# 2008 Washington State Green Economy Jobs

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# Green Economy Jobs in Washington State

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# Executive Summary

This report presents the findings of a survey of private-sector employers in Washington state. The goal of the survey was to identify the number and type of jobs in the state's emerging green economy and to establish a baseline measure that can be used to track industry and job growth in Washington's "green economy."

The study was requested by the state Legislature and specified in Engrossed Second Substitute House Bill 2815 (E2SHB 2815), which passed during the 2008 legislative session. The overall intent of the bill is to provide a framework for reducing greenhouse gas emissions in the Washington economy. Section 9 of the bill also calls for a green jobs study. The study results will be combined with other research activities to identify high-demand green industries, to create new green jobs, and to guide state policies and strategies that will support future growth in Washington's green economy.

## How Many Green Jobs are There?

Prior to the study required under E2SHB 2815, a 2005 study of clean energy and energy efficiency employment identified 8,400 individuals employed in clean energy jobs. This baseline was used to establish the goal of 25,000 green jobs by 2020.

The findings of existing green economy employment studies vary greatly depending on the definitions, methods, and assumptions used by researchers. No uniform definitions of a green economy or a green job exist. The current study uses the following definitions as the basis for the research:

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

- Energy efficiency
- Renewable energy
- Preventing and reducing pollution
- Mitigating or cleaning up pollution

*Green jobs* promote environmental protection and energy security.

This study employs a rigorous scientific survey design and sampling procedures to measure direct employment in green economy jobs. Over 9,500 private-sector employers from a broad range of industries participated in the survey. The survey results were subsequently weighted to represent the relative distribution of green jobs across the broader population of private-sector employers. This enabled the computation of statewide estimates for green economy employment by industry and occupation.

## Study Results

The results show an estimated total employment of 47,194 in four green core areas among private-sector employers. About 13 percent of this total consists of part-time employment. As a percentage of total state employment, green jobs is relatively small at around 1.6 percent of all private-sector employment. The total green jobs estimate is conservative, since only direct employment in green industries was measured, and no public-sector employment was included.

## The Four Green Core Areas

The overall findings for the four green core areas show that:

- **Energy Efficiency** accounts for over half of all green jobs. Construction-related industries and occupations account for 70 percent of employment in the energy efficiency area, followed by professional and technical services such as architecture and engineering.

- **Preventing or Reducing Pollution** was the second largest green core area, accounting for one-third of all green jobs. Agriculture-related industries and occupations represent over half of all employment in this green area, followed by construction, and waste management and remediation services.

- **Mitigation and Cleanup of Pollution** was the third largest green core area, accounting for just nine percent of all green jobs. Professional and technical services, and waste management and remediation services, represent over two-thirds of employment in this green area.

- **Renewable Energy** provided just over four percent of all green jobs. Construction-related industries and occupations, and professional and technical services, account for nearly half of all employment in this core area, followed by agriculture-related sectors, and electrical equipment manufacturing.

Eighty-six percent of total green employment is represented by just six industry classes, with the largest proportion coming from construction and agriculture-related industries. The prominence of these two industries is in part a reflection of their status as key drivers of the Washington economy. Similarly, the distribution of occupations is also heavily-weighted in these two industries. The largest construction-related occupations represent 40 percent of all green employment.

## Green Occupations: What's New?

Although employers identified many different occupational titles, there were no new or unique job titles identified by employers that were not already reflected in the existing national Standard Occupation Code (SOC) classification system. This suggests that employers have chosen to retain traditional occupational titles, or that the fundamental work performed by employees in these green jobs has not changed substantially such that employers believe that new occupational titles are necessary. Further investigation will be needed to determine the extent to which changes in the structure or content of these green jobs may have altered the knowledge, skills or abilities required of employees.

## Geographical Differences

Analysis of green jobs for the state's 12 Workforce Development Areas (WDAs) and by urban-rural categories shows that the distribution of employment in energy efficiency is considerably larger for urban WDAs with concentrated population centers (such as Seattle-King County) than for rural WDAs with less concentrated population bases (such as North Central Washington). Similarly, the data show that employment in construction-related industries is considerably larger in urban than in rural WDAs.

Preventing and reducing environmental pollution is heavily represented by agriculture-related industry sectors and occupations. Employment in agriculture-related jobs is greatest in rural WDAs such as North Central and South Central Washington, which are geographically large but are sparsely populated and have small-sized population centers.

## Earnings, Education, and Skills

Several secondary analyses were conducted integrating existing data on earnings, education, and skill requirements for the leading occupations identified in the study. Since these data were 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, as well as the education and skill requirements of employers.

Estimates of total earnings suggest that employment in the reported green jobs accounts for over $2.2 billion annually. As might be expected, earnings are highest for professional or technical occupations requiring long-term, post-secondary education and degrees. Numerous skilled trades and some scientific occupations requiring significant post-secondary education or training through apprenticeships earn median annual earnings that range from $40,000 to $55,000. Lower earnings are associated with less-skilled occupations that require only short-term or minimal training, such as general laborers. As a group, agriculture-related workers have the lowest annual median earnings of all, at around $21,000 or less.

## Employment Projections

A secondary analysis matching the top 25 green occupations with existing employment projections shows that employment growth rates are uneven. Growth in green occupations with the largest current employment is expected to be modest. Growth rates for architects and several engineering occupations are expected to exceed the statewide average for all occupations. Conversely, a number of construction management, skilled trades and agricultural occupations are forecast to grow at below-average rates. But the average number of annual openings for some occupations with low growth rates (carpenters, for instance) may still be substantial due to the large size of the existing employment base, and because total annual openings forecasts combine growth rates and the estimated replacement of employees due to attrition and retirements.

## Industry Certifications

Over 47 percent of all employers who participated in the survey reported that they hold industry certifications in one or more green core areas. Construction accounted for 54 percent of all reported certifications. Two-thirds of construction industry firms identified energy efficiency as the primary focus of these certifications. Professional, scientific and technical services firms account for about 20 percent of all certifications, and around half of all certifications in this industry are related to energy efficiency. Finally, around 20 percent of all certifications are reported for the agriculture, forestry, fishing, and hunting industry sector, with 70 percent of those certifications relating to preventing or reducing pollution.

The breakdown of certifications for the four green core areas is consistent with the overall findings and supports the relationship between the core areas, industry sectors, and occupations identified by employers who participated in the study.

## Future Research

The overall design of this study establishes a solid research foundation for identifying green economy industries and jobs in Washington state. Creating operational definitions and using a random sample design makes it possible to employ a systematic approach that can be replicated over time. Recommendations for future research include:

- Repeat the green jobs survey every two or three years to measure changes in industry composition, employment, and progress against state economic development goals.
- Implement a green employment study of public-sector organizations to provide a comprehensive estimate of green jobs across the state.
- Conduct targeted analyses of green industries and occupations to identify key growth factors, employment projections, and to define the education and skill standards required of current and emerging green sector occupations.
- Expand analyses of green industries and occupations to address anticipated future labor shortages.
- Conduct an economic analysis to estimate the total impact of green industry growth and employment on the Washington economy.

# Introduction

This report presents the findings of a survey of private-sector employers in Washington state. The goal of the survey was to identify the number of jobs that have been created within the state's emerging "*green economy*" and to establish a baseline measure that can be used to track industry and job growth over time.

The study was requested by the state Legislature and specified in Engrossed Second Substitute House Bill 2815 (E2SHB 2815), which passed during the 2008 legislative session.[1] The overall intent of the bill is to provide a framework for reducing greenhouse gas emissions in the Washington economy. E2SHB 2815 also contains a section (Section 9) with specific language that directs several state agencies to stimulate the development of a "green economy" and to increase the number of green economy jobs from an estimated 8,400 in 2004 to 25,000 by 2020.

E2SHB 2815 directs the Employment Security Department to conduct labor market research to determine the number of green economy jobs in the state's economy. The bill further specifies that the results of this study, in combination with findings from other research activities specified in the bill, will be used to identify high-demand green industries, and to guide state policies and strategies that will support future growth in Washington's green economy.

# 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. Clean energy, which encompasses new technologies, renewable energy, energy efficiency, and the policies and practices that support them, are typically at the core of green economy definitions, and they emphasize the development of environmentally-friendly, sustainable energy sources that will reduce our carbon footprint. At the same time, more efficient use of existing energy resources and the development of alternative energy can supplement domestic energy production and reduce our dependence on foreign oil, thereby enhancing energy security. Most current definitions of a green economy emphasize the benefits that will accrue for environmental protection and for energy security.

Growing a green economy is also viewed by many as a key strategy for ushering in a new foundation for national economic growth and employment that will generate thousands of new, good-paying jobs, enhance future prosperity for businesses and communities, revitalize lagging industrial sectors such as manufacturing, and provide new employment opportunities for economically disadvantaged populations, thereby enhancing social equity. New reports and position papers written by a broad range of industry and trade associations, labor unions, research institutions, and advocacy groups provide growing support for the potential of green economy initiatives as a driver for accomplishing these multi-faceted goals.[2]

Just as no common definition of a green economy currently exists, there is no uniform definition of a green job. In general, jobs that have a direct, positive impact on the environment have become known as green jobs; they include jobs at all levels of the earnings and skills spectrum, from professional-level employment of managers, architects, and engineers, to jobs in the skilled trades, which are often referred to as green-collar jobs. Some researchers note that green jobs are represented in nearly all economies, industries, and occupations, suggesting that the question is more about understanding what shades of green exist in an economy.[3] Green jobs are not necessarily new jobs, but often traditional

jobs in industries and companies that are adapting to new markets and opportunities available in a clean energy economy. In whichever manner the green economy is defined, however, forecasts about growth in green industries and occupations have also generated keen interest among advocacy groups who emphasize the potential of green jobs to promote jobs and career pathways out of poverty for economically disadvantaged individuals, communities of color, and for dislocated workers.[4]

## Review of Existing Research on Green Jobs

Prior to the study required under E2SHB 2815, only one study attempted to measure green jobs by industry for the state of Washington.[5] This report, which was commissioned by the Department of Community, Trade and Economic Development (CTED) in 2005, was limited to identifying "clean energy" industries and jobs that existed in 2004, building on an informal survey of energy efficiency and renewable energy industries conducted in 1998. The 2005 study did not employ a random sample survey design, relying instead on a list of employers known to be engaged in renewable energy, energy efficiency or related business activities. The study identified 241 organizations that operated in at least one clean energy core area, and these organizations employed almost 8,400 people in direct jobs. It was this number (8,400) that formed the baseline described in Executive Order 07-02 and E2SHB 2815, and was the basis for establishing the goal of 25,000 green jobs by 2020.

The existing research on job creation and economic outcomes tied to the green economy varies widely, and depends in large part on the focus of the research, operational definitions, and the economic models employed. For newly emerging green industries, employment estimates are sometimes derived from industry surveys, where companies are identified through directories or professional associations, or from analyses of investment spending or productivity coefficients for specifically defined green industries or sectors of the economy. Other studies use multivariate macroeconomic models that use existing databases to estimate employment effects of new policies or future investments in green industries, where the results are presented to show the effects on employment of several different scenarios.[6]

Studies that attempt to measure only the direct effects of green economy expansion on employment typically only consider jobs that are associated with finished products (i.e., solar panels) or the provision of services (i.e., energy efficient building designs) directly to markets or consumers. In contrast, studies that attempt to also measure indirect job growth typically include forecast job growth in companies that provide generic materials, parts, or new or expanded services (such as metals, electronic switches, or accounting services) that are indirectly associated with primary green

Studies that attempt to measure only the direct effects of green economy expansion on employment typically only consider jobs that are associated with finished products (i.e., solar panels) or the provision of services (i.e., energy efficient building designs) directly to markets or consumers.

Regardless of the model used, the results of these analyses depend heavily on the underlying assumptions employed by the researchers.

## Operational Definitions

The definitions were determined following an extensive literature search and analysis of the intent and requirements of Initiative 937, Executive Order 07-02, and E2SHB 2815. The resulting definitions were reviewed by researchers and a project advisory team comprising the lead agencies named in the bill along with other public and private-sector stakeholders. The project advisory team met monthly to provide input about the study design.

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

- Energy efficiency
- Renewable energy
- Preventing and reducing pollution
- Mitigation or cleanup of pollution

industries or employers. Still other studies may compute what are known as "induced effects," which refers to retail and wholesale jobs that are created when workers now employed in green industries spend their earnings on other products in the economy.[7]

Regardless of the model used, the results of these analyses depend heavily on the underlying assumptions employed by the researchers. For instance, assumptions about the number of indirect jobs created by each direct job can vary considerably by industry and employer, and the coefficients used to predict job creation, such as per dollar of new investment or through a specific tax credit, may also differ greatly between studies. In short, the basic assumptions employed by researchers can influence the focus of the research as well as the findings. And as the existing research on green jobs suggests, many different approaches and models have been employed, making it difficult to compare the results.

Many studies seem to agree that a likely outcome of an expanding green economy will be a net gain in total employment.[8] Some studies show that clean energy creates more jobs per megawatt of power installed, per unit of energy produced, and per dollar of investment, than the fossil fuel energy-based sector.[9]

## How Many Green Jobs are There, and How Many Future Jobs Will be Created?

A number of studies provide national estimates of the existing number of green jobs, and a few studies provide state-level estimates and projected growth rates for green jobs.[10] A recent report by Global Insight for the U.S. Conference of Mayors estimates that in 2006 there were more than 750,000 green jobs in the U.S. economy.[11] Researchers suggest that there is the potential for 4.2 million new green jobs to be added to the U.S. economy by 2038. According to breakdowns by metropolitan area, Washington state has around 13,075 green jobs now, and that number could increase to over 100,000 by 2038; nearly 50,000 of those jobs are forecast to occur in the Seattle-Tacoma-Bellevue region.[12]

Other studies on potential green job creation suggest that growth in the number of new green jobs may be somewhat more modest, but as described earlier, many of these studies use different methodologies and are not comparable.[13] A 2006 study of the effects of Initiative 937 by the Union of Concerned Scientists estimated that in addition to many other positive economic and environmental benefits, Washington's Clean Energy Initiative would generate 2,000 new jobs in manufacturing, construction, operations, maintenance, and other industries in the state by 2025.[14]

In summary, there is marked variation in findings among different research reports, and this is often due to differences in the key definitions, assumptions, and analytical models employed by researchers. Moreover, the studies reviewed for this report

suggest that while many of the same industries are included in studies of green jobs, there is no common definition of a green economy or a green job. Although several states have engaged in research that attempts to systematically define and measure employment associated with the emerging green economy, these studies also vary considerably in the definitions, scope of the research, and methodologies used.

# Methodology

The research team decided that accurately identifying green jobs and tracking growth of Washington's green economy was paramount. To accomplish this goal, the research team concluded that a rigorous survey design and sampling method should be employed to establish valid baseline estimates of the number of persons who are employed currently in green jobs.

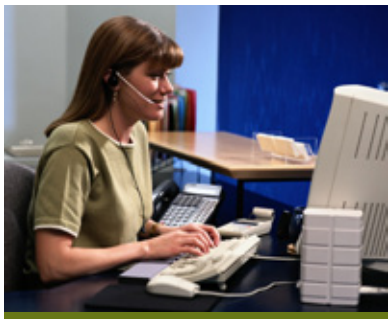
The decision was to focus on measurement of direct jobs supported by identified green economy employers, rather than attempting to measure some combination of direct, indirect, or induced employment. Establishing the baseline by estimating direct employment is a more conservative approach and may ultimately understate the total economic impact. On the other hand, choosing a conservative measurement approach can also reduce measurement error due to incorrect assumptions that may be introduced in more elaborate forecasting models that use only secondary data, or that attempt to estimate direct, indirect, and induced effects on employment.

The study relied on a written survey that was mailed by the Employment Security Department to a random sample of 17,000 Washington state employers in early August 2008. The primary goal was to determine how many workers are employed in a green job, as defined earlier.[15] The survey asked employers to identify how many of their employees hold green jobs, and whether this employment was full time or part time. If employees performed work in more than one green industry of the economy, employers were asked to identify the one green industry that accounted for the most time on the job.

Employers were also asked to name the job titles of employees who hold green jobs. Finally, employers were asked whether they held any special industry certifications related to any of the green jobs.

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

Participation: Over 9,500 employers who were contacted over a three-month period chose to participate in the survey. This represents a participation rate of over 60 percent (*Appendix 1*).



The survey was mailed to a random sample of 17,000 Washington state employers in August 2008.

Over 9,500 employers chose to participate in the survey.

This represents a participation rate of over 60 percent.

Nearly 25 percent of the 9,500 survey participants reported that they engage in one or more green business activities.

27 out of 99 three-digit NAICS codes were used exclusively during the analyses of industry-level data.

Nearly 25 percent of the 9,500 employers who completed the survey reported that they engage in one or more business activities that had employees who were responsible for producing green products or providing green services. The survey results were subsequently weighted to represent the relative distribution of green jobs across the broader population of private-sector employers, which enabled the computation of estimates of the number of green economy industries, employers, and employment by occupation.

The survey sample was selected based on their three-digit North American Industrial Classification System (NAICS) industry classifications. This occurred in two stages: first, the design team selected NAICS industries that were thought to contain green jobs, by expert judgment, based upon our operational definition. This produced the initial NAICS list. Next, a random sample of 7,500 firms whose NAICS classifications were not included in the first list was surveyed to determine if they had any green products or services. If they reported a green product or service, their NAICS was added to the original list. In this manner, we sampled all NAICS industries in the state. This process resulted in a sample frame of 27 three-digit NAICS industries, and these codes were used exclusively in the analysis of industry-level data.

For further explanation of the selection of these NAICS and the methods used in the study, please refer to the methodology section in Appendix 2.

# Study Results

The following survey results are presented as a series of tables with accompanying narrative that describes the main findings for each table. A separate section summarizes and integrates the survey findings and offers recommendations for future research.

## Green Core Areas and Employment

*Table 1* shows that an estimated 47,194 green jobs exist among private-sector employers located throughout Washington. These jobs have been categorized in *Table 1* into four green core areas that describe green activities or green attributes. Roughly 13 percent of these green jobs identified in the survey were part-time positions. The total green job estimate accounted for roughly 1.6 percent of Washington's total private-sector employment, as of the survey date.[16]

**Table 1**
Full-Time and Part-Time Employment by Green Core Area
*Source:* Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2008

| | TOTAL FULL-TIME AND PART-TIME EMPLOYMENT BY GREEN CORE AREA | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ENERGY EFFICIENCY | | RENEWABLE ENERGY | | REDUCING POLLUTION | | MITIGATION OR POLLUTION CLEANUP | | TOTAL BY FULL TIME AND PART TIME | PERCENT OF TOTAL FULL TIME AND PART TIME |
| | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT |
| Full Time by Core Area | 23,241 | 93% | 1,523 | 75% | 12,472 | 80% | 3,815 | 85% | 41,052 | 87% |
| Part Time by Core Area | 1,735 | 7% | 503 | 25% | 3,204 | 20% | 668 | 15% | 6,110 | 13% |
| Total Full Time and Part Time by Core Areas* | 24,976 | 100% | 2,027 | 100% | 15,676 | 100% | 4,483 | 100% | 47,194 | 100% |
| Percent of All Green Jobs | 52.9% | | 4.3% | | 33.2% | | 9.5% | | 100.0% | |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

*Table 1* shows the employment and percentages for each green core area. Summary findings for each core area include the following:

- The leading green core area is energy efficiency, which accounts for nearly 53 percent of all employment in green jobs (24,976). Energy efficiency also has the smallest proportion of part-time employment among the four green core areas, at just seven percent.

- Employment associated with preventing or reducing pollution ranks second highest, with total employment of 15,676, which represents one-third of all green jobs. Twenty percent of this employment (3,204) was identified as part time.

- In contrast, total employment was substantially smaller for the mitigation or cleanup of pollution (4,483), which was the third highest green core area, and accounts for 9.5 percent of total green jobs. Approximately 15 percent of this total (668) represents part-time employment.

- The renewable energy sector represents the smallest total employment among all core areas listed in *Table 1* at 2,027, or just 4.3 percent of all green jobs. Renewable energy also had the highest proportion of part-time employment among all green core areas: one quarter of all renewable energy employment (503) is part time.

## Green Job Industry Summary

*Table 2* shows the distribution of green jobs for the 27 established industries included in the study, as defined by the NAICS.[17] While most of the industries listed come from the goods-producing sector, several significant service-providing industries also are present on the list. Some of the industry classes (i.e., construction of buildings) describe a specific type of activity, while others describe business activities that cut across many different types of employers (i.e., professional and technical services).

Eighty-six percent of all green jobs is accounted for by the first six NAICS classified industries.[18] Several of the six leading industries are related specifically to construction or agriculture: two of the industries related to building construction (specialty trade contractors, and construction of buildings) combined account for nearly 44 percent of all green jobs. The top two agriculture-related industries (crop production, and agriculture and forestry support activities) account for 20 percent of all green jobs.

Energy Efficiency

Preventing and Reducing Pollution

Mitigation or Cleanup of Pollution

Renewable Energy

**Table 2**

Green Core Area Employment in 27 NAICS Industry Classes

*Source:* QCEW 2007 Third Quarter; Green Jobs Survey, Employment Security Department, LMEA, 2008

| | | TOTAL GREEN JOBS | | | | | | |
|---|---|---|---|---|---|---|---|---|
| NAICS** | NAICS TITLES | ENERGY EFFICIENCY | RENEWABLE ENERGY | REDUCING POLLUTION | MITIGATION OR POLLUTION CLEANUP | TOTAL EMPLOYMENT GREEN JOBS | TOTAL ALL EMPLOYMENT REPORTED 2007 THIRD QUARTER | GREEN JOBS AS A PERCENT OF INDUSTRY EMPLOYMENT |
| 238 | Specialty Trade Contractors | 12,215 | 278 | 1,152 | 341 | 13,985 | 127,632 | 11.0% |
| 541 | Professional and Technical Services | 3,627 | 442 | 1,748 | 1,604 | 7,456 | 152,274 | 4.9% |
| 111 | Crop Production | 629 | 160 | 6,321 | 160 | 7,270 | 76,548 | 9.5% |
| 236 | Construction of Buildings | 5,287 | 211 | 1,045 | 200 | 6,743 | 51,541 | 13.1% |
| 562 | Waste Mgmt. and Remediation Services | 210 | 60 | 1,262 | 1,384 | 2,918 | 14,188 | 20.6% |
| 115 | Agriculture and Forestry Support Activities | 140 | 160 | 1,949 | 134 | 2,384 | 19,239 | 12.4% |
| 423 | Merchant Wholesalers, Durable Goods | 134 | 10 | 602 | 87 | 832 | 68,059 | 1.2% |
| 327 | Nonmetallic Mineral Products Manufacturing | 480 | 1 | 213 | 57 | 751 | 10,865 | 6.9% |
| 335 | Electrical Equip. and Appliance Manuf. | 368 | 290 | 34 | - | 694 | 4,285 | 16.2% |
| 221 | Utilities | 622 | 56 | 1 | 1 | 679 | 4,698 | 14.5% |
| 237 | Heavy and Civil Engineering Construction | 291 | 55 | 192 | 86 | 624 | 25,071 | 2.5% |
| 112 | Animal Production | 48 | 42 | 225 | 154 | 469 | 6,170 | 7.6% |
| 522 | Credit Intermediation and Related Activities | 403 | 2 | 5 | 3 | 412 | 52,260 | 0.8% |
| 113 | Forestry and Logging | 2 | 60 | 285 | 59 | 406 | 5,206 | 7.8% |
| 326 | Plastics and Rubber Products Manuf. | 209 | 2 | 103 | 64 | 377 | 10,528 | 3.6% |
| 813 | Membership Assoc. and Organization | 17 | 0 | 261 | 55 | 334 | 25,592 | 1.3% |
| 321 | Wood Products Manufacturing | 114 | 65 | 97 | 40 | 311 | 19,035 | 1.6% |
| 332 | Fabricated Metal Products Manufacturing | 39 | 74 | 55 | 25 | 193 | 19,721 | 1.0% |
| 811 | Repair and Maintenance | 46 | 3 | 83 | 4 | 136 | 26,663 | 0.5% |
| 454 | Nonstore Retailers | 43 | 1 | 20 | 6 | 70 | 10,975 | 0.6% |
| 531 | Real Estate | 46 | - | 5 | 3 | 55 | 37,037 | 0.1% |
| 334 | Computer and Electronic Products Manuf. | 3 | 48 | - | - | 51 | 22,873 | 0.2% |
| 325 | Chemical Manufacturing | 1 | 7 | 6 | - | 14 | 6,063 | 0.2% |
| 322 | Paper Manufacturing | - | - | 5 | 7 | 12 | 11,171 | 0.1% |
| 114 | Fishing, Hunting and Trapping | 1 | 1 | 5 | 4 | 10 | 1,894 | 0.5% |
| 336 | Transportation Equipment Manufacturing | - | - | - | 6 | 6 | 93,731 | 0.0% |
| 523 | Securities, Commodity Contracts, Investments | 1 | - | 1 | - | 2 | 10,892 | 0.0% |
| | Totals | 24,976 | 2,027 | 15,676 | 4,483 | 47,194* | 914,211 | 5.2% |
| | Total For All NAICS Industries | | | | | | 2,974,524 | |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

** Green jobs were reported in 27 out of 99 three-digit NAICS.

*Table 2* shows specific breakdowns ranked by green jobs, including the percentage of total statewide employment in that industry. Summary descriptions for the top six NAICS classified industries are included below:

- **Specialty Trade Contractors** represent the largest total employment (13,985) of the 27 NAICS classified industries, and accounts for nearly 30 percent of all green jobs. This industry includes a broad range of contracting organizations associated with residential, commercial, and industrial building construction: masonry, electrical, and painting contractors are among the 19 different contracting sub-specialties included in this industry. Green jobs identified by survey respondents represents around 11 percent of total state employment in this industry.

- The **Professional, Scientific, and Technical Services** industry comprises the second largest employment totals (7,456), accounting for around 16 percent of all green jobs. This industrial class is extremely diverse, comprising organizations such as law firms, accounting services, architectural, advertising, and engineering services firms. Green jobs identified in the survey account for more than 5 percent of total state employment in this industry.

- **Crop Production** represents the industry with the third highest number of green jobs (7,270), which is 15 percent of all green jobs. This industrial class includes more than 30 different categories of major crops, ranging from apples, potatoes, and wheat, to grapes and tree nuts. Green jobs represent over 9.5 percent of total state employment in this industry.

- **Building Construction** has the fourth highest number of green jobs (6,743). This large industrial class includes residential, commercial and industrial building construction firms. These firms typically serve as general contractors, and they may use existing staff to execute some or all contract work, however general contractors typically enter into contractual agreements with other firms (such as the specialty trade contractors, described above) to complete construction projects. Green jobs represent around 13 percent of total state employment in this industry.

- **Waste Management and Remediation Services** comprises employment of 2,918. This industry area includes facilities and services such as hazardous and non-hazardous solid waste collection, treatment and disposal, landfill and materials recovery facilities, and recycling services. Waste management and remediation has the fifth-largest number of green jobs. It represents 21 percent of total state employment in this industry, which is the largest statewide proportion among all 27 industry classes.

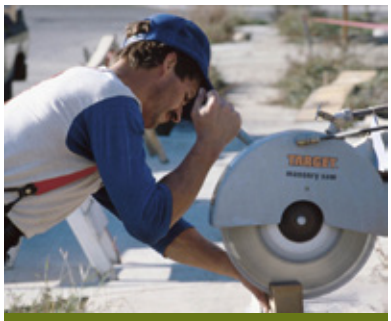
- **Agriculture and Forestry Support Activities** ranks sixth (2,384), and consists of crop harvesting (machine-based) services, management, farm labor contractors, soil preparation and planting, and related services. Green jobs represent over 12 percent of total state employment in this industrial class.

## Green Core Area Occupations

As part of the survey, employers were asked to provide the job titles for employees who have primary responsibility for one of the four green core areas. 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 green jobs.

Content analysis of the raw job titles provided by employers showed that employers did not identify new job titles that could be linked explicitly to a new class of green occupations. Employers reported that they offer green products or services, however they appear to be relying on traditional occupational titles to categorize or describe the jobs of employees.[19]

*Table 3* shows the top 25 standard occupational codes (SOC) with the largest number of green jobs, and the percentage that each occupation represents.



Specialty Trade Contractors:

Represents the largest total employment of the 27 NAICS classified industries.

Professional, Scientific and Technical Services:

This industry comprises the second largest employment totals.

Crop Production:

Represents the industry with the third highest number of green jobs.

The occupational titles identified by employers reflect those we would expect to find within the green core areas and NAICS described earlier. This provides one indicator of internal consistency of the data, as we would expect to find a high degree of overlap between industry classes and specific occupations.

These top 25 occupations are also remarkable because they represent over 74 percent of all green jobs. Although green jobs represent 266 different SOCs that were identified by employers, the largest employment counts were concentrated in a small number of related occupations. Indeed, the first 10 occupations listed in the table collectively account for 56 percent of all green jobs. These leading occupations represent mostly skilled trades and technical jobs that are directly related to the development of green economy products or the provision of services. Administrative, management or other support jobs were frequently identified by employers, but employment in these occupations was generally small.

**Table 3**

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

*Source:* Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2008

| | | TOTAL GREEN JOBS | | | | | |
|---|---|---|---|---|---|---|---|
| SOC | OCCUPATIONAL TITLE | ENERGY EFFICIENCY | RENEWABLE ENERGY | REDUCING POLLUTION | MITIGATION OR POLLUTION CLEANUP | TOTAL EMPLOYMENT GREEN JOBS | PERCENT OF TOTAL GREEN JOBS |
| 452092 | Farmworkers and Laborers, Crop, Nursery, and Greenhouse | 557 | 149 | 4,065 | 43 | 4,814 | 10.2% |
| 472111 | Electricians | 3,651 | 84 | 17 | 32 | 3,784 | 8.0% |
| 472061 | Construction Laborers | 2,050 | 217 | 651 | 217 | 3,136 | 6.6% |
| 472031 | Carpenters | 2,394 | 38 | 208 | 34 | 2,674 | 5.7% |
| 452099 | Agricultural Workers, All Other | 37 | 1 | 2,381 | 225 | 2,645 | 5.6% |
| 499021 | Heating, Air Cond., and Refrig. Mechanics and Installers | 2,341 | 42 | 127 | 82 | 2,590 | 5.5% |
| 172051 | Civil Engineers | 1,157 | 98 | 627 | 197 | 2,085 | 4.4% |
| 472152 | Plumbers, Pipefitters, and Steamfitters | 1,675 | 6 | 176 | 19 | 1,875 | 4.0% |
| 171011 | Architects, Except Landscape and Naval | 1,433 | 83 | 176 | 12 | 1,702 | 3.6% |
| 172141 | Mechanical Engineers | 610 | 71 | 127 | 235 | 1,047 | 2.2% |
| 472121 | Glaziers | 831 | - | 8 | - | 838 | 1.8% |
| 472181 | Roofers | 658 | 33 | 75 | 56 | 821 | 1.7% |
| 519199 | Production Workers, All Other | 406 | 35 | 234 | 71 | 747 | 1.6% |
| 537081 | Refuse and Recyclable Material Collectors | 220 | 8 | 299 | 218 | 745 | 1.6% |
| 533032 | Truck Drivers, Heavy and Tractor-Trailer | 30 | 14 | 416 | 282 | 744 | 1.6% |
| 119021 | Construction Managers | 498 | 22 | 97 | 32 | 648 | 1.4% |
| 471011 | First-Line Sprvrs./Mgrs. of Const. Trades and Extraction Wrkrs. | 560 | - | 42 | 14 | 616 | 1.3% |
| 472131 | Insulation Workers, Floor, Ceiling, and Wall | 533 | 10 | 16 | 10 | 569 | 1.2% |
| 452041 | Graders and Sorters, Agricultural Products | - | - | 518 | 3 | 521 | 1.1% |
| 172071 | Electrical Engineers | 378 | 31 | 17 | 30 | 458 | 1.0% |
| 474041 | Hazardous Materials Removal Workers | 6 | - | 63 | 380 | 449 | 1.0% |
| 192041 | Environmental Scientists and Specialists, Including Health | 24 | 14 | 149 | 222 | 409 | 0.9% |
| 472211 | Sheet Metal Workers | 370 | - | 22 | 9 | 401 | 0.8% |
| 119199 | Managers, All Other | 228 | 24 | 90 | 52 | 396 | 0.8% |
| 537062 | Laborers and Freight, Stock, and Material Movers, Hand | 126 | 5 | 205 | 47 | 383 | 0.8% |
| | TOTAL | 20,772 | 985 | 10,806 | 2,520 | 35,096 | 74.4% |
| | Total of All Green Jobs by Core Areas* | 24,976 | 2,027 | 15,676 | 4,483 | 47,194 | 100.0% |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

*Table 3* shows that farmworkers and laborers, crop, nursery, and greenhouse workers comprise the single largest occupational group, with total employment of 4,814. Adding all other agricultural workers (the fifth largest occupational group with employment of 2,645) brings the total employment in agriculture-related occupations to 7,459, which represents nearly 16 percent of all green jobs.

Electricians comprise the second largest occupational group with employment of 3,784, or about eight percent of all green jobs. Electricians were one of a number of leading occupations that support the construction industry. Indeed, the majority of the top 10 occupations are either directly or indirectly related to construction. Combined, the eight largest construction-related occupations listed in *Table 3* account for total employment of 18,893, or 40 percent of all green jobs.

## Distribution of Green Core Area Employment by Workforce Development Area (WDA)

In order to examine the distribution of green jobs in different regions of the state, the survey data were disaggregated for each of the state's 12 Workforce Development Areas (WDAs) which are composed of a combination of the state's 39 counties. WDAs define regional economic and labor markets and related data, education, and employment-related resources such as WorkSource centers that are organized to support workforce development activities across the WDA.

As shown in *Table 4*, there is considerable variation in employment among WDAs for each of the four green core areas. [20]

**Table 4**

Green Core Area Employment by Workforce Development Area (WDA)

*Source:* Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2008

| | ENERGY EFFICIENCY | | RENEWABLE ENERGY | | REDUCING POLLUTION | | MITIGATION OR POLLUTION CLEANUP | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| WDA | GREEN JOBS | PERCENT OF TOTAL EFFICIENCY | GREEN JOBS | PERCENT OF TOTAL RENEWABLE | GREEN JOBS | PERCENT OF TOTAL POLLUTION | GREEN JOBS | PERCENT OF TOTAL CLEANUP | TOTAL GREEN JOBS | ***TOTAL COVERED EMPLOYMENT 2007 THIRD QUARTER | GREEN JOBS AS A PERCENT OF TOTAL EMPLOYMENT |
| 5 - Seattle-King County | 9,962 | 69.2% | 581 | 4.0% | 2,649 | 18.4% | 1,193 | 8.3% | 14,387 | 1,158,441 | 1.2% |
| 8 - North Central Wash/Columbia Basin | 783 | 14.5% | 34 | 0.6% | 4,451 | 82.5% | 126 | 2.3% | 5,394 | 123,932 | 4.4% |
| 9 - South Central | 432 | 12.4% | 147 | 4.2% | 2,832 | 81.3% | 75 | 2.2% | 3,485 | 126,563 | 2.8% |
| 11 - Benton-Franklin | 1,101 | 34.6% | 79 | 2.5% | 931 | 29.3% | 1,067 | 33.6% | 3,178 | 97,906 | 3.2% |
| 3 - Northwest Washington | 1,285 | 46.1% | 247 | 8.9% | 963 | 34.5% | 295 | 10.6% | 2,790 | 155,992 | 1.8% |
| 6 - Pierce County | 1,401 | 52.6% | 165 | 6.2% | 892 | 33.5% | 205 | 7.7% | 2,663 | 275,515 | 1.0% |
| 12 - Spokane | 1,516 | 65.8% | 225 | 9.8% | 305 | 13.2% | 259 | 11.2% | 2,305 | 208,014 | 1.1% |
| 4 - Snohomish County | 1,199 | 60.2% | 144 | 7.2% | 369 | 18.5% | 286 | 14.4% | 1,992 | 250,953 | 0.8% |
| 7 - Southwest Washington | 1,254 | 66.9% | 31 | 1.7% | 350 | 18.7% | 240 | 12.8% | 1,876 | 171,920 | 1.1% |
| 2 - Pacific Mountain | 1,122 | 64.5% | 57 | 3.3% | 420 | 24.1% | 141 | 8.1% | 1,740 | 172,262 | 1.0% |
| 1 - Olympic Consortium | 970 | 68.3% | 56 | 3.9% | 322 | 22.7% | 75 | 5.3% | 1,420 | 116,809 | 1.2% |
| 10 - Eastern Washington | 520 | 51.4% | 68 | 6.7% | 320 | 31.7% | 103 | 10.2% | 1,012 | 68,754 | 1.5% |
| 99 - Other* | 3,431 | 69.3% | 191 | 3.9% | 871 | 17.6% | 417 | 8.4% | 4,952 | 8,187 | 60.5% |
| TOTAL | 24,976 | 52.9% | 2,027 | 4.3% | 15,676 | 33.2% | 4,483 | 9.5% | 47,194** | 2,935,248 | 1.6% |

* This primarily consists of firms with green jobs in more than one area.

** The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

*** Covered employment are all those workers covered by unemployment insurance. The data comes from the Quarterly Census of Employment and Wages data series.

### The more notable findings include:

- The **Seattle-King County WDA** with 14,387 green jobs, accounts for the largest share (30 percent) of all green jobs across the state. Green jobs represent just 1.2 percent of all employment in the WDA. *Table 4* also shows that 69 percent of all green jobs in the Seattle-King County WDA are in energy efficiency. About 18 percent of green jobs are associated with the prevention or reduction of pollution.

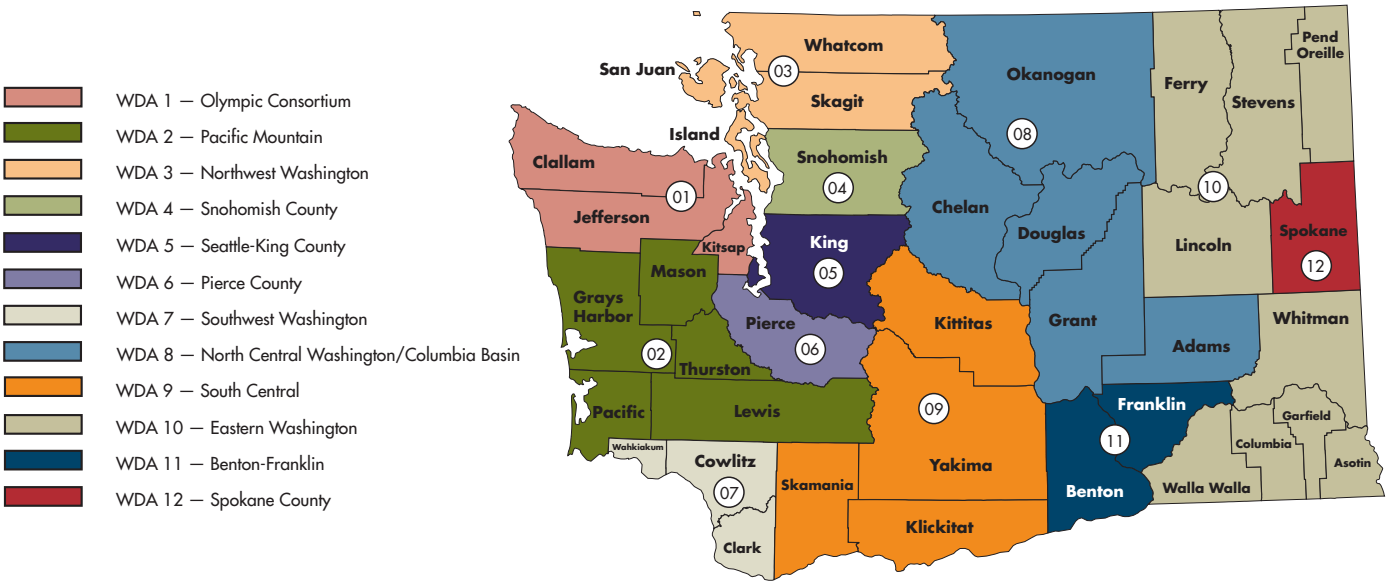
- The **North Central WDA**, which represents a geographically large rural area consisting primarily of small-sized cities and towns, had the second highest total number of green jobs at 5,394. Over 82 percent of green jobs in the North Central WDA is associated with preventing or reducing pollution, and this represents the highest concentration of green jobs by a WDA in any green core area. At 4.4 percent of total employment, green jobs in the North Central WDA are proportionately higher than any other WDA.

- A similar employment pattern exists for the **South Central WDA**, a large and mostly rural geographic area in which 81 percent of all green jobs in the WDA (3,485) is associated with preventing or reducing pollution. Green jobs account for 2.8 percent of total employment in the WDA.

- The **Benton-Franklin WDA** has the fifth largest number of green jobs (3,178), and there is a fairly even distribution of employment across three of the four green core areas. The percentage of green jobs in the mitigation or cleanup of pollution is the highest among all WDAs, and total green jobs in this green core area is second highest after Seattle-King County.[21] Green jobs in the Benton-Franklin WDA account for 3.2 percent of total employment in the WDA, second only to the North Central WDA (4.4 percent).

- As the WDA with the smallest total employment, **Eastern Washington** also has the smallest total number of green jobs (1,012). Unlike many rural WDAs, however, over half of all green jobs in the Eastern Washington WDA are in energy efficiency. Green jobs account for 1.5 percent of total employment in this WDA.

**WASHINGTON STATE WORKFORCE DEVELOPMENT AREAS**




## Differences in Green Core Area Employment: Urban and Rural WDAs

The preceding section noted considerable variation among some WDAs in the number and type of green jobs reported by employers. The analysis also revealed that WDAs that encompass predominantly urban counties with large population centers tend to have more employment in the energy efficiency core area than sparsely-populated rural WDAs. By comparison, rural WDAs tend to have higher employment in the reducing and preventing pollution core area than predominantly urban WDAs.

To investigate these findings further, we integrated industry and occupational data and identified categories consisting of the three most urban WDAs, and the three most rural WDAs. A third category was identified that combined the remaining six WDAs and represented a comparatively balanced urban-rural mix. *Table 5* is a three-way cross tabulation of green jobs by core area, type of WDA, and NAICS industry classification. *Table 6* sorts green jobs by core area, type of WDA, and type of occupation.

**Table 5**

Comparison of Urban and Rural WDAs, Employment by Industry Areas (NAICS) and Green Core Areas

*Source:* Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2008

| TOP FIVE GREEN NAICS AS A FUNCTION OF FOUR GREEN CORE AREAS, COMBINED FULL TIME AND PART TIME, URBAN AND RURAL WDAS | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ENERGY EFFICIENCY | | RENEWABLE ENERGY | | REDUCING POLLUTION | | MITIGATION OR POLLUTION CLEANUP | | TOTAL BY INDUSTRY |
| INDUSTRY (NAICS), WDAs | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER |
| Top Five NAICS, Urban WDAs | | | | | | | | | |
| Specialty Trade Contractors | 6,028 | 85.8% | 115 | 1.6% | 737 | 10.5% | 146 | 2.1% | 7,026 |
| Construction of Buildings | 3,436 | 80.3% | 183 | 4.3% | 536 | 12.5% | 123 | 2.9% | 4,278 |
| Professional and Technical Services | 1,956 | 49.6% | 290 | 7.4% | 1,092 | 27.7% | 604 | 15.3% | 3,942 |
| Waste Mgmt. and Remediation Services | 36 | 3.8% | 60 | 6.3% | 370 | 39.2% | 479 | 50.7% | 946 |
| Merchant Wholesalers, Durable Goods | 28 | 4.9% | 10 | 1.7% | 518 | 90.9% | 14 | 2.4% | 570 |
| Total Urban NAICS | 11,484 | 68.5% | 658 | 3.9% | 3,253 | 19.4% | 1,366 | 8.2% | 16,762 |
| Top Five NAICS, Rural WDAs | | | | | | | | | |
| Crop Production | 538 | 8.6% | 118 | 1.9% | 5,560 | 88.8% | 49 | 0.8% | 6,264 |
| Agriculture and Forestry Support Activities | 4 | 0.2% | 10 | 0.6% | 1,702 | 94.6% | 83 | 4.6% | 1,799 |
| Specialty Trade Contractors | 808 | 88.1% | 27 | 3.0% | 67 | 7.3% | 16 | 1.7% | 917 |
| Construction of Buildings | 251 | 93.3% | 1 | 0.2% | 12 | 4.6% | 5 | 1.9% | 269 |
| Professional and Technical Services | 83 | 59.4% | 18 | 12.8% | 30 | 21.5% | 9 | 6.3% | 139 |
| Total Rural NAICS | 1,683 | 17.9% | 173 | 1.8% | 7,371 | 78.5% | 162 | 1.7% | 9,388 |
| Top Five NAICS, All Other WDAs | | | | | | | | | |
| Specialty Trade Contractors | 5,379 | 89.0% | 136 | 2.2% | 348 | 5.8% | 179 | 3.0% | 6,042 |
| Professional and Technical Services | 1,588 | 47.1% | 134 | 4.0% | 626 | 18.5% | 991 | 29.4% | 3,375 |
| Construction of Buildings | 1,600 | 72.8% | 27 | 1.2% | 497 | 22.6% | 72 | 3.3% | 2,196 |
| Waste Mgmt. and Remediation Services | 170 | 9.1% | - | 0.0% | 819 | 43.9% | 875 | 46.9% | 1,866 |
| Crop Production | 90 | 11.0% | 42 | 5.2% | 651 | 79.6% | 34 | 4.2% | 818 |
| Total All Other NAICS | 8,827 | 61.7% | 339 | 2.4% | 2,941 | 20.6% | 2,152 | 15.1% | 14,297 |
| Total All Industries | 24,976 | 52.9% | 2,027 | 4.3% | 15,676 | 33.2% | 4,483 | 9.5% | 47,194* |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

Note: Urban WDAs include Snohomish, King, Pierce; Rural WDAs include North Central Washington, South Central, Eastern Washington; All Other WDAs include all other regions.

*Table 5* shows that in the urban WDA category, two construction-related NAICS industry classes (specialty trade contractors and construction of buildings) represent the largest employment totals (7,026 and 4,278, respectively). Over 68 percent of employment in the top five industries in the urban WDA category is in the energy efficiency core area. In contrast, in the rural WDA category, the two agriculture-related industries support the highest concentration of green jobs, and over 78 percent of employment in the top five industry classes pertains to the prevention and reduction of pollution. Finally, the hybrid urban-rural WDA category shows a more balanced distribution of green jobs among different industry classes and core areas. However, energy efficiency comprises the largest concentration of green jobs.

A similar and even more pronounced distinction between WDA categories was found when comparing employment by occupational title, as shown in *Table 6*. Over 81 percent of employment in the five leading occupations is in energy efficiency. Moreover, all five of the occupational titles in the urban category are related primarily to the construction industry. In contrast, over 85 percent of green jobs in the rural category pertain to the prevention and reduction of pollution. Further, four of the top five occupations in the rural category are tied directly to agriculture-based industries. Finally, the profile of green jobs for the hybrid urban-rural category is very similar to that described for the urban WDA category: a large concentration of employment in energy efficiency, with most occupations directly tied to the construction industry.

**Table 6**

Comparison of Urban-Rural WDA Categories, Employment by Occupation (SOC) and Green Core Areas

*Source:* Green Jobs Survey, Employment Security Department, Labor Market and Economic Analysis, 2008

| TOP FIVE GREEN OCCUPATIONS AS A FUNCTION OF FOUR GREEN CORE AREAS, COMBINED FULL TIME AND PART TIME, URBAN AND RURAL WDA, DECEMBER 2008 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ENERGY EFFICIENCY | | RENEWABLE ENERGY | | REDUCING POLLUTION | | MITIGATION OR POLLUTION CLEANUP | | TOTAL BY OCCUPATIONS |
| OCCUPATIONS (SOC), WDAs | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER | PERCENT | NUMBER |
| Top Five Occupations, Urban WDAs | | | | | | | | | |
| Electricians | 1,953 | 97.2% | 44 | 2.2% | 7 | 0.3% | 6 | 0.3% | 2,009 |
| Carpenters | 1,448 | 89.4% | 27 | 1.7% | 120 | 7.4% | 24 | 1.5% | 1,619 |
| Construction Laborers | 1,061 | 67.3% | 163 | 10.3% | 218 | 13.8% | 136 | 8.6% | 1,577 |
| Architects, Except Landscape and Naval | 1,022 | 82.1% | 75 | 6.0% | 143 | 11.5% | 5 | 0.4% | 1,245 |
| Civil Engineers | 709 | 61.9% | 40 | 3.5% | 354 | 30.9% | 42 | 3.7% | 1,146 |
| Total Urban | 6,192 | 81.5% | 350 | 4.6% | 842 | 11.1% | 213 | 2.8% | 7,597 |
| Top Five Occupations, Rural WDAs | | | | | | | | | |
| Farmworkers and Laborers, Crop, Nursery, and Greenhouse | 502 | 12.0% | 117 | 2.8% | 3,550 | 85.1% | 4 | 0.1% | 4,173 |
| Agricultural Workers, All Other | 13 | 0.6% | - | 0.0% | 2,107 | 93.7% | 129 | 5.7% | 2,249 |
| Graders and Sorters, Agricultural Products | - | 0.0% | - | 0.0% | 476 | 100.0% | - | 0.0% | 476 |
| Electricians | 342 | 95.4% | 10 | 2.7% | 4 | 1.1% | 3 | 0.8% | 359 |
| Packers and Packagers, Hand | - | 0.0% | - | 0.0% | 312 | 100.0% | - | 0.0% | 312 |
| Total Rural | 857 | 11.3% | 127 | 1.7% | 6,448 | 85.2% | 136 | 1.8% | 7,569 |
| Top Five Occupations, All Other WDAs | | | | | | | | | |
| Heating, Air Cond., and Refrig. Mech. and Installers | 1,296 | 89.7% | 17 | 1.2% | 61 | 4.2% | 71 | 4.9% | 1,445 |
| Construction Laborers | 892 | 62.1% | 54 | 3.8% | 411 | 28.6% | 79 | 5.5% | 1,435 |
| Electricians | 1,357 | 95.8% | 30 | 2.1% | 6 | 0.4% | 23 | 1.6% | 1,416 |
| Carpenters | 833 | 88.9% | 11 | 1.2% | 83 | 8.9% | 10 | 1.1% | 938 |
| Civil Engineers | 427 | 46.7% | 57 | 6.2% | 269 | 29.4% | 154 | 16.8% | 913 |
| Total All Other | 4,804 | 78.2% | 169 | 2.7% | 829 | 13.5% | 336 | 5.5% | 6,146 |
| Total All Occupations | 24,976 | 52.9% | 2,027 | 4.3% | 15,676 | 33.2% | 4,483 | 9.5% | 47,194* |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

Note: Urban WDAs include Snohomish, King, Pierce; Rural WDAs include North Central Washington, South Central, Eastern Washington; All Other WDAs include all other regions.

## Secondary Analyses

An additional analysis of green jobs was conducted by integrating available data on earnings, education, and training requirements, and employment projections for the 25 occupations with the largest number of green jobs. As noted earlier, these 25 occupations collectively account for 74 percent of all green jobs. The survey team decided that matching green job estimates to existing median earnings rates by occupation, to educational requirements, and to projected employment would improve survey response rates by reducing the burden on employers to provide specific, more detailed information.

## Green Occupations and Earnings

*Table 7* shows the distribution of statewide median annual earnings for the 25 leading occupations. The last column in the table provides an estimate of total earnings associated with green occupations, and suggests that green jobs are an economic driver for the state. The table shows that the 25 leading occupations alone account for over $1.6 billion in annual earnings. Estimating earnings for all green jobs combined shows that employment in these occupations is estimated to account for over $2.2 billion in earnings.

**Table 7**
Statewide Annual Median Earnings
Top 25 Green Occupations by Employment
*Source:* Occupational Employment Statistics (OES) Survey, Employment Security Department, LMEA

| OCCUPATION TITLE | STATEWIDE MEDIAN ANNUAL EARNINGS | STATEWIDE GREEN JOBS | TOTAL EARNINGS BY EMPLOYMENT* |
|---|---|---|---|
| Farmworkers and Laborers, Crop, Nursery, and Greenhouse | $21,151 | 4,814 | $101,819,674 |
| Electricians | $54,501 | 3,784 | $206,239,772 |
| Construction Laborers | $32,119 | 3,136 | $100,718,786 |
| Carpenters | $45,955 | 2,674 | $122,878,814 |
| Agricultural Workers, All Other | $31,571 | 2,645 | $83,496,162 |
| Heating, Air Conditioning, and Refrigeration Mechanics and Installers | $48,564 | 2,590 | $125,784,572 |
| Civil Engineers | $76,425 | 2,085 | $159,345,133 |
| Plumbers, Pipefitters, and Steamfitters | $52,812 | 1,875 | $99,041,198 |
| Architects, Except Landscape and Naval | $70,398 | 1,702 | $119,792,729 |
| Mechanical Engineers | $82,616 | 1,047 | $86,488,143 |
| Glaziers | $41,800 | 838 | $35,040,032 |
| Roofers | $46,726 | 821 | $38,360,131 |
| Production Workers, All Other | $27,411 | 747 | $20,471,314 |
| Refuse and Recyclable Material Collectors | $40,351 | 745 | $30,042,662 |
| Truck Drivers, Heavy and Tractor-Trailer | $39,989 | 744 | $29,755,135 |
| Construction Managers | $100,962 | 648 | $65,439,425 |
| First-Line Supervisors/Managers of Construction Trades and Extraction Workers | $70,281 | 616 | $43,258,736 |
| Insulation Workers, Floor, Ceiling, and Wall | $31,391 | 569 | $17,857,338 |
| Graders and Sorters, Agricultural Products | $20,030 | 521 | $10,435,613 |
| Electrical Engineers | $81,486 | 458 | $37,344,669 |
| Hazardous Materials Removal Workers | $63,620 | 449 | $28,595,213 |
| Environmental Scientists and Specialists, Including Health | $65,148 | 409 | $26,659,459 |
| Sheet Metal Workers | $58,865 | 401 | $23,597,480 |
| Managers, All Other | $103,718 | 396 | $41,027,617 |
| Laborers and Freight, Stock, and Material Movers, Hand | $24,802 | 383 | $9,497,600 |
| Total of Top 25 Green Occupations | | 35,096 | $1,662,987,408 |
| Total of All Other Employment and Earnings | | 11,423 | $578,790,018 |
| *Total All Green Employment and Earnings | | 47,194 | $2,241,777,426 |
| Percent of Top 25 Green Employment to all Green Employment | | 74.4% | |

* The earnings data are derived from all occupations, not just green occupations. In producing the occupational earnings estimates, the data for 13 occupations were not available. Because of this, the total employment for all occupations will not add up to the reported employment total of 47,194. This was because the OES wage survey data did not pick up certain roll-up occupations, or agriculture-related occupations that were out of the scope in the nonagricultural survey, or because there was an insufficient sample size for an occupation. The resulting employment total without the 13 occupations would reflect a 675 (1.4 percent) employment difference from the 47,194 total.

As depicted in *Table 7*, earnings are generally highest for professional or technical occupations that require long-term, post-secondary education and degrees.[22] Managers earn the highest median earnings among all occupations. Engineers and architects account for the second highest earnings level (approximately $70,000 to $83,000). The third tier of earnings includes a variety of skilled trades (i.e., carpenters, electricians, and roofers) and some scientific occupations such as environmental scientists. As a group, skilled trades occupations related to the construction industry represent the largest employment in jobs with median annual earnings that range from approximately $40,000 to $55,000.

As might be expected, lower earnings are generally associated with less-skilled occupations that do not require long-term preparation, such as insulation workers, general laborers, and production workers who earn median annual earnings of $30,000 to $33,000. Agricultural workers earn the lowest median earnings among all occupational groups at $20,000 to $21,000. As noted earlier, agriculture-related industries represent approximately 20 percent of all green jobs.

## Education and Experience Requirements for Green Occupations

As with earnings, the education and experience requirements of green jobs vary considerably depending on the job title and type of work performed. As shown in *Table 8*, the levels of education and length of training required is highest for professional and technical occupations: management, architectural, engineering, and other professional occupations generally require a four-year degree or higher.

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 (OJT) that can take up to four years to complete. Extensive OJT with supplemental coursework is a requirement of registered apprenticeship programs. Of the 25 occupations listed in *Table 8*, over 36 percent of employment is 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 of a range of construction and production jobs, and typically combines limited coursework with OJT.

Finally, agriculture-related laborer occupations comprise the largest number of occupations that require preparation of less that one month, typically through OJT. Occupations requiring little preparation represent around 26 percent of employment among the leading 25 occupations.

Professional Occupations:

Managers make the highest median earnings among all occupations.

Technical Occupations:

Engineers and architects account for the second highest earnings.

Skilled Trades:

The third tier of earnings includes a variety of skilled trades such as electricians.

**Table 8**

Education and Work Experience Requirements by Level of Preparation for Top 25 Occupations[23]

*Source:* Bureau of Labor Statistics, 2002 National Employment Matrix Occupation Title; Washington State Green Jobs Survey; 2008 Spring Job Vacancy Survey, Employment Security Department, LMEA, 2008

| OCCUPATION | EDUCATION AND EXPERIENCE REQUIREMENTS | NUMBER OF GREEN JOBS |
|---|---|---|
| | Long Preparation | |
| Civil Engineers | e.g., Bachelor's Degree or Higher | 2,085 |
| Architects, Except Landscape and Naval | | 1,702 |
| Mechanical Engineers | | 1,047 |
| Construction Managers | | 648 |
| Electrical Engineers | | 458 |
| Environmental Scientists and Specialists, Including Health | | 409 |
| | Mid-Level Preparation | |
| Electricians | >1 year, <4 years, includes on-the-job training, classes or combination | 3,784 |
| Carpenters | | 2,674 |
| Heating, Air Conditioning, and Refrigeration Mechanics and Installers | | 2,590 |
| Plumbers, Pipefitters, and Steamfitters | | 1,875 |
| Glaziers | | 838 |
| First-Line Supervisors/Managers of Construction Trades and Extraction Workers | | 616 |
| Managers, All Other | | 396 |
| | Short Preparation | |
| Construction Laborers | 1 to 12 months, on-the-job training, classes or combination | 3,136 |
| Roofers | | 821 |
| Production Workers, All Other | | 747 |
| Truck Drivers, Heavy and Tractor-Trailer | | 744 |
| Insulation Workers, Floor, Ceiling, and Wall** | | 569 |
| Hazardous Materials Removal Workers | | 449 |
| Sheet Metal Workers | | 401 |
| | Little Preparation | |
| Farmworkers and Laborers, Crop, Nursery, and Greenhouse | <1 month, usually on-the-job training | 4,814 |
| Agricultural Workers, All Other* | | 2,645 |
| Refuse and Recyclable Material Collectors | | 745 |
| Graders and Sorters, Agricultural Products | | 521 |
| Laborers and Freight, Stock, and Material Movers, Hand | | 383 |
| Total | | 35,096 |
| All Other Green Jobs | | 12,098 |
| Total All Green Jobs | | 47,194 |

* SOC code 452099 Agricultural Workers, All Other is not available in the economic data so equivalent agricultural codes 452092 Farmworkers and Laborers, Crop, Nursery, and Greenhouse and 459093 Farmworkers, Farm and Ranch Animals has been used.

** SOC code 472131 Insulation Workers, Floor, Ceiling, and Wall is not available in the economic data for education and experience so an equivalent SOC code 472130 Insulation Workers is used.

## Employment Projections and Green Occupations

Existing state employment projections were applied to the survey results to generate one possible estimate of future annual growth rates and job openings in the top 25 green occupations through 2016.[24]

Comparing growth rates and annual openings in this way shows that with a few exceptions, growth estimates among the top 25 green occupations for the forecast period are likely to be uneven (*Table 9*). Growth rates for several occupations are expected to be higher than the statewide average of 1.4 percent (2006 to 2016). For occupations with the largest

Green Occupations:

Civil engineers are projected to experience employment growth of two percent over the 2006 to 2016 period.

Several technical, skilled trades and semi-skilled occupations show the next highest growth rates, ranging from sheet metal workers and hazardous materials removal workers to mechanical engineers and environmental scientists.

current employment, however, growth rates are expected to be fairly modest, with several occupations growing at rates that are less than the statewide average. These include construction managers, supervisors and laborers, carpenters, and several other skilled trade occupations.

*Table 9* shows that three of the 25 occupations are expected to have average annual growth rates of 2.0 percent or higher over the forecast period. Of the three, architects represent the largest projected statewide annual growth rate of 3.0 percent (2006 to 2016).

Civil engineers are projected to experience employment growth of two percent over the 2006 to 2016 period. Production workers (All Other) are projected to grow by 2.1 percent. Several technical, skilled trades and semi-skilled occupations show the next highest growth rates, ranging from sheet metal workers and hazardous materials removal workers, to mechanical engineers and environmental scientists.

As described earlier, a number of construction-related management and skilled craft occupations are expected to experience relatively low rates of growth over the forecast period, as are agricultural occupations. It should be noted, however, that occupations with large employment bases but small growth rates may still generate substantial new employment. For instance, even though architects show the highest growth rate of 3.0 percent, the 0.7 percent growth rate for carpenters will generate more total new employment per year (343) than architects (142) during the 2006 to 2016 forecast period, due to the large existing employment base of carpenters.

Moreover, the last two columns in *Table 9* represent forecasts of annual employment openings due both to job growth, and to replacement openings that are estimated to occur due to employee attrition and retirements. The last two columns of the table show, for instance, that the total average annual openings for carpenters during the 2006 to 2011 forecast period is 802, while for architects the total average openings is 254.

**Table 9**

Top 25 Green Occupations and Estimated Statewide Employment,
Growth Rates and Annual Openings, 2006 to 2011 and 2011 to 2016

*Source:* Employment Projections Data, Employment Security Department, Labor Market and Economic Analysis

| | | ALL EMPLOYMENT | | | | |
|---|---|---|---|---|---|---|
| SOC TITLE | GREEN JOBS 2008 | ESTIMATED EMPLOYMENT ALL INDUSTRIES 2006 | ESTIMATED EMPLOYMENT ALL INDUSTRIES 2016 | AVERAGE ANNUAL GROWTH RATE ALL INDUSTRIES 2006-2016 | AVERAGE ANNUAL TOTAL OPENINGS ALL INDUSTRIES 2006-2011 | AVERAGE ANNUAL TOTAL OPENINGS ALL INDUSTRIES 2011-2016 |
| Total of Agricultural Occupations** | 8,590 | 73,157 | 76,125 | 0.4% | 2,280 | 1,948 |
| Electricians | 3,784 | 17,524 | 20,115 | 1.4% | 674 | 805 |
| Construction Laborers | 3,136 | 31,238 | 33,663 | 0.8% | 356 | 614 |
| Carpenters | 2,674 | 49,400 | 52,829 | 0.7% | 802 | 1,256 |
| Heating, Air Cond., and Refrig. Mech. and Installers | 2,590 | 5,979 | 6,943 | 1.5% | 186 | 231 |
| Civil Engineers | 2,085 | 13,068 | 15,981 | 2.0% | 706 | 643 |
| Plumbers, Pipefitters, and Steamfitters | 1,875 | 12,085 | 13,836 | 1.4% | 399 | 482 |
| Architects, Except Landscape and Naval | 1,702 | 4,179 | 5,601 | 3.0% | 254 | 216 |
| Mechanical Engineers | 1,047 | 5,047 | 5,842 | 1.5% | 213 | 184 |
| Glaziers | 838 | 1,881 | 2,154 | 1.4% | 52 | 69 |
| Roofers | 821 | 5,125 | 5,912 | 1.4% | 179 | 228 |
| Production Workers, All Other | 747 | 3,862 | 4,735 | 2.1% | 177 | 175 |
| Refuse and Recyclable Material Collectors | 745 | 1,988 | 2,337 | 1.6% | 99 | 88 |
| Truck Drivers, Heavy and Tractor-Trailer | 744 | 36,829 | 41,744 | 1.3% | 1,090 | 1,281 |
| Construction Managers | 648 | 9,984 | 11,041 | 1.0% | 227 | 309 |
| First-Line Spvrs./Mgrs. of Construction Trades and Extraction Wrkrs. | 616 | 18,645 | 20,465 | 0.9% | 357 | 551 |
| Insulation Workers, Floor, Ceiling, and Wall | 569 | 903 | 1,008 | 1.1% | 25 | 38 |
| Electrical Engineers | 458 | 3,183 | 3,727 | 1.6% | 138 | 132 |
| Hazardous Materials Removal Workers | 449 | 2,056 | 2,386 | 1.5% | 97 | 66 |
| Environmental Scientists and Specialists, Including Health | 409 | 3,716 | 4,449 | 1.8% | 182 | 177 |
| Sheet Metal Workers | 401 | 4,878 | 5,640 | 1.5% | 187 | 219 |
| Managers, All Other | 396 | 18,818 | 21,666 | 1.4% | 679 | 698 |
| Laborers and Freight, Stock, and Material Movers, Hand | 383 | 47,237 | 55,877 | 1.7% | 2,593 | 2,403 |
| Loan Officers | 362 | 9,891 | 10,421 | 0.5% | 147 | 178 |
| Drywall and Ceiling Tile Installers | 360 | 5,900 | 6,494 | 1.0% | 90 | 196 |
| Total Top 50 Green Jobs | 36,428 | | | | | |
| All Other Green Jobs | 10,766 | | | | | |
| Total of All Green Employment* | 47,194 | 3,272,529 | 3,755,401 | 1.4% | 129,149 | 123,269 |

* The totals of all green jobs (47,194) is greater than the row and column total by 32 jobs because some respondents did not report green jobs by any core area.

** Currently agriculture-related occupations are not accurately captured in the data collection process, for example the OES Survey which is used by this estimate does exclude agriculture except agriculture services. To provide a better agricultural estimate, the SOC codes 119012 Famers and Ranchers, 452041 Graders and Sorters, 452091 Agricultural Equipment Operators, 452092 Farmworkers and Laborers, 452093 Farmworkers, Farm and Ranch Animals, and 452099 Agricultural Workers, All Other were rolled up in one.

## Green Certifications

The study also attempted 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 green 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 individual employees. *Table 10* shows the number of firms that indicated that they do hold special certifications in one or more of the four green core areas. The table includes the percentages for each core area classified by two-digit NAICS titles.[25]

**Table 10**

Employers with Industry Certifications for One or More Green Core Areas, by Two-Digit NAICS
Growth Rates and Annual Openings, 2006 to 2011 and 2011 to 2016
*Source:* Washington State Green Jobs Survey, Employment Security Department, LMEA, 2008

| NAICS TITLE* | GREEN FIRMS | TOTAL CERTIFIED | ENERGY EFFICIENCY TOTAL CERTIFICATIONS | RENEWABLE ENERGY TOTAL CERTIFICATIONS | REDUCING POLLUTION TOTAL CERTIFICATIONS | CLEANUP OR MITIGATION TOTAL CERTIFICATIONS |
|---|---|---|---|---|---|---|
| 11 Agriculture | 879 | 590 | 13.0% | 10.1% | 70.3% | 6.6% |
| 22 Utilities | 14 | 8 | 32.0% | 68.0% | 0.0% | 0.0% |
| 23 Construction | 3,758 | 1,617 | 72.9% | 3.0% | 17.4% | 6.7% |
| 31-33 Manufacturing | 206 | 56 | 40.5% | 12.1% | 29.3% | 18.0% |
| 42 Wholesale Trade | 77 | 24 | 20.2% | 6.8% | 42.6% | 30.4% |
| 45 Retail Trade | 13 | 5 | 40.0% | 0.0% | 20.0% | 40.0% |
| 52 Finance and Insurance | 26 | 9 | 100.0% | 0.0% | 0.0% | 0.0% |
| 53 Real Estate, Rental and Leasing | 36 | 0 | 0.0% | 0.0% | 0.0% | 0.0% |
| 54 Professional Services | 1,056 | 615 | 49.6% | 9.0% | 28.7% | 12.7% |
| 56 Administrative, Support, and Waste Mgmt. | 192 | 82 | 6.3% | 2.2% | 28.2% | 63.4% |
| 81 Other Services (Except Public Admin.) | 136 | 11 | 32.7% | 0.0% | 67.3% | 0.0% |
| Total | 6,391 | 3,017 | 53.4% | 5.9% | 30.8% | 9.9% |

* Some NAICS titles are abbreviated to accommodate data in the table.

Employers participating in the survey indicated that they hold a total of 3,017 industry certifications in one or more of the four green core areas. *Table 10* shows that the largest total number of certifications identified by employers is associated with construction (1,617). Construction represents 43 percent of core area certifications of all construction-related firms who participated in the survey. Nearly 73 percent of construction-related certifications were associated with energy efficiency.

The second largest number of certifications is associated with professional services (615). Fifty-eight percent of all employers in this industry indicated that they held certifications, of which 49.6 percent were related to energy efficiency.

The third largest number of certifications was in agriculture, forestry, fishing and hunting (590). Sixty-seven percent of all employers in this industry class indicated they held certifications, of which 70 percent were associated with the prevention and reduction of pollution. This industry also had the highest proportion of certifications to employers among all NAICS categories.[26]

The remaining NAICS categories account for a relatively small proportion of certifications, and the aggregate-level classification structure prevents interpretation of the results for certifications. For example, administrative, support, waste management and remediation, combines many different industry classifications that cannot be easily related to certifications specific to any single core area.

# 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 establish a baseline measure that can be used to track industry and employment growth in the state's emerging green economy. The scope of the study was limited to assessing the current composition of green economy employment in private-sector companies across the state, with supplemental analyses that incorporate existing data on earnings, education and skill requirements, and employment projections.

The research design provides a statistically sound foundation for measuring changes in industry and job growth over time. The research model can be expanded to incorporate new variables that are determined to be important to develop a deeper understanding of the growth of Washington's green economy. The primary findings of this research are summarized and discussed below.

## Green Economy Employment

The study estimates total state employment of 47,194 across the four green core areas. About 13 percent of this total represents part-time employment. Compared to all covered employment, green jobs account for only about 1.6 percent of the statewide total. This overall estimate should be regarded as conservative for several reasons: first, employers were asked to identify only direct employment in one or more green core areas; the counts exclude consultants, outside contractors, vendors/suppliers and others not considered regular employees. Second, this survey was limited to private employers and employment. This was done because the existing state data on private-sector employment are the most complete and reliable sources available. This analysis did not attempt to measure any public sector green jobs present in government agencies or other public institutions, where many thousands of green jobs likely reside. The public sector was excluded because no existing, comprehensive database for public-sector employment was available at the time of the survey. Finally, a number of completed surveys were received following the submission deadline, and these data were not included in the analysis. These late submissions would likely add more than 1,000 green jobs to the final count.

## Green Job Profiles

The overall findings by core area showed that energy efficiency accounted for over half of all green jobs. Construction-related industries and occupations accounted for 70 percent of employment in the energy efficiency core area, followed by professional and technical services such as architecture and engineering.

The study estimates total state employment of 47,194 across four green core areas.

Employers were asked to identify only direct employment in one or more green core areas.

This survey was limited to private-sector employers and employment.

Energy Efficiency:

The overall findings showed that energy efficiency had the largest employment in any green core area.

Preventing or Reducing Pollution:

This core area accounted for the second highest employment among the four core areas.

Preventing or reducing pollution was the second largest green core area, with agriculture-related industries and occupations representing over half of green jobs in that area, followed by construction and waste management and remediation services. Mitigation or cleanup of pollution was the third largest green core area, accounting for just nine percent of all green jobs, with professional and technical services and waste management and remediation services representing over two-thirds of employment in this area. Renewable energy provided just over four percent of all green jobs. Construction-related industries and occupations and professional and technical services accounted for nearly half of all green jobs in this area, followed by agriculture-related industries and electrical equipment manufacturing.

### A Detailed Summary for Each of the Green Core Areas is Provided Below

**Energy Efficiency:** This was by far the largest green employment core area, accounting for 24,976 green jobs and around 53 percent of all green sector employment. Further, the energy efficiency core area was heavily represented by employment in industries and occupations that directly or indirectly support the construction industry as a whole; at least 70 percent of employment in this area was from construction-related industries (see *Table 1*).

It is likely that the large proportion of employment in the energy efficiency core area stems in part from the fact that energy efficiency products and services are found in a wide variety of industries and occupations; and these products and services have strong markets and historical connections with residential, commercial, and industrial construction. Energy efficiency is also the most appropriate green category for construction-related business activities. Therefore it seems reasonable that the majority of construction firms would identify employees engaged in green construction activities within the context of energy efficiency.

Construction is also a significant player in the state's overall economy, accounting for approximately 6.4 percent of all nonagricultural earnings and employment. At its peak in 2007, the construction industry provided around 7.25 percent of nonfarm payrolls in Washington state.[27] The prominence of energy efficiency in the results may also represent, in part, the current and future market expectations of construction-related employers. Steady growth in green building practices and Leadership in Energy Environmental Design (LEED) certified construction projects has been accompanied by larger numbers of new products and construction methods that meet more stringent energy efficiency standards. The steep decline in residential and commercial construction markets may also be compelling employers to position themselves to pursue retrofit or renovation-related projects until the market for new building construction rebounds. Finally, it also seems likely that some employers are choosing to become more environmentally conscious themselves, pursuing business opportunities that offer long-term growth and competitive advantage, but that are also consistent with corporate values that emphasize environmental protection and sustainability.

**Preventing or Reducing Pollution:** This core area accounted for the second highest employment (15,676) among the four green core areas, and over one-third of all green jobs. While these results are notable for their overall contribution, an even more interesting finding is that 53 percent of all employment in this core area was related to two agriculture-related industries (crop production, and agricultural and forestry support activities). As previously noted, these two industry classes account for 16 percent of all green jobs. By identifying agriculture-related employment in the context of preventing or reducing pollution, it may be that employers are relating the work of employees – most of whom are farm workers and laborers – with organic farming or sustainable farming practices that use less harmful chemicals and fertilizers. These sustainble practices also help control animal waste and runoff, and prevent soil depletion and erosion. In this respect, the primary work of employees may not actually be to produce green products or provide services to prevent or reduce pollution. Rather, these are perhaps more accurately described as very desirable secondary outcomes of sustainable farming and harvesting practices.

**Mitigation or Pollution Cleanup:** This core area accounted for the third highest employment (4,483), but just 9.5 percent of all green jobs. As might be expected, professional and technical services and waste management and remediation services accounted for over two-thirds of employment in this core area. Both of these NAICS industries include employers who offer specialty services related to mitigation or pollution cleanup, including professional consulting and evaluative analysis, legal and related services, and pollution recovery and disposal. Twenty percent of all waste management and remediation services-related employment was identified as green in the survey, a higher share than any other industry. In effect, this makes waste management and remediation services the 'greenest' of the 27 NAICS industries.

**Renewable Energy:** Washington state relies on hydroelectricity for around 76 percent of electric power generation, yet only around two percent of non-hydro power comes from renewable energy.[28] While it is an emerging and fast-growing contributor to the green economy, renewable energy represents the smallest proportion of employment among the four core areas: just 4.3 percent of all green jobs (2,027) identified by employers was in the renewable energy core area. The distribution of employment associated with the renewable energy core area provides a snapshot of the industry composition of this segment. Around 22 percent of employment was in the professional and technical services industry area, which includes architectural, engineering, and legal services firms. Further, employment in the two largest construction-related industry classes (specialty trade contractors, and building construction) accounted for 24 percent of employment in renewable energy, followed by electrical equipment and appliance manufacturing, at 14 percent. Utilities accounted for less than three percent of green jobs in the renewable energy core area.[29]

Mitigation or Pollution Cleanup:

This core area accounted for the third highest employment, but just nine percent of all green jobs.

Renewable Energy:

While renewable energy is an emerging and fast-growing contributor to the green economy, it represents the smallest proportion of green jobs among the four core areas.

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 facilities.

Once erected, most renewable energy facilites operate with a relatively small number of operations and maintenance employees.

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. Moreover, maintenance services are often provided by outside contractors.[30] The reasons why part-time employment in renewables is the highest among the four green core areas are not entirely clear. This could be related to the developmental stage of many small-scale renewable projects and smaller employers. It could also be due to the fact that crop production and agricultural and forestry support activities – which may relate to bio-fuels or bio-energy power generation projects – together accounted for around 16 percent of employment in this core area. Part-time employment in crop production is relatively high at around 29 percent.

## Green Job Characteristics

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

Eighty-six percent of total green jobs is represented by just six industr classes, with the largest proportion coming from construction and agriculture-related industries (*Table 2*). As noted earlier, the prominence of these two industries is in part a reflection of their status as major employers and as drivers of the Washington economy. Similarly, the distribution of occupations is also heavily weighted in these two industries, with the eight largest construction-related occupations representing 40 percent of all green jobs (*Table 3*). The timing of the survey and the fact that seasonal employment fluctuations are common in both industries may help explain the prevalence of construction and agriculture employment in the results.[31] However, the year-long downturn in construction-related business activity and the emerging economic recession may have actually moderated employers' reports for this study.

### Green Occupations – What's New?

Although employers identified many different occupational titles, there were no new or unique job titles identified by employers that were not already reflected in the existing national Standard Occupation Code (SOC) classification system. Occupational titles for green jobs were indistinguishable from standard occupations that were considered in the study. This suggests that employers have simply chosen to retain 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.

What these findings do not address is the extent to which the skill sets required of employees in these occupations have changed. Research on green jobs suggest that for most occupations the need for new skills probably occurs incremental. That is, new skills are simply added through additional training to the broader foundation of skill sets required in existing occupations.[32] It seems likely that many of the changes in the structure of work for green jobs will remain similar to those for many other occupations: advances in technology, the development of new materials, products and production processes, and innovations in the content and delivery of services.[33] For now, the creation of entirely new job classes or occupational titles to support green business activities or skills does not appear to be a common practice among employers. Further investigation of employer skill requirements will be needed to determine the extent to which the structure or content of green jobs has altered the knowledge, skills or abilities required of employees.

The prominence of the construction and agriculture-related industries is in part a reflection of their status as major employers and drivers of the Washington economy.

### WDAs and Geographical Differences (Urban-Rural)

Analyses of green employment for the state's 12 WDAs and by urban-rural categories shows that the distribution of employment in the energy efficiency core area was considerably larger for urban WDAs with concentrated population centers (such as Seattle-King County) than for rural WDAs with less concentrated population bases (such as North Central Washington). Similarly, the data showed that green jobs in construction-related industries was considerably larger in urban WDAs than in rural WDAs (*Tables 5* and *6*).

Preventing and reducing environmental pollution was the green core area with the second largest total employment (15,676) and around one third of all green employment. This area was heavily represented by agriculture-related industries and occupations. Employment in agriculture-related jobs was greatest in more sparsely-populated rural WDAs such as North Central and South Central, which are geographically large but have small-sized population centers.

Further investigation of employer skill requirements will be needed to determine the extent to which the structure or content of green jobs has altered the knowledge, skills, or abilities required of employees.

### Earnings, Education, and Skills

Several secondary analyses were conducted by integrating existing data on wages education, and skill requirements for the leading occupations identified in the study. Since these data were 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.

Estimates of total earnings suggest that employment in the reported green occupations accounts for over $2.2 billion annually. As might be expected, earnings are highest for professional or technical occupations requiring long-term, post-secondary education and degrees (*Tables 7* and *8*). Numerous skilled trades

Wages are highest for professional or technical occupations requiring long-term, post-secondary education and degrees.

Numerous skilled trades and some scientific occupations requiring significant post-secondary education and training through apprenticeships earn median annual wages.

and some scientific occupations requiring significant post-secondary education and training through apprenticeships command median annual earnings that range from around $40,000 to $55,000. Lower earnings are associated with less-skilled occupations that require only short-term or minimal training, such as general laborers. As a group, agriculture-related workers have the lowest annual median earnings of all, at around $21,000 or less.

### Employment Projections

A secondary analysis matching the top 25 green occupations with existing employment projections showed that employment growth rates are uneven, with growth in occupations representing the largest current employment expected to be modest through 2016. Growth rates for architects and several engineering occupations are expected to exceed the statewide average for all occupations, while a number of construction management, skilled trades, and agricultural occupations are projected to grow at rates that are below average (*Table 9*). However, the average number of annual openings for some occupations with low growth rates (carpenters, for instance) may still be substantial due to the size of the existing employment base, and because total annual openings projected combine growth rates and the estimated replacement of employees due to attrition and retirements. As with the earnings and educational data previously cited, these existing employment projections should be regarded as approximations of actual growth rates and total annual openings, which may be different for these green occupations.

### Industry Certifications

Over 47 percent of all employers who participated in the survey reported that they hold industry certifications in one or more green core areas (*Table 10*). Two-thirds of construction industry firms identified energy efficiency as the primary focus of these certifications. Around half of all certifications in professional, scientific, and technical services firms are related to energy efficiency. Finally, 70 percent of all certifications for the agriculture, forestry, fishing and hunting industry classes related to preventing or reducing pollution.

### Future Research

The overall design of this study has established a solid scientific research foundation for identifying green economy industries and occupations in Washington state. Creating operational definitions and employing a random sample design made it possible to conduct a study that employed a systematic approach using scientific methods that can be replicated over time. 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 or three years in order to asses job growth in core areas, industries and occupations, and as a basis for measuring progress against current and future state economic goals.

- Design a complementary survey project for use with public sector organizations and employment, because there may be a large number of state, regional, and local organizations that provide green economy products and services. These data should be collected systematically and integrated with the private-sector data so that all green jobs can be identified and tracked over time.

- Conduct detailed analyses of targeted green industry areas 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 anticipated labor shortages in many green jobs due to retirements, population trends, low enrollments in related education and training programs, and a lack of career interest among K-12 students in the industries and occupations that support green economy growth.[34]

- Conduct an economic analysis to estimate the total impact of green sector industry growth and employment on the Washington economy.

Over 47 percent of all employers who participated in the survey reported that they hold industry certifications in one or more green core areas. The largest total number was associated with construction, which accounted for 54 percent of all reported certifications.

Around 20 percent of all certifications were reported for the agriculture, forestry, fishing and hunting industry areas, with 70 percent of those certifications relating to preventing or reducing pollution.

# Endnotes


1. Engrossed Second Substitute House Bill 2815.

2. See: "*Green Jobs: Towards sustainable work in a low-carbon world*." Washington D.C.: Worldwatch Institute for the United Nations Environment Programme, 2008 (September). See also: "*Manufacturing Climate Solutions: Carbon-reducing Technologies and U.S. jobs*." Center on Globalization, Governance and Competitiveness, Duke University, 2008 (November). Also: "*Carbon-free Prosperity 2025: How the northwest can create green jobs, deliver energy security, and thrive in the global clean-tech marketplace*." Clean Edge, Inc., and Climate Solutions, 2008 (October). Also: "*Clean Energy Corps: Jobs, service, and equal opportunity in America's clean energy economy*." Executive Summary: The Apollo Alliance, the Center for American Progress Action Fund, the Center on Wisconsin Strategy, Energy Action Coalition, Green For All (2008).

3. 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.**

4. 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. Suter, C. (2005). "*A 2005 Look at the Renewable Energy, Energy Efficiency, and Smart Energy Industries in Washington State*." Olympia, WA: Energy Policy Office, Department of Community, Trade and Economic Development (CTED).

6. These scenarios may range from several different types of policy instruments or size of investment in green economy industry sectors, and may include, for instance, no new investment, a moderate investment, or a large investment. For a summary of different approaches used in studies of energy efficiency, see: Laitner, S. and McKinney, V. (2008). "*Positive Returns: State energy efficiency analyses can inform U.S. energy policy analyses*." Washington D.C.: American Council for an Energy-Efficient Economy, Report Number E084 (June).

7. For examples of studies that estimate direct, indirect, and induced employment, see Laitner and McKinney (2008), and: Pollin, R., Garrett-Peltier, H., Heintz, J. and Scharber, H. (2008). "*Green Recovery: A program to create good jobs and start building a low-carbon economy*." Amherst, MA: Center for American Progress and the Political Economy Research Institute, University of Massachusetts, Amherst (September). Also: "*Economic Impacts of Extending Federal Solar Tax Credits*." Navigant Consulting, for the Solar Energy Research and Education Foundation, 2008 (September). Also: "*Massachusetts Clean Energy Industry Census*." Global Insight, for the Massachusetts Renewable Energy Trust, 2007 (August).

8. "*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*." Also: Bournakis, A., Cuttica, J., Mueller, S., and G. Hewings (2005). "*The Economic and Environmental Impacts of Clean Energy Development in Illinois*." Chicago, IL: The Energy Resources Center, University of Illinois at Chicago, and the Regional Economics Application Laboratory, University of Illinois at Urbana-Champaign (June).

9. Kammen, D., Kapadia, K., and Fripp, M. (2004). "*Putting Renewables to Work: How many jobs can the clean energy industry generate?*" Berkeley, CA: Renewable and Appropriate Energy Laboratory, University of California, Berkeley, 2004 (April). Also: Deyette, J. and Clemmer, S. (2006). The Washington Clean Energy Initiative: Effects of I-937 on Consumers, Jobs and the Economy. Washington, D.C.: Union of Concerned Scientists (October), **http://www.ucsusa.org**. Also: "*Green Recovery: A program to create good jobs and start building a low-carbon economy.*" Also: Singh, V., BBC Research and Consulting, and Fehrs, J.A. (2001) "*The Work That Goes into Renewable Energy*." Washington D.C.: The Renewable Energy Policy Project (November). Also: Brower, M., Tennis, M., and Denzler, E. (1993). "*Powering the Midwest*," Washington, D.C.: Union of Concerned Scientists, (107-108).

10. Examples include California, Massachusetts, Florida, and Ohio and Texas. Other reports estimate green job growth for individual cities. See: Pollin, R. and Wicks-Lim, J. (2008). "*Job Opportunities for the Green Economy: A state-by-state picture of occupations that gain from green investments.*" Amherst, MA: Political Economy Research Institute, University of Massachusetts, Amherst (June).

11. "*U.S. Metro Economies: Current and potential green jobs in the U.S. economy.*" Global Insight. Produced for the U.S. Conference of Mayors and the Mayors Climate Protection Center (2008) October.

12. Estimates for Washington state include forecasts in the combined Portland-Beaverton (OR) and Vancouver (WA) metropolitan area. It was estimated by the author that the Vancouver area could account for approximately 37 percent of the jobs for that metro area, which was included as part of the current and long-term estimates for Washington.

13. "*U.S. Metro Economies: Current and potential green jobs in the U.S. economy.*" Also: Kammen, D., Kapadia, K., and Fripp, M. (2004). "*Putting Renewables to Work: How many jobs can the clean energy industry generate?*"

14. Deyette, J. and Clemmer, S. (2006). "*The Washington Clean Energy Initiative: Effects of I-937 on consumers, jobs and the economy.*"

15. A copy of the survey instrument can be found in the Appendix Five.

16. Computation is based upon total covered employment in the 3rd Quarter of 2008, which is the period from which the sample was drawn.

17. As noted earlier in the Methodology section, the survey design and pre-test phases of the study determined that of the 99 three-digit NAICS codes, these 27 industries were most likely to contain the majority of employment in the defined green areas, and therefore were the focus of this study.

18. Descriptions for each of the 27 industry areas can be found at **http://www.census.gov/eos/www/naics/2007NAICS/2007_Definition_File.pdf**

19. The raw job titles provided by employers were later converted into equivalent Standard Occupational Classification (SOC) codes. This step enabled the integration of a standardized coding scheme and facilitated comparative analyses. Examples of the few job titles that appeared to be linked to new or emerging green business activities included: solar PV installer, biomass harvester operator, and conservation director.

20. The *Other* category included in the table is comprised mainly of large companies that have many facilities across the state, and therefore represents employment in more than one WDA. Employment in this category should not be compared to other WDAs. It is worth noting that over 69 percent of employment in the *Other* category is in the energy efficiency core area.

21. Although unconfirmed, this finding is likely due to employment related to ongoing mitigation and cleanup work at the former Hanford nuclear site.

22. The earnings ranges noted in this section are approximations and pertain only to the top 25 occupations listed in the table.

23. The education and experience requirements presented in the table collapses 11 Bureau of Labor Statistics categories into the four listed in the table. This four-level classification is employed by the Washington State Workforce Training and Education Coordinating Board.

24. Relying on existing projections of statewide occupations to forecast green jobs is speculative, and is presented here only to illustrate one possible scenario for future employment growth in green occupations; employers were not asked to provide employment projections for the occupations included in this study.

25. Two-digit NAICS reflect aggregate industry categories rather than at the level of individual industry areas shown in earlier tables. Depicting the distribution of certifications at the two-digit level in *Table 10* greatly simplified the presentation of the results.

26. Utilities ranks second in the percent of certifications by two-digit NAICS (60.2 percent), however the total number of firms identifying certifications is very small (8). The third highest percentages of certifications are in professional, scientific, and technical services, followed by construction.

27. *"State of the Washington Labor Market,"* Employment Security Department, Labor Market and Economic Analysis, December 4, 2008. Also: Quarterly Census of Employment and Wages (QCEW).

28. U.S. Department of Energy, Energy Information Administration, 2006.

29. It should be noted that public sector utilities are large sponsors of renewable energy projects. However, as described earlier in the Methodology section, public-sector employers were not included in this study.

30. Maintenance of Puget Sound Energy's (PSE) two wind farms are provided primarily under contract with wind turbine manufacturer Vestus, a multi-national corporation which has a regional office in Portland, Oregon.

31. Employers were asked to report employment for the three months of June through August 2008.

32. Hayes, C. and Rafkind, D. (2008). "*Analysis of Clean Energy Workforce Needs and Programs in Oregon*." Sustainable Oregon Workforce Initiative and 3E Strategies.

33. 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.**

34. Margolis, R. and Zuboy, J. (2006). "*Nontechnical Barriers to Solar Energy Use: Review of Recent Literature*" National Renewable Energy Laboratory. Also: Hardcastle, A. (2008) "*Workforce challenges of electric sector employers in Washington and Oregon*." Olympia, WA: Washington State University, Extension Energy Program. Also: "*Job Trends Report*," Seattle Jobs Initiative, 2008 (July).

# Appendices

## Appendix 1 - Green Jobs Survey Response Rates

| Sample Summary | Number of Establishments |
|---|---|
| Population of Establishments | 27,284 |
| Original Sample Drawn | 17,221 |
| Number of Firms in-Sample | 15,649 |
| Contacted in-Sample | 9,749 |
| Not Contacted | 5,900 |

| Total in and out of Sample, by Reason | | |
|---|---|---|
| Reason Code | Number of Establishments | In/Out of Sample |
| Responses | 9,562 | in |
| Refusal | 187 | in |
| Invalid Address | 848 | out |
| Out of business | 210 | out |
| Inactive | 418 | out |
| Out of State | 96 | out |

| Response Rate | |
|---|---|
| Number of Firms in Sample | 15,649 |
| Total Response | 9,562 |
| Response Rate | 61.1% |

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

# Appendix 2 - Methodology[1]

## 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.

The study measures only the direct jobs supported by identified green economy employers. It does not attempt to measure indirect or induced employment, as is done in, say, an input/output analysis of the economy. Establishing the baseline green employment by estimating direct employment is a more conservative approach to identifying the extent and depth of green employment 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 that this approach will understate to some degree the total impact of green employers and their green employment on the total economy.

## 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:** 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)[2] database was used to form the universe of all phases of the study. Only private employers (except private households) with at least one employee in the third quarter of 2007 were included. This was further narrowed as needed based on the North American Industrial Classification System (NAICS)[3] code in the database.

[1] 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.

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

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

As one can surmise from the above survey strategy, 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 not clearly likely 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 expert judgment of the research team, 74 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 120,000 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 54 of 4,500 usable responses or 1.4 percent were positive, and the 36 industries containing these firms (at the six-digit level) were added to the 74 previously selected to form the universe of the second survey.

The second result of this survey was an estimate of the number of firms not in the 110 NAICS codes in the phase 2 survey. There are approximately 1,055 industries in the overall universe, so most industries were not in the main survey's universe. Combined with the second phase results, there are approximately 1,200 green firms not in the final green industries (and a 95 percent chance that there are less than 2,600).

**The Phase 2 Survey:** This was the main survey, on which most of the overall survey's results are based. Only the 101 industries presumed or determined in the phase 1 survey to have a concentration of green-employing firms were included (*Appendix 4*), leading to a universe of 27,000 firms. From this population, a sample of 17,000 Washington state employers was selected. The survey was taken in early August 2008.

The above population frame was stratified by area and industry. The areas were Workforce Development Areas. The industries were grouped into 29 cells at the three-digit NAICS level, with one cell (541) split into four sub-cells at the four-digit NAICS level to improve detailed analysis in that industry group. Two three-digit cells had no positive responses, leading to the 27 three-digit industries analyzed in this report. Firms were then selected within each stratum with the probability of selection-proportionate-to-size of the firm. Large firms were selected with certainty – a probability of selection equal to 1.00. The cut-off on firm size was 200 employees. The measure of size was average employment in the third quarter, 2007.

As noted, the primary study goal was to determine how many workers were employed in a green core area. Employers were asked to list the job titles of employees who hold green core area jobs. The definition of a green core area was included in the preface to the survey questionnaire.[4] The definition of a green job can be found in the Executive Summary and the full report.

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.[5]

[4] A copy of the survey instrument can be found in Appendix 5.

[5] 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.

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

**Response Rate:** Over 9,500 employers contacted chose to participate in the survey. This represents a participation rate of over 60 percent. Nearly 25 percent of the 9,500 employers who completed the survey reported that they engage in one or more type of green core area business activity, and that they had employees who were responsible for producing green products or services. 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 nonresponse bias. Firms in a green industry but without any green employment 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 363 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 induce these firms to at least partially complete the survey. The responses of these 363 firms were compared with those firms who had initially responded to the phase 2 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.

**Sampling Error:** Error bounds were estimated using a bootstrapping re-sampling technique.[6] This method provided error bounds of +/- 6 percent for overall firm count and +/- 10 percent for total green employment.

**Final Steps:** Following completion of the three-phase survey process, existing data on industry and occupational forecasts and earnings were linked to the survey findings to enable further analysis of green economy characteristics, employment and projected growth.

[6] Tim Hesterberg, David S. Moore, Shaun Monaghan, Ashley Clipson, and Rachel Epstein (2005), Bootstrap Methods and Permutation Tests, 2nd edition, W. H. Freeman, N.Y.

# Appendix 3 - NAICS in Sample

| NAICS | 2007 NAICS TITLE |
|---|---|
| 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 |
| 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 |
| 221122 | Electric Power Distribution |
| 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 |
| 238151 | Glass and Glazing Contractors |
| 238152 | Glass and Glazing Contractors |
| 238161 | Roofing Contractors |
| 238162 | Roofing Contractors |
| 238171 | Siding Contractors |
| 238172 | Siding Contractors |
| 238211 | Electrical Contractors and Other Wiring Installation Contractors |
| 238212 | Electrical Contractors and Other Wiring Installation Contractors |
| 238221 | Plumbing, Heating, and Air-Conditioning Contractors |
| 238222 | Plumbing, Heating, and Air-Conditioning Contractors |
| 238292 | Other Building Equipment Contractors |

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

## Appendix 3 - NAICS in Sample

| NAICS | 2007 NAICS TITLE |
|---|---|
| 238311 | Drywall and Insulation Contractors |
| 238312 | Drywall and Insulation Contractors |
| 238351 | Finish Carpentry Contractors |
| 238911 | Site Preparation Contractors |
| 321113 | Sawmills |
| 321920 | Wood Container and Pallet Manufacturing |
| 321991 | Manufactured Home (Mobile Home) Manufacturing |
| 321999 | All Other Miscellaneous Wood Products Manufacturing |
| 322121 | Paper (except Newsprint) Mills |
| 325199 | All Other Basic Organic Chemical Manufacturing |
| 326199 | All Other Plastics Product Manufacturing |
| 327215 | Glass Products 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 |
| 332313 | Plate Work Manufacturing |
| 332710 | Machine Shops |
| 332999 | All Other Miscellaneous Fabricated Metal Products 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 |
| 423860 | Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers |
| 423930 | Recyclable Material Merchant Wholesalers |
| 454311 | Heating Oil Dealers |
| 522110 | Commercial Banking |
| 522120 | Savings Institutions |
| 522130 | Credit Unions |
| 522190 | Other Depository Credit Intermediation |
| 523910 | Miscellaneous Intermediation |
| 531210 | Offices of Real Estate Agents and Brokers |

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

# Appendix 3 - NAICS in Sample

| NAICS | 2007 NAICS TITLE |
|---|---|
| 541310 | Architectural Services |
| 541330 | Engineering Services |
| 541340 | Drafting Services |
| 541420 | Industrial Design Services |
| 541620 | Environmental Consulting Services |
| 541712 | Reseach and Development in the Physical, Engineering, and Life Sciences (except Biotechnology) |
| 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 |
| 811310 | Commercial and Industrial Machinery and Equipment (except Automotive and Electronic) Repair and Maintenance |
| 813312 | Environment, Conservation and Wildlife Organizations |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 111011 | Chief Executives | 113 |
| 111021 | General and Operations Managers | 267 |
| 112021 | Marketing Managers | 94 |
| 112022 | Sales Managers | 21 |
| 112031 | Public Relations Managers | 19 |
| 113011 | Administrative Services Managers | 16 |
| 113021 | Computer and Information Systems Managers | 12 |
| 113031 | Financial Managers | 25 |
| 113040 | Human Resources Managers | 22 |
| 113042 | Training and Development Managers | 5 |
| 113051 | Industrial Production Managers | 53 |
| 113061 | Purchasing Managers | 3 |
| 113071 | Transportation, Storage, and Distribution Managers | 3 |
| 119011 | Farm, Ranch, and Other Agricultural Managers | 92 |
| 119012 | Farmers and Ranchers | 248 |
| 119021 | Construction Managers | 648 |
| 119041 | Engineering Managers | 34 |
| 119121 | Natural Sciences Managers | 33 |
| 119141 | Property, Real Estate, and Community Association Managers | 6 |
| 119151 | Social and Community Service Managers | 15 |
| 119199 | Managers, All Other | 396 |
| 131022 | Wholesale and Retail Buyers, Except Farm Products | 3 |
| 131023 | Purchasing Agents, Except Wholesale, Retail, and Farm Products | 23 |
| 131041 | Compliance Officers, Except Agriculture, Construction, Health and Safety, and Transportation | 41 |
| 131051 | Cost Estimators | 98 |
| 131073 | Training and Development Specialists | 2 |
| 131079 | Human Resources, Training, and & Labor Relations Specialists, All Other | 11 |
| 131111 | Management Analysts | 87 |
| 131199 | Business Operations Specialists, All Other | 5 |
| 132011 | Accountants and Auditors | 37 |
| 132021 | Appraisers and Assessors of Real Estate | 3 |
| 132051 | Financial Analysts | 3 |
| 132052 | Personal Financial Advisors | 1 |
| 132072 | Loan Officers | 362 |
| 151021 | Computer Programmers | 31 |
| 151031 | Computer Software Engineers, Applications | 37 |
| 151032 | Computer Software Engineers, Systems Software | 10 |
| 151041 | Computer Support Specialists | 15 |
| 151051 | Computer Systems Analysts | 1 |
| 151071 | Network and Computer Systems Administrators | 2 |
| 152031 | Operations Research Analysts | 66 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 152041 | Statisticians | 1 |
| 171011 | Architects, Except Landscape and Naval | 1,702 |
| 171012 | Landscape Architects | 126 |
| 171021 | Cartographers and Photogrammetrists | 8 |
| 171022 | Surveyors | 77 |
| 172011 | Aerospace Engineers | 15 |
| 172041 | Chemical Engineers | 61 |
| 172051 | Civil Engineers | 2,085 |
| 172071 | Electrical Engineers | 458 |
| 172072 | Electronics Engineers, Except Computer | 26 |
| 172081 | Environmental Engineers | 164 |
| 172111 | Health and Safety Engineers, Except Mining Safety Engineers and Inspectors | 26 |
| 172112 | Industrial Engineers | 36 |
| 172121 | Marine Engineers and Naval Architects | 23 |
| 172131 | Materials Engineers | 51 |
| 172141 | Mechanical Engineers | 1,047 |
| 172151 | Mining and Geological Engineers, Including Mining Safety Engineers | 30 |
| 172161 | Nuclear Engineers | 10 |
| 172199 | Engineers, All Other | 9 |
| 173011 | Architectural and Civil Drafters | 125 |
| 173012 | Electrical and Electronics Drafters | 1 |
| 173013 | Mechanical Drafters | 87 |
| 173022 | Civil Engineering Technicians | 90 |
| 173023 | Electrical and Electronic Engineering Technicians | 176 |
| 173024 | Electro-Mechanical Technicians | 8 |
| 173025 | Environmental Engineering Technicians | 9 |
| 173026 | Industrial Engineering Technicians | 65 |
| 173031 | Surveying and Mapping Technicians | 9 |
| 191013 | Soil and Plant Scientists | 14 |
| 191020 | Biologists | 113 |
| 191021 | Biochemists and Biophysicists | 1 |
| 191023 | Zoologists and Wildlife Biologists | 57 |
| 191031 | Conservation Scientists | 8 |
| 191032 | Foresters | 176 |
| 191042 | Medical Scientists, Except Epidemiologists | 13 |
| 192012 | Physicists | 1 |
| 192021 | Atmospheric and Space Scientists | 2 |
| 192031 | Chemists | 38 |
| 192041 | Environmental Scientists and Specialists, Including Health | 409 |
| 192042 | Geoscientists, Except Hydrologists and Geographers | 170 |
| 192043 | Hydrologists | 67 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 192099 | Physical Scientists, All Other | 3 |
| 193011 | Economists | 4 |
| 193021 | Market Research Analysts | 19 |
| 193051 | Urban and Regional Planners | 17 |
| 193091 | Anthropologists and Archeologists | 15 |
| 194011 | Agricultural and Food Science Technicians | 31 |
| 194021 | Biological Technicians | 2 |
| 194041 | Geological and Petroleum Technicians | 4 |
| 194051 | Nuclear Technicians | 308 |
| 194061 | Social Science Research Assistants | 3 |
| 194091 | Environmental Science and Protection Technicians, Including Health | 332 |
| 194092 | Forensic Science Technicians | 1 |
| 194093 | Forest and Conservation Technicians | 30 |
| 194099 | Life, Physical, and Social Science Technicians, All Other | 6 |
| 211093 | Social and Human Service Assistants | 1 |
| 231011 | Lawyers | 7 |
| 251053 | Environmental Science Teachers, Postsecondary | 3 |
| 253099 | Teachers and Instructors, All Other | 22 |
| 259021 | Farm and Home Management Advisors | 17 |
| 259099 | Education, Training, and Library Workers, All Other | 16 |
| 271013 | Fine Artists, Including Painters, Sculptors, and Illustrators | 3 |
| 271021 | Commercial and Industrial Designers | 13 |
| 271025 | Interior Designers | 81 |
| 271029 | Designers, All Other | 7 |
| 273031 | Public Relations Specialists | 10 |
| 273041 | Editors | 4 |
| 273042 | Technical Writers | 5 |
| 274014 | Sound Engineering Technicians | 21 |
| 292099 | Health Technologists and Technicians, All Other | 3 |
| 299011 | Occupational Health and Safety Specialists | 93 |
| 331021 | First-Line Supervisors/Managers of Fire Fighting and Prevention Workers | 2 |
| 332011 | Fire Fighters | 90 |
| 371012 | First-Line Supervisors/Managers of Landscaping, Lawn Service, and Groundskeeping | 5 |
| 372011 | Janitors and Cleaners, Except Maids and Housekeeping Cleaners | 108 |
| 372021 | Pest Control Workers | 10 |
| 373011 | Landscaping and Groundskeeping Workers | 7 |
| 373013 | Tree Trimmers and Pruners | 52 |
| 373019 | Grounds Maintenance Workers, All Other | 5 |
| 392021 | Nonfarm Animal Caretakers | 35 |
| 396021 | Tour Guides and Escorts | 1 |
| 411011 | First-Line Supervisors/Managers of Retail Sales Workers | 10 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 411012 | First-Line Supervisors/Managers of Non-Retail Sales Workers | 2 |
| 412011 | Cashiers | 13 |
| 412031 | Retail Salespersons | 243 |
| 414011 | Sales Representatives, Wholesale and Manufacturing, Technical and Scientific Products | 36 |
| 414012 | Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products | 23 |
| 419022 | Real Estate Sales Agents | 18 |
| 419031 | Sales Engineers | 10 |
| 431011 | First-Line Supervisors/Managers of Office and Administrative Support Workers | 74 |
| 433031 | Bookkeeping, Accounting, and Auditing Clerks | 7 |
| 433051 | Payroll and Timekeeping Clerks | 11 |
| 433061 | Procurement Clerks | 3 |
| 434051 | Customer Service Representatives | 30 |
| 434161 | Human Resources Assistants, Except Payroll and Timekeeping | 1 |
| 434171 | Receptionists and Information Clerks | 1 |
| 435032 | Dispatchers, Except Police, Fire, and Ambulance | 12 |
| 435041 | Meter Readers, Utilities | 150 |
| 435061 | Production, Planning, and Expediting Clerks | 13 |
| 435071 | Shipping, Receiving, and Traffic Clerks | 60 |
| 435081 | Stock Clerks and Order Fillers | 4 |
| 435111 | Weighers, Measurers, Checkers, and Samplers, Recordkeeping | 2 |
| 436011 | Executive Secretaries and Administrative Assistants | 163 |
| 436014 | Secretaries, Except Legal, Medical, and Executive | 10 |
| 439061 | Office Clerks, General | 262 |
| 439199 | Office and Administrative Support Workers, All Other | 148 |
| 451011 | First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers | 143 |
| 452041 | Graders and Sorters, Agricultural Products | 521 |
| 452091 | Agricultural Equipment Operators | 156 |
| 452092 | Farmworkers and Laborers, Crop, Nursery, and Greenhouse | 4,814 |
| 452093 | Farmworkers, Farm and Ranch Animals | 207 |
| 452099 | Agricultural Workers, All Other | 2,645 |
| 453011 | Fishers and Related Fishing Workers | 8 |
| 454011 | Forest and Conservation Workers | 297 |
| 454021 | Fallers | 127 |
| 454022 | Logging Equipment Operators | 13 |
| 454023 | Log Graders and Scalers | 6 |
| 454029 | Logging Workers, All Other | 56 |
| 471011 | First-Line Supervisors/Managers of Construction Trades and Extraction Workers | 616 |
| 472031 | Carpenters | 2,674 |
| 472051 | Cement Masons and Concrete Finishers | 52 |
| 472061 | Construction Laborers | 3,136 |
| 472071 | Paving, Surfacing, and Tamping Equipment Operators | 20 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 472073 | Operating Engineers and Other Construction Equipment Operators | 235 |
| 472081 | Drywall and Ceiling Tile Installers | 360 |
| 472111 | Electricians | 3,784 |
| 472121 | Glaziers | 838 |
| 472131 | Insulation Workers, Floor, Ceiling, and Wall | 569 |
| 472132 | Insulation Workers, Mechanical | 19 |
| 472141 | Painters, Construction and Maintenance | 30 |
| 472151 | Pipelayers | 31 |
| 472152 | Plumbers, Pipefitters, and Steamfitters | 1,875 |
| 472161 | Plasterers and Stucco Masons | 61 |
| 472181 | Roofers | 821 |
| 472211 | Sheet Metal Workers | 401 |
| 472221 | Structural Iron and Steel Workers | 9 |
| 473013 | Helpers--Electricians | 12 |
| 473015 | Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters | 8 |
| 474011 | Construction and Building Inspectors | 5 |
| 474041 | Hazardous Materials Removal Workers | 449 |
| 474071 | Septic Tank Servicers and Sewer Pipe Cleaners | 38 |
| 474099 | Construction Workers, All Other | 28 |
| 475012 | Rotary Drill Operators, Oil and Gas | 1 |
| 475021 | Earth Drillers, Except Oil and Gas | 33 |
| 475031 | Explosives Workers, Ordnance Handling Experts, and Blasters | 4 |
| 491011 | First-Line Supervisors/Managers of Mechanics, Installers, and Repairers | 28 |
| 492022 | Telecommunications Equipment Installers and Repairers, Except Line Installers | 71 |
| 492092 | Electric Motor, Power Tool, and Related Repairers | 18 |
| 492096 | Electronic Equipment Installers and Repairers, Motor Vehicles | 2 |
| 493021 | Automotive Body and Related Repairers | 1 |
| 493023 | Automotive Service Technicians and Mechanics | 8 |
| 493031 | Bus and Truck Mechanics and Diesel Engine Specialists | 67 |
| 493041 | Farm Equipment Mechanics | 7 |
| 493042 | Mobile Heavy Equipment Mechanics, Except Engines | 2 |
| 493053 | Outdoor Power Equipment and Other Small Engine Mechanics | 3 |
| 499011 | Mechanical Door Repairers | 2 |
| 499021 | Heating, Air Conditioning, and Refrigeration Mechanics and Installers | 2,590 |
| 499031 | Home Appliance Repairers | 2 |
| 499041 | Industrial Machinery Mechanics | 16 |
| 499042 | Maintenance and Repair Workers, General | 253 |
| 499044 | Millwrights | 64 |
| 499051 | Electrical Power-Line Installers and Repairers | 332 |
| 499095 | Manufactured Building and Mobile Home Installers | 3 |
| 499096 | Riggers | 7 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 499098 | Helpers--Installation, Maintenance, and Repair Workers | 8 |
| 511011 | First-Line Supervisors/Managers of Production and Operating Workers | 223 |
| 512022 | Electrical and Electronic Equipment Assemblers | 91 |
| 512031 | Engine and Other Machine Assemblers | 4 |
| 512041 | Structural Metal Fabricators and Fitters | 28 |
| 512091 | Fiberglass Laminators and Fabricators | 25 |
| 512092 | Team Assemblers | 63 |
| 512099 | Assemblers and Fabricators, All Other | 238 |
| 513092 | Food Batchmakers | 126 |
| 514011 | Computer-Controlled Machine Tool Operators, Metal and Plastic | 33 |
| 514031 | Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic | 2 |
| 514033 | Grinding, Lapping, Polishing, and Buffing Mach. Tool Setters, Oprs., and Tenders, Metal and Plastic | 61 |
| 514034 | Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic | 3 |
| 514035 | Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic | 2 |
| 514041 | Machinists | 119 |
| 514072 | Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal and Plastic | 13 |
| 514121 | Welders, Cutters, Solderers, and Brazers | 46 |
| 514191 | Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic | 2 |
| 514194 | Tool Grinders, Filers, and Sharpeners | 1 |
| 514199 | Metal Workers and Plastic Workers, All Other | 163 |
| 517011 | Cabinetmakers and Bench Carpenters | 37 |
| 517041 | Sawing Machine Setters, Operators, and Tenders, Wood | 77 |
| 517042 | Woodworking Machine Setters, Operators, and Tenders, Except Sawing | 13 |
| 517099 | Woodworkers, All Other | 11 |
| 518013 | Power Plant Operators | 35 |
| 518021 | Stationary Engineers and Boiler Operators | 14 |
| 518031 | Water and Liquid Waste Treatment Plant and System Operators | 67 |
| 518093 | Petroleum Pump System Operators, Refinery Operators, and Gaugers | 3 |
| 518099 | Plant and System Operators, All Other | 11 |
| 519011 | Chemical Equipment Operators and Tenders | 233 |
| 519012 | Separating, Filtering, Clarifying, Precipitating, and Still Machine Setters, Operators, and Tenders | 15 |
| 519021 | Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders | 11 |
| 519023 | Mixing and Blending Machine Setters, Operators, and Tenders | 10 |
| 519032 | Cutting and Slicing Machine Setters, Operators, and Tenders | 4 |
| 519041 | Extruding, Forming, Pressing, and Compacting Machine Setters, Operators, and Tenders | 2 |
| 519061 | Inspectors, Testers, Sorters, Samplers, and Weighers | 39 |
| 519111 | Packaging and Filling Machine Operators and Tenders | 24 |
| 519121 | Coating, Painting, and Spraying Machine Setters, Operators, and Tenders | 6 |
| 519195 | Molders, Shapers, and Casters, Except Metal and Plastic | 50 |
| 519196 | Paper Goods Machine Setters, Operators, and Tenders | 4 |
| 519198 | Helpers--Production Workers | 104 |

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

# Appendix 4 - Green Job Occupations

| ALL REPORTED GREEN JOB OCCUPATIONS | | |
|---|---|---|
| SOC CODE | OCCUPATIONAL TITLE | TOTAL EMPLOYMENT |
| 519199 | Production Workers, All Other | 747 |
| 531021 | First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand | 8 |
| 531031 | First-Line Supervisors/Managers of Trans. and Material-Moving Machine and Vehicle Operations | 4 |
| 532021 | Air Traffic Controllers | 4 |
| 533031 | Driver/Sales Workers | 4 |
| 533032 | Truck Drivers, Heavy and Tractor-Trailer | 744 |
| 533033 | Truck Drivers, Light or Delivery Services | 12 |
| 533099 | Motor Vehicle Operators, All Other | 12 |
| 535011 | Sailors and Marine Oilers | 4 |
| 535021 | Captains, Mates, and Pilots of Water Vessels | 3 |
| 536041 | Traffic Technicians | 62 |
| 537032 | Excavating and Loading Machine and Dragline Operators | 163 |
| 537051 | Industrial Truck and Tractor Operators | 38 |
| 537061 | Cleaners of Vehicles and Equipment | 7 |
| 537062 | Laborers and Freight, Stock, and Material Movers, Hand | 383 |
| 537063 | Machine Feeders and Offbearers | 38 |
| 537064 | Packers and Packagers, Hand | 320 |
| 537072 | Pump Operators, Except Wellhead Pumpers | 7 |
| 537081 | Refuse and Recyclable Material Collectors | 745 |
| 537121 | Tank Car, Truck, and Ship Loaders | 30 |
| | TOTAL | 47,194 |

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

# WASHINGTON STATE GREEN JOBS SURVEY

## 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 September 30, 2008.
- 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 ___

## CONTACT PERSON

Name: _____

Title: _____

Telephone: (  ) _____

Date: _____

**THANK YOU FOR PARTICIPATING!**

**Washington State**
**Employment Security Department**

Labor Market and Economic Analysis

LMEA

*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.*

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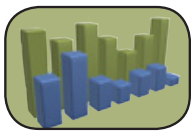
# WASHINGTON STATE GREEN JOBS SURVEY



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

**Total Number of Workers in Washington State and Job Titles Related to Four Core Areas**

- Enter total number of workers for each job title and the core area they work in.
- Please estimate how many full and part time employees have the following four core areas as their primary focus. (Choose only one core area per employee. For employees responsible for more than one core area, choose the one that accounts for the most time on the job).
- Exclude consultants, outside contractors, vendors, and others not considered employees.

**Core Areas for Green Jobs**

| Job Title Related to Core Area | Total Number of Workers in position | 1 Increasing Energy Efficiency – Number of Employees | | 2 Producing Renewable Energy – Number of Employees | | 3 Preventing and Reducing Environmental Pollution – Number of Employees | | 4 Providing Mitigation or Cleanup of Environmental Pollution – Number of Employees | |
|---|---|---|---|---|---|---|---|---|---|
| | | Full Time | Part Time | Full Time | Part Time | Full Time | Part Time | Full Time | Part Time |
| Example: *Civil Engineer* | 3 | 2 | | | | | | | 1 |
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| **Industry Certifications** Does your organization have any special industry certifications that relate to **any of the four core areas** (i.e., LEED, Certified Organic, etc.)? **Yes** ● **or No** ○ | | Yes ○ | or No ○ | Yes ○ | or No ○ | Yes ○ | or No ○ | Yes ○ | or No ○ |

Thank you for your participation.

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
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