
12. Source: Washington State Employment Security Department, 2010:  
[http://www.workforceexplorer.com/admin/uploadedPublications/9776\\_2008AA\\_REVISED\\_Pub.xls](http://www.workforceexplorer.com/admin/uploadedPublications/9776_2008AA_REVISED_Pub.xls)
13. U.S. Department of Energy, Energy Information Administration, 2010. See also: Hardcastle, A., Waterman-Hoey, S., & R. Kunkle (2009). “Renewable Energy Trends and Workforce Development in Washington State.” Olympia, WA: Washington State University, Extension Energy Program.
14. While private- and public-sector utilities are large sponsors and supporters of renewable energy projects, many of these sites and components are designed, constructed, and maintained by private contractors.
15. See: 2009 Washington State Labor Market and Economic Report, Washington State Employment Security Department (December):  
[http://www.workforceexplorer.com/admin/uploadedPublications/10112\\_2009\\_Annual\\_Report\\_Web.pdf](http://www.workforceexplorer.com/admin/uploadedPublications/10112_2009_Annual_Report_Web.pdf)
16. See the U.S. Green Building Council: <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1718>. Washington state has the most buildings per capita that meet the U.S. Green Building Council’s Leadership in Energy and Environmental Design (LEED) standard.
17. Employers were asked to report employment for the three months of June through August, 2009.
18. See: Long-Term Forecast of the Washington Labor Force, Washington State Office of Financial Management, 2009: <http://www.ofm.wa.gov/economy/longterm/2009/lt09ch2.pdf>

# Appendices

## Appendix 1 - Private- and Public-Sector Positions by Core Area and Workforce Development Area (WDA)

	INCREASING ENERGY EFFICIENCY		PRODUCING RENEWABLE ENERGY		PREVENTING AND REDUCING POLLUTION		PROVIDING MITIGATION OR CLEANUP OF ENVIRONMENTAL POLLUTION	
WORKFORCE DEVELOPMENT AREA	TOTAL GREEN POSITIONS	PERCENT OF TOTAL	TOTAL GREEN POSITIONS	PERCENT OF TOTAL	TOTAL GREEN POSITIONS	PERCENT OF TOTAL	TOTAL GREEN POSITIONS	PERCENT OF TOTAL
Olympic Consortium	1,370	3.5%	64	1.9%	1,666	3.6%	242	2.1%
Pacific Mountain	3,111	8.0%	227	6.5%	4,171	9.1%	1,136	9.8%
Northwestern Washington	2,585	6.6%	207	6.0%	2,739	6.0%	429	3.7%
Snohomish County	2,677	6.9%	126	3.6%	2,189	4.8%	464	4.0%
Seattle-King County	15,500	39.9%	972	28.1%	13,484	29.3%	3,091	26.6%
Pierce County	2,707	7.0%	105	3.0%	3,671	8.0%	939	8.1%
Southwest Washington	2,289	5.9%	234	6.8%	2,100	4.6%	615	5.3%
North Central Wash./Columbia Basin	850	2.2%	39	1.1%	6,207	13.5%	641	5.5%
South Central	1,247	3.2%	450	13.0%	3,053	6.6%	265	2.3%
Eastern Washington	2,197	5.6%	98	2.8%	1,846	4.0%	150	1.3%
Benton-Franklin	1,703	4.4%	624	18.0%	2,922	6.4%	2,936	25.3%
Spokane	2,656	6.8%	317	9.2%	1,704	3.7%	642	5.5%

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009



## Appendix 2 - 2009 Green Jobs Survey Response Rates

SAMPLE SUMMARY	NUMBER OF ESTABLISHMENTS
Population of Establishments	52,382
Original Sample Drawn	21,664
Number of Firms in Sample	19,241
Contacted in Sample	13,642
Not Contacted	5,599

TOTAL IN AND OUT OF SAMPLE, BY REASON		
REASON CODE	NUMBER OF ESTABLISHMENTS	IN/OUT OF SAMPLE
Responses	13,457	in
Refusal	185	in
Invalid Address	1,204	out
Out of Business	364	out
Inactive	486	out
Out of State	369	out

RESPONSE RATE	
Number of Firms in Sample	19,241
Total Response	13,457
Response Rate	69.9%

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

## Appendix 3 - Methodology<sup>1</sup>

### Introduction

The purpose of the Green Jobs Survey is to identify green-economy employers and the jobs they provide in the Washington state economy. The study employs a rigorous scientific survey research design and sampling method to establish baseline measures that provide valid and reliable estimates of the number of green-economy jobs and the workers employed thereby. It employs state-of-the-art corrections for sample non-response.

The study measures only the direct jobs identified as green by employers, rather than attempting to measure some combination of direct and secondary employment (i.e., indirect or induced employment as is done in, say, an input/output analysis of the economy). Establishing the baseline green employment by estimating direct jobs is a more conservative approach to identifying the extent and depth of green jobs in the state. In addition, choosing this conservative measurement approach can also reduce measurement error, since no additional assumptions have to be made concerning the forward and backward linkages in the economy of the green jobs directly provided. Note, of course, that this approach will understate to some degree the total impact of green employers and their green employment on the total economy.

<sup>1</sup> The basic scientific text used to conduct this survey is: Särndal, C.E., Swensson, B. and Wretman, J., Model Assisted Survey Sampling. New York: Springer-Verlag. The survey authors would like to thank Dr. Charles D. Palit, Professor Emeritus, University of Wisconsin, Madison, for significant assistance in the design of this survey.

## Overall Survey Strategy

The survey has been conducted in three phases.

- Phase 1:** The first phase was a screening survey of the state economy to help identify industries with a concentration of green jobs. It also provides an estimate of the number of green firms not included in the green industries.
- Phase 2:** Once the universe of green industries was identified, the second phase was to survey a probability sample of the employers in these green industries. This produced the body of the survey data.
- Phase 3:** As is always the case, some survey units (employers) do not respond to the survey. Thus, the last phase was a survey of the non-respondent employers in order to adjust for the effects of response bias. The results from the second phase survey and the non-response survey were then combined to produce the best non-biased estimate of the number of green employers, green jobs, and green employment in the state.

## The Detailed Survey Methodology

*The Quarterly Census of Employment and Wages* (QCEW)<sup>2</sup> database was used to form the universe of all phases of the study. Private- and public-sector employers (except private households) with at least one employee in the third quarter of 2008 were included. This was further narrowed as needed based on the North American Industry Classification System (NAICS)<sup>3</sup> codes in the database.

Green jobs are believed to be concentrated in certain green industries. Targeting only those industries maximizes the survey's efficiency, but also has the danger of missing an unknown number of green firms in other industries that were clearly unlikely to have a large number of green employers and jobs. Thus, the phase 1 screening survey was designed to test this possibility and identify any other industries that may have green firms and green employment. Based on the results of the 2008 survey, 101 industries were selected as likely to include green firms and green jobs. These six-digit NAICS industries were moved directly to the main (phase 2) survey, bypassing the screening (phase 1) survey.

**The Phase 1 Survey:** As noted, the phase 1 survey is a screening survey. It consisted of 7,500 firms randomly chosen from all firms in industries not presumed to have a concentration of green employment. This survey simply asked if the firm had any green employment, according to the definitions used here. A total of 568 responses were positive, and the 95 industries containing these firms (at the six-digit level) were added to the 101 previously selected to form the universe of the second survey. These additions included 17 government and 78 private NAICS.

**The Phase 2 Survey:** This was the main survey, on which the overall survey's results are based. Only the 196 industries presumed or determined in phase 1 to have a concentration of green-employing firms were included (*Appendix 5*), leading to a universe of 52,382 firms. From this population, a sample of 21,664 employers in Washington state was selected. The survey was taken in early August 2009.

The above population frame was stratified by area and industry. The areas were Workforce Development Areas. The private-sector industries were grouped into 13 cells at the two-digit NAICS level. All government industries were grouped into one cell. Firms were then selected within each stratum with probability of selection-proportionate-to-size of the firm. Firms with 200 or more employees were selected with certainty – a probability of selection equal to 1.00. The measure of size was average employment in the third quarter, 2008.

<sup>2</sup> The QCEW database maintains extensive descriptive detail on every employer in Washington's Unemployment Insurance program. UI coverage is mandatory for most employers.

<sup>3</sup> NAICS uses a six-digit code for individual industries, and industry groups can be formed from the first two to five digits.

As noted, the primary study goal is to determine how many workers were employed in a green job. Employers were asked to list the job titles of employees who hold green jobs. The definition of a green job was included in the preface to the survey questionnaire.<sup>4</sup>

The survey asked employers to identify how many of their employees held green jobs, and whether this employment was full time or part time. Where employees performed work in more than one green job, the employer was asked to identify the one green job that accounted for the highest proportion of that employee's time on the job.<sup>5</sup>

Finally, employers were asked whether they held any special industry certifications related to any of the four core areas.

**Response Rate:** 13,457 employers contacted chose to participate in the survey. This represents a participation rate of nearly 70 percent. Nearly 23 percent of the 13,457 employers who responded to the survey reported that their business activity is engaged in one or more type of core area, and that they had employees who were responsible for producing goods or providing services that support these core areas and the related goals. The survey results were subsequently weighted to represent all firms in the green-concentrated industries, which enabled the computation of estimates of the number of green-economy industries, employers, and employment by occupation.

**The Phase 3 Survey:** A potential problem in any survey design is non-response bias. Firms in a green industry, but without any green jobs, may be less likely to respond for any number of reasons. Because lack of a response is not taken as a negative response, the number of green jobs would be estimated with bias. The third phase was designed to measure this effect.

The phase 3 survey was of 365 firms randomly chosen from those that didn't respond to the phase 2 survey by a cut-off date. Intensive follow-up by mail, email, and phone contact was then conducted to persuade these firms to at least partially complete the survey. The responses of these 365 firms were compared with those firms who had initially responded to the survey. This comparison allows one to estimate the response bias. No differences in the data provided were detected to well within the error range of the survey, leading to the conclusion that there is no significant response bias in the main survey.

## Final Steps

Following completion of the survey process, the results were further revised by editing reported jobs that were determined to be support occupations and not direct green jobs.

In order to keep to the measurement of only direct green jobs, the data was further screened for secondary or indirect jobs. Through this process many indirect green jobs were identified and were culled from the results.

The approach taken for this process was to closely analyze and review the data. Those determined to be indirect green jobs or did not appear to meet the green-job definition of being directly connected to green products and services, were excluded from the final database. A conservative approach was taken, and if there was any doubt as to the job being a direct green job, it was retained. The exclusion of the indirect green jobs is not meant to infer that these jobs are any less important, they simply did not meet the definition used for this survey. Some of these support or indirect green jobs included school teachers, administrative support, and retail occupations.

<sup>4</sup> A copy of the survey instrument can be found in Appendix 6.

<sup>5</sup> For example, professional architects may spend a portion of their time – whether part time or full time-temporary – working on specific projects that may be considered 'green.' For example, an architect may be engaged in designing LEED-certified (highly energy-efficient) new buildings, or providing designs for renovating existing buildings to incorporate energy-efficient materials such as insulation, roofing or energy-efficient heating and cooling systems. These same individuals may also work on non-green projects as well.

## Appendix 4 - NAICS in Sample

NAICS	2007 NAICS TITLES
111140	Wheat Farming
111150	Corn Farming
111331	Apple Orchards
111332	Grape Vineyards
111334	Berry (except Strawberry) Farming
111339	Other Noncitrus Fruit Farming
111421	Nursery and Tree Production
111422	Floriculture Production
111998	All Other Miscellaneous Crop Farming
112111	Beef Cattle Ranching and Farming
112120	Dairy Cattle and Milk Production
112512	Shellfish Farming
112910	Apiculture
113310	Logging
114111	Finfish Fishing
115114	Postharvest Crop Activities (except Cotton Ginning)
115210	Support Activities for Animal Production
115310	Support Activities for Forestry
221111	Hydroelectric Power Generation
221112	Fossil Fuel Electric Power Generation
221113	Nuclear Electric Power Generation
221119	Other Electric Power Generation
221121	Electric Bulk Power Transmission and Control
221122	Electric Power Distribution
221310	Water Supply and Irrigation Systems
221320	Sewage Treatment Facilities
221330	Steam and Air-Conditioning Supply
236115	New Single-Family Housing Construction (except Operative Builders)
236116	New Multifamily Housing Construction (except Operative Builders)
236117	New Housing Operative Builders
236118	Residential Remodelers
236210	Industrial Building Construction
236220	Commercial and Institutional Building Construction
237110	Water and Sewer Line and Related Structures Construction
237130	Power and Communication Line and Related Structures Construction
237310	Highway, Street, and Bridge Construction
237990	Other Heavy and Civil Engineering Construction
238151	Residential Glass and Glazing Contractors
238152	Nonresidential Glass and Glazing Contractors
238161	Residential Roofing Contractors
238162	Nonresidential Roofing Contractors
238171	Residential Siding Contractors
238172	Nonresidential Siding Contractors



## Appendix 4 - NAICS in Sample

NAICS	2007 NAICS TITLES
238211	Residential Electrical Contractors and Other Wiring Installation Contractors
238212	Nonresidential Electrical Contractors and Other Wiring Installation Contractors
238221	Residential Plumbing, Heating, and Air-Conditioning Contractors
238222	Nonresidential Plumbing, Heating, and Air-Conditioning Contractors
238292	Other Nonresidential Building Equipment Contractors
238311	Residential Drywall and Insulation Contractors
238312	Nonresidential Drywall and Insulation Contractors
238321	Residential Painting and Wall Covering Contractors
238351	Residential Finish Carpentry Contractors
238911	Residential Site Preparation Contractors
321113	Sawmills
321920	Wood Container and Pallet Manufacturing
321991	Manufactured Home (Mobile Home) Manufacturing
321999	All Other Miscellaneous Wood Product Manufacturing
322121	Paper (except Newsprint) Mills
325199	All Other Basic Organic Chemical Manufacturing
326199	All Other Plastics Product Manufacturing
327215	Glass Product Manufacturing Made of Purchased Glass
327320	Ready-Mix Concrete Manufacturing
327390	Other Concrete Product Manufacturing
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
331513	Steel Foundries (except Investment)
332313	Plate Work Manufacturing
332710	Machine Shops
332813	Electroplating, Plating, Polishing, Anodizing, and Coloring
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing
334419	Other Electronic Component Manufacturing
335121	Residential Electric Lighting Fixture Manufacturing
335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing
335129	Other Lighting Equipment Manufacturing
335222	Household Refrigerator and Home Freezer Manufacturing
335228	Other Major Household Appliance Manufacturing
335311	Power, Distribution, and Specialty Transformer Manufacturing
335312	Motor and Generator Manufacturing
335313	Switchgear and Switchboard Apparatus Manufacturing
335314	Relay and Industrial Control Manufacturing
335911	Storage Battery Manufacturing
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing
336111	Automobile Manufacturing
336120	Heavy Duty Truck Manufacturing
336411	Aircraft Manufacturing
337110	Wood Kitchen Cabinet and Countertop Manufacturing

## Appendix 4 - NAICS in Sample

NAICS	2007 NAICS TITLES
337127	Institutional Furniture Manufacturing
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant Wholesalers
423810	Construction and Mining (except Oil Well) Machinery and Equipment Merchant Wholesalers
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers
423830	Industrial Machinery and Equipment Merchant Wholesalers
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers
423930	Recyclable Material Merchant Wholesalers
424120	Stationery and Office Supplies Merchant Wholesalers
424210	Drugs and Druggists' Sundries Merchant Wholesalers
424330	Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers
424410	General Line Grocery Merchant Wholesalers
424490	Other Grocery and Related Products Merchant Wholesalers
424690	Other Chemical and Allied Products Merchant Wholesalers
424710	Petroleum Bulk Stations and Terminals
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and Terminals)
424950	Paint, Varnish, and Supplies Merchant Wholesalers
424990	Other Miscellaneous Nondurable Goods Merchant Wholesalers
425120	Wholesale Trade Agents and Brokers
454311	Heating Oil Dealers
481111	Scheduled Passenger Air Transportation
484110	General Freight Trucking, Local
484121	General Freight Trucking, Long-Distance, Truckload
484220	Specialized Freight (except Used Goods) Trucking, Local
485111	Mixed Mode Transit Systems
485113	Bus and Other Motor Vehicle Transit Systems
485210	Interurban and Rural Bus Transportation
485999	All Other Transit and Ground Passenger Transportation
488119	Other Airport Operations
488310	Port and Harbor Operations
488320	Marine Cargo Handling
488490	Other Support Activities for Road Transportation
488999	All Other Support Activities for Transportation
511210	Software Publishers
522110	Commercial Banking
522120	Savings Institutions
522130	Credit Unions
522190	Other Depository Credit Intermediation
523910	Miscellaneous Intermediation
524210	Insurance Agencies and Brokerages
531130	Lessors of Miniwarehouses and Self-Storage Units

## Appendix 4 - NAICS in Sample

NAICS	2007 NAICS TITLES
531210	Offices of Real Estate Agents and Brokers
531312	Nonresidential Property Managers
541110	Offices of Lawyers
541310	Architectural Services
541330	Engineering Services
541340	Drafting Services
541420	Industrial Design Services
541512	Computer Systems Design Services
541611	Administrative Management and General Management Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
541620	Environmental Consulting Services
541712	Research and Development in the Physical, Engineering, and Life Sciences (except Biotechnology)
541820	Public Relations Agencies
561439	Other Business Service Centers (including Copy Shops)
561710	Exterminating and Pest Control Services
561720	Janitorial Services
561730	Landscaping Services
561740	Carpet and Upholstery Cleaning Services
562111	Solid Waste Collection
562112	Hazardous Waste Collection
562119	Other Waste Collection
562211	Hazardous Waste Treatment and Disposal
562212	Solid Waste Landfill
562219	Other Nonhazardous Waste Treatment and Disposal
562910	Remediation Services
562920	Materials Recovery Facilities
562998	All Other Miscellaneous Waste Management Services
611110	Elementary and Secondary Schools
611210	Junior Colleges
611310	Colleges, Universities, and Professional Schools
611430	Professional and Management Development Training
611710	Educational Support Services
811112	Automotive Exhaust System Repair
811118	Other Automotive Mechanical and Electrical Repair and Maintenance
811121	Automotive Body, Paint, and Interior Repair and Maintenance
811191	Automotive Oil Change and Lubrication Shops
811192	Car Washes
811211	Consumer Electronics Repair and Maintenance
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance
811420	Reupholstery and Furniture Repair
811490	Other Personal and Household Goods Repair and Maintenance
812112	Beauty Salons

## Appendix 4 - NAICS in Sample

NAICS	2007 NAICS TITLES
812910	Pet Care (except Veterinary) Services
813312	Environment, Conservation and Wildlife Organizations
813319	Other Social Advocacy Organizations
813410	Civic and Social Organizations
813920	Professional Organizations
813990	Other Similar Organizations (except Business, Professional, Labor, and Political Organizations)
921110	Executive Offices
921120	Legislative Bodies
921130	Public Finance Activities
921140	Executive and Legislative Offices, Combined
921150	American Indian and Alaska Native Tribal Governments
921190	Other General Government Support
923110	Administration of Education Programs
923120	Administration of Public Health Programs
923130	Administration of Human Resource Programs (except Education, Public Health, and Veterans' Affairs Programs)
924110	Administration of Air and Water Resource and Solid Waste Management Programs
924120	Administration of Conservation Programs
925110	Administration of Housing Programs
925120	Administration of Urban Planning and Community and Rural Development
926110	Administration of General Economic Programs
926120	Regulation and Administration of Transportation Programs
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities
926140	Regulation of Agricultural Marketing and Commodities
926150	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors

Source: Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

**Note:** NAICS listed are as classified from the Bureau of Labor Statistics which differs slightly from the general NAICS list from U.S. Census.



## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
111011	Chief Executives	162
111021	General and Operations Managers	822
112011	Advertising and Promotions Managers	3
112021	Marketing Managers	4
112022	Sales Managers	18
113051	Industrial Production Managers	108
119011	Farm, Ranch, and Other Agricultural Managers	1,206
119012	Farmers and Ranchers	204
119021	Construction Managers	472
119041	Engineering Managers	88
119121	Natural Sciences Managers	108
119151	Social and Community Service Managers	156
119199	Managers, All Other*	2,020
131041	Compliance Officers, except Agriculture, Construction, Health and Safety, and Transportation	27
131073	Training and Development Specialists	18
131081	Logisticians	1
131111	Management Analysts	194
131199	Business Operations Specialists, All Other*	155
151021	Computer Programmers	50
151031	Computer Software Engineers, Applications	138
151032	Computer Software Engineers, Systems Software	287
151041	Computer Support Specialists	366
151051	Computer Systems Analysts	139
151071	Network and Computer Systems Administrators	2
151081	Network Systems and Data Communications Analysts	18
151099	Computer Specialists, All Other*	73
171011	Architects, except Landscape and Naval	2,232
171012	Landscape Architects	122
171021	Cartographers and Photogrammetrists	106
171022	Surveyors	205
172011	Aerospace Engineers	17
172021	Agricultural Engineers	104
172041	Chemical Engineers	139
172051	Civil Engineers	5,772
172061	Computer Hardware Engineers	1
172071	Electrical Engineers	1,333
172072	Electronics Engineers, except Computer	25
172081	Environmental Engineers	2,057
172111	Health and Safety Engineers, except Mining Safety Engineers and Inspectors	133
172112	Industrial Engineers	151
172121	Marine Engineers and Naval Architects	71
172131	Materials Engineers	63

## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
172141	Mechanical Engineers	1,066
172151	Mining and Geological Engineers, Including Mining Safety Engineers	15
172161	Nuclear Engineers	120
172199	Engineers, All Other*	1,262
173011	Architectural and Civil Drafters	137
173012	Electrical and Electronics Drafters	8
173013	Mechanical Drafters	6
173019	Drafters, All Other*	508
173021	Aerospace Engineering and Operations Technicians	37
173022	Civil Engineering Technicians	359
173023	Electrical and Electronic Engineering Technicians	314
173025	Environmental Engineering Technicians	44
173026	Industrial Engineering Technicians	452
173027	Mechanical Engineering Technicians	103
173029	Engineering Technicians, except Drafters, All Other*	249
173031	Surveying and Mapping Technicians	12
191012	Food Scientists and Technologists	5
191013	Soil and Plant Scientists	29
191020	Biological Scientists	295
191022	Microbiologists	65
191023	Zoologists and Wildlife Biologists	471
191029	Biological Scientists, All Other*	180
191031	Conservation Scientists	390
191032	Foresters	135
192012	Physicists	6
192021	Atmospheric and Space Scientists	6
192031	Chemists	246
192032	Materials Scientists	12
192041	Environmental Scientists and Specialists, Including Health	2,222
192042	Geoscientists, except Hydrologists and Geographers	228
192043	Hydrologists	156
193011	Economists	4
193021	Market Research Analysts	104
193051	Urban and Regional Planners	1,148
193091	Anthropologists and Archeologists	100
194011	Agricultural and Food Science Technicians	98
194021	Biological Technicians	1
194031	Chemical Technicians	56
194011	Agricultural and Food Science Technicians	98
194021	Biological Technicians	1
194031	Chemical Technicians	56
194041	Geological and Petroleum Technicians	20

## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
194051	Nuclear Technicians	5
194091	Environmental Science and Protection Technicians, Including Health	1,074
194092	Forensic Science Technicians	5
194093	Forest and Conservation Technicians	269
194099	Life, Physical, and Social Science Technicians, All Other*	5
211022	Medical and Public Health Social Workers	15
211091	Health Educators	1
211099	Community and Social Service Specialists, All Other*	76
251051	Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary	2
253099	Teachers and Instructors, All Other*	18
254031	Library Technicians	5
259031	Instructional Coordinators	8
271021	Commercial and Industrial Designers	704
271024	Graphic Designers	14
271025	Interior Designers	67
273031	Public Relations Specialists	1
273042	Technical Writers	148
274021	Photographers	3
291051	Pharmacists	3
292033	Nuclear Medicine Technologists	4
292034	Radiologic Technologists and Technicians	417
292052	Pharmacy Technicians	62
299011	Occupational Health and Safety Specialists	269
299012	Occupational Health and Safety Technicians	25
331099	First-Line Supervisors/Managers, Protective Service Workers, All Other*	62
332011	Fire Fighters	789
339011	Animal Control Workers	11
339021	Private Detectives and Investigators	153
371011	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers	9
371012	First-Line Supervisors/Managers of Landscaping, Lawn Service, and Groundskeeping Workers	64
372011	Janitors and Cleaners, Except Maids and Housekeeping Cleaners	486
372012	Maids and Housekeeping Cleaners	197
372021	Pest Control Workers	20
373011	Landscaping and Groundskeeping Workers	1,099
373012	Pesticide Handlers, Sprayers, and Applicators, Vegetation	1
373013	Tree Trimmers and Pruners	69
392021	Nonfarm Animal Caretakers	2
411012	First-Line Supervisors/Managers of Non-Retail Sales Workers	1
413031	Securities, Commodities, and Financial Services Sales Agents	1
413099	Sales Representatives, Services, All Other*	3
419011	Demonstrators and Product Promoters	1
419021	Real Estate Brokers	7

## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
431011	First-Line Supervisors/Managers of Office and Administrative Support Workers	46
434031	Court, Municipal, and License Clerks	61
435061	Production, Planning, and Expediting Clerks	18
435081	Stock Clerks and Order Fillers	1
439061	Office Clerks, General	1
439199	Office and Administrative Support Workers, All Other*	7
451011	First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers	120
452011	Agricultural Inspectors	163
452041	Graders and Sorters, Agricultural Products	60
452091	Agricultural Equipment Operators	395
452092	Farmworkers and Laborers, Crop, Nursery, and Greenhouse	1,106
452093	Farmworkers, Farm and Ranch Animals	353
452099	Agricultural Workers, All Other*	7,292
454011	Forest and Conservation Workers	216
454021	Fallers	20
454022	Logging Equipment Operators	12
454023	Log Graders and Scalers	15
454029	Logging Workers, All Other*	3
471011	First-Line Supervisors/Managers of Construction Trades and Extraction Workers	316
472011	Boilermakers	21
472031	Carpenters	4,963
472041	Carpet Installers	46
472042	Floor Layers, except Carpet, Wood, and Hard Tiles	22
472051	Cement Masons and Concrete Finishers	132
472061	Construction Laborers	3,812
472073	Operating Engineers and Other Construction Equipment Operators	1,436
472081	Drywall and Ceiling Tile Installers	718
472111	Electricians	5,467
472121	Glaziers	792
472131	Insulation Workers, Floor, Ceiling, and Wall	797
472132	Insulation Workers, Mechanical	7
472141	Painters, Construction and Maintenance	1,851
472151	Pipelayers	102
472152	Plumbers, Pipefitters, and Steamfitters	1,377
472161	Plasterers and Stucco Masons	91
472181	Roofers	1,380
472211	Sheet Metal Workers	339
472221	Structural Iron and Steel Workers	20
473012	Helpers--Carpenters	1
473016	Helpers--Roofers	3
473019	Helpers, Construction Trades, All Other*	2
474011	Construction and Building Inspectors	549



## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
474041	Hazardous Materials Removal Workers	719
474061	Rail-Track Laying and Maintenance Equipment Operators	16
474071	Septic Tank Servicers and Sewer Pipe Cleaners	122
474099	Construction and Related Workers, All Other*	33
475012	Rotary Drill Operators, Oil and Gas	8
475013	Service Unit Operators, Oil, Gas, and Mining	71
475021	Earth Drillers, except Oil and Gas	70
475031	Explosives Workers, Ordnance Handling Experts, and Blasters	55
475099	Extraction Workers, All Other*	8
491011	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	95
492096	Electronic Equipment Installers and Repairers, Motor Vehicles	9
493011	Aircraft Mechanics and Service Technicians	16
493021	Automotive Body and Related Repairers	55
493022	Automotive Glass Installers and Repairers	5
493023	Automotive Service Technicians and Mechanics	447
493031	Bus and Truck Mechanics and Diesel Engine Specialists	748
493041	Farm Equipment Mechanics	122
493042	Mobile Heavy Equipment Mechanics, except Engines	25
493051	Motorboat Mechanics	26
493091	Bicycle Repairers	1
499011	Mechanical Door Repairers	23
499012	Control and Valve Installers and Repairers, except Mechanical Door	30
499021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	3,012
499031	Home Appliance Repairers	2
499041	Industrial Machinery Mechanics	25
499042	Maintenance and Repair Workers, General	3,282
499043	Maintenance Workers, Machinery	4
499044	Millwrights	53
499051	Electrical Power-Line Installers and Repairers	990
499099	Installation, Maintenance, and Repair Workers, All Other*	178
511011	First-Line Supervisors/Managers of Production and Operating Workers	213
512021	Coil Winders, Tapers, and Finishers	22
512022	Electrical and Electronic Equipment Assemblers	28
512031	Engine and Other Machine Assemblers	1
512091	Fiberglass Laminators and Fabricators	2
512092	Team Assemblers	7
512099	Assemblers and Fabricators, All Other*	740
514011	Computer-Controlled Machine Tool Operators, Metal and Plastic	181
514031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	50
514033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	18
514035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	10
514041	Machinists	255

## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
514121	Welders, Cutters, Solderers, and Brazers	148
514193	Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	3
514194	Tool Grinders, Filers, and Sharpeners	3
515023	Printing Machine Operators	16
516052	Tailors, Dressmakers, and Custom Sewers	13
516064	Textile Winding, Twisting, and Drawing Out Machine Setters, Operators, and Tenders	12
517011	Cabinetmakers and Bench Carpenters	153
517021	Furniture Finishers	172
517041	Sawing Machine Setters, Operators, and Tenders, Wood	88
517042	Woodworking Machine Setters, Operators, and Tenders, except Sawing	3
518012	Power Distributors and Dispatchers	37
518013	Power Plant Operators	27
518021	Stationary Engineers and Boiler Operators	56
518031	Water and Liquid Waste Treatment Plant and System Operators	915
518091	Chemical Plant and System Operators	5
518099	Plant and System Operators, All Other*	10
519011	Chemical Equipment Operators and Tenders	19
519012	Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders	2
519021	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	7
519032	Cutting and Slicing Machine Setters, Operators, and Tenders	30
519051	Furnace, Kiln, Oven, Drier, and Kettle Operators and Tenders	5
519061	Inspectors, Testers, Sorters, Samplers, and Weighers	129
519122	Painters, Transportation Equipment	126
519132	Photographic Processing Machine Operators	12
519191	Cementing and Gluing Machine Operators and Tenders	24
519192	Cleaning, Washing, and Metal Pickling Equipment Operators and Tenders	6
519195	Molders, Shapers, and Casters, except Metal and Plastic	35
519196	Paper Goods Machine Setters, Operators, and Tenders	3
519198	Helpers--Production Workers	27
519199	Production Workers, All Other*	1,983
531021	First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand	115
531031	First-Line Supervisors/Managers of Transportation and Material-Moving Machine and Vehicle Operators	43
532011	Airline Pilots, Copilots, and Flight Engineers	13
532012	Commercial Pilots	4
533021	Bus Drivers, Transit and Intercity	4,626
533022	Bus Drivers, School	1,731
533032	Truck Drivers, Heavy and Tractor-Trailer	2,659
533033	Truck Drivers, Light or Delivery Services	22
535011	Sailors and Marine Oilers	640
535021	Captains, Mates, and Pilots of Water Vessels	8
535022	Motorboat Operators	3

## Appendix 5 - Green Job Occupations

ALL REPORTED GREEN JOB OCCUPATIONS		
SOC CODE	OCCUPATIONAL TITLE	GREEN JOBS
535031	Ship Engineers	118
536099	Transportation Workers, All Other*	3
537021	Crane and Tower Operators	6
537032	Excavating and Loading Machine and Dragline Operators	6
537051	Industrial Truck and Tractor Operators	264
537061	Cleaners of Vehicles and Equipment	158
537062	Laborers and Freight, Stock, and Material Movers, Hand	616
537064	Packers and Packagers, Hand	1,674
537071	Gas Compressor and Gas Pumping Station Operators	7
537073	Wellhead Pumpers	8
537081	Refuse and Recyclable Material Collectors	375
537121	Tank Car, Truck, and Ship Loaders	3

*Source:* Washington State Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2009

**Note:** \*Occupational titles ending with "All Other" are considered residual and combine occupations which don't fit into other detailed codes.

## WASHINGTON STATE GREEN JOBS SURVEY



### Washington State Employment Security Department

Labor Market and Economic Analysis



#### ABOUT THE SURVEY

Washington has long been a leader in environmental stewardship, climate protection, the development of renewable energy, and energy efficiency. Washington State has established goals to grow business sectors and jobs that support environmental protection and clean energy.

The legislature has directed the Employment Security Department to conduct this survey to determine the number of jobs that directly support environmental protection and clean energy goals. We are surveying firms that produce any goods or provide services that support any of the following four core areas and goals:

1. Increasing energy efficiency
2. Producing renewable energy
3. Preventing and reducing environmental pollution
4. Providing mitigation or clean-up of environmental pollution

If you or any of your staff have worked in any of these four core areas as their primary job function, either full or part time within the **past three months**, continue to page two. If not, please fill out the information below and return using the postage-paid envelope.

- Please direct this survey to your Operations Manager or Human Resources Department.
- Include information about all your locations in Washington State.
- All information will be treated confidentially.

#### OPTIONS FOR RESPONDING TO THE SURVEY

- Return the survey in the enclosed postage-paid envelope, or
- Fax both sides to (360) 438-3215, or
- Contact us at (800) 837-3074 to report by telephone or receive answers to your questions.
- In order to use your information, please respond before October 16, 2009.
- Your prompt response is appreciated.

#### PLEASE REPORT FOR ALL WASHINGTON STATE BUSINESS LOCATIONS

How many employees do you currently have in Washington State? \_\_\_\_\_

Number of employees who are full time: \_\_\_\_\_

Number of employees who are part time: \_\_\_\_\_

Do you provide goods or services in any of the four core areas? Yes \_\_\_\_ No \_\_\_\_

If 'Yes,' please complete back of survey.

If 'No' stop here and mail back survey.

#### CONTACT PERSON

Name: \_\_\_\_\_

Title: \_\_\_\_\_

Telephone: (     ) \_\_\_\_\_

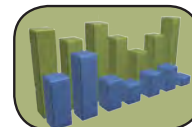
Date: \_\_\_\_\_

#### THANK YOU FOR PARTICIPATING!

*Employment Security is an equal-opportunity employer and provider of programs and services. Auxiliary aids and services are available upon request to people with disabilities.*



# WASHINGTON STATE GREEN JOBS SURVEY



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

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

Washington State Employment Security Department, Labor Market and Economic Analysis; PO Box 9046 Olympia, WA 98507-9046  
Phone: (800) 837-3074; Fax: (360) 438-3215; E-mail: [rhaqlund@esd.wa.gov](mailto:rhaqlund@esd.wa.gov)

# Glossary of Terms Used in this Report

**Core Area:** One of the four types of green activity used as our basis for defining green jobs. These activities are: 1) increasing energy efficiency; 2) producing renewable energy; 3) preventing and reducing environmental pollution; and, 4) providing mitigation or cleanup of environmental pollution.

**Direct Job Creation:** For a given firm, this type of job directly produces services or products that reduce the level and/or rate of carbon emissions in the economy. For example, Firm A produces triple-paned insulated windows for retail sale. Thus, we observe a direct green job within Firm A.

**Green Jobs:** A green job is one that promotes environmental protection and clean energy. The weighted estimate of each individual worker engaged in one or more green activity. A given green job can contain several positions by core area.

**Green Jobs Multiplier:** Consider the firm that is engaged in direct green job creation. Firm A produces triple-paned insulated windows for individual home construction. The multiplier effect occurs as follows: the triple-paned windows, when installed, create additional green construction jobs. Now, Firm A has sold off some inventory of triple-paned windows, so Firm A contacts its suppliers of glass, wood, aluminum, argon, etc., and asks for more supplies. This then, creates (if demand is increasing for triple-paned windows) or preserves (if demand is constant for triple-paned windows) additional jobs. The sum of jobs created by the forward linkages to Firm A and the backward linkages to Firm A, are total indirect jobs created. Dividing this sum by the total direct green jobs in Firm A produces a ratio. This ratio is the multiplier.

**Indirect Job Creation:** For a given firm, this type of job is created through the use of the goods and services produced by those directly working in green jobs. For example, retail sellers of triple-paned windows.

**Induced Job Creation:** Any jobs created by the spending of earnings from workers in direct and indirect green job production. When these earnings are spent, they can be used by those workers to purchase additional green products and services. This added expenditure induces the creation of additional green jobs.

**Measurement Error:** The difference between the actual value of a quantity and the value determined by measuring it.

**Occupations:** Occupational titles based on the Standard Occupational Classification (SOC) coding system. These can be broken out by either green jobs or green positions.

**Positions:** The estimated number of individuals engaged in a given core area activity. This number is different from the estimate of green jobs since a given green job may be engaged in one or more core area activities.

**Sector:** A grouping of industries, primarily at the two-digit North American Industry Classification System (NAICS) level. Some two-digit NAICS are combined such as 31, 32, and 33, which together comprise the manufacturing sector.

**Total Covered Employment:** All employment covered by the Unemployment Insurance program as measured by the Quarterly Census of Employment and Wages (QCEW).

**Weighted Estimate:** An estimate of either positions or jobs that modifies the raw reported number to account for firms which were not included in the survey. Such accounting then allows one to use the sample statistics to represent the population statistics for all green firms and green jobs.