



# North Carolina Green Economy Study

## **North Carolina's Green Economy Study Report: Product Number 3704-P08-001**

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Pictured is the Duke University Marine Lab, Marguerite Kent Repass Ocean Conservation Center,  
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## Message From Assistant Secretary Lynn R. Holmes

Dear Colleagues,

I am pleased to present to you findings from North Carolina's Green Economy Study. The goal of the study was to help increase our understanding of North Carolina's green economy. The project focused on collecting and estimating information related to occupations and industries involved in North Carolina's green economic activities as well as producing supplemental information on training and educational resources focused on developing the green workforce. The work was funded through a grant from the U.S. Department of Labor. This research is just one of the many state and national initiatives focused on describing, measuring, and understanding green economic activity. It serves as a basis for future research and contributes to the body of knowledge regarding North Carolina's green economy.

We hope that the results from the study, along with the supplemental informational products, will be useful to individuals making career and training decisions in the green economy. In addition, we are hopeful that the results from the study will help play a critical role informing discussions about North Carolina's future strategies and investments in workforce development, education and training, and economic development activities targeted at the green segments of our economy. We believe green is gold for North Carolina.

Sincerely,

A handwritten signature in black ink, appearing to read "Lynn R. Holmes", with a stylized flourish at the end.

Lynn R. Holmes  
Assistant Secretary  
Department of Commerce  
Division of Employment Security

# Table of Contents

|                                                                                            |    |
|--------------------------------------------------------------------------------------------|----|
| Executive Summary .....                                                                    | 5  |
| Economic Context.....                                                                      | 6  |
| Conclusions.....                                                                           | 7  |
| The Special Challenge in Defining a Green Job.....                                         | 7  |
| Additional Terminology.....                                                                | 8  |
| Section 1: Employer Survey Results.....                                                    | 9  |
| Table 1 Survey Response Data.....                                                          | 9  |
| Green Job Employment by Industry Sectors .....                                             | 10 |
| Table 2 Top Industry Sectors With Green Jobs .....                                         | 10 |
| Table 3 Distribution of Jobs by Green Task Category .....                                  | 11 |
| Green Jobs by Industry in North Carolina's Economic Development Regions.....               | 12 |
| Table 4 Economic Development Region Green Job Employment by Industry Sector.....           | 12 |
| Survey Results by Occupation.....                                                          | 13 |
| Table 5 Top Green Jobs by Occupation .....                                                 | 13 |
| Table 6 Top Green Jobs by Green Task Category.....                                         | 14 |
| Occupation by Green Area.....                                                              | 14 |
| Table 8 Tasks Employers Reported for Green Occupations.....                                | 15 |
| Occupation and Wages.....                                                                  | 16 |
| Figure 1 Distribution of Reported Annual Wages .....                                       | 16 |
| Occupation and Education.....                                                              | 16 |
| Occupation by Economic Development Region.....                                             | 17 |
| Table 10 Top Occupations by Economic Development Region.....                               | 17 |
| Section 2: Help Wanted Online Green Job Demand Analysis.....                               | 18 |
| North Carolina HWOL Results.....                                                           | 18 |
| Table 11 Top 10 Occupations Ranked by the Number of Postings Classified as Green.....      | 19 |
| Figure 2 Differences by Occupational Groups Between HWOL and the NC Green Jobs Survey..... | 20 |
| Figure 3 Educational Requirements .....                                                    | 21 |
| Appendix 1: Study Methodology.....                                                         | 22 |
| Green Economy Survey.....                                                                  | 23 |
| Survey Instrument .....                                                                    | 24 |
| Survey Data Collection .....                                                               | 29 |
| Data Cleaning and Coding.....                                                              | 29 |
| Employment Estimates by Occupation.....                                                    | 29 |
| Employment Estimates by Industry.....                                                      | 29 |
| Appendix 2: Post-Survey Focus Group.....                                                   | 30 |
| Table 12 Focus Group Attendee List.....                                                    | 30 |
| Focus Group Observations .....                                                             | 30 |
| Acknowledgments.....                                                                       | 31 |
| Bibliography .....                                                                         | 32 |

## Executive Summary

The North Carolina Green Economy Study, conducted by the Division of Employment Security of the North Carolina Department of Commerce, is a baseline review of what North Carolina public and private sector employers consider to be the green jobs in their workforces. The study was funded by a Labor Market Information Improvement Grant from the U.S. Department of Labor, Employment and Training Administration. Like other states and organizations that have endeavored to meet the extraordinary need for workforce information specific to the green economy, this study assembles and analyzes information about the State's green occupations as a reference for the North Carolina public workforce system, policymakers, employers and job seekers. The study will also play a critical role in informing North Carolina's future strategic investments in workforce, education, training and economic development activities targeted at the green segments of the State's economy.

Carried out over 2010-2011, the study demonstrates current employment, wage levels and educational requirements for green workers in the State. It illustrates the concentration of green employment within industry sectors and occupational categories. It also examines the similarities and differences in green employment across the State's economic development regions.

The findings of the study are supported by data drawn from several sources. Division of Employment Security analysts conducted a statewide survey of nearly 25,000 firms and analyzed the findings in Section 1. Employers had the option to assign employees to one of six green task categories: energy efficient building; biofuels and energy-efficient transportation; pollution prevention (including waste management and recycling) and environmental cleanup; the renewable power industry; sustainable products manufacturing; or education, consulting, policy promotion, accreditation, or similar services supporting any of the other categories<sup>1</sup>. Data were analyzed according to the State's seven regional partnerships for economic development. These seven regions are organized to capture regional economic activities and laborsheds. They share industry recruitment, business retention and workforce development goals.

To supplement the survey findings, analysts reviewed more than 300,000 online job postings using the Conference Board Help Wanted OnLine® (HWOL) database. The purpose was to determine if the HWOL database can be a useful proxy for measuring green job demand. Findings from this research are described in Section 2.

To provide context for the study overall, a focus group of stakeholders including educators, policymakers, private sector employers, workforce developers and environmental advocates was convened to review the findings of the employer survey and job postings analysis. Observations from the focus group participants are provided in Appendix 2.

According to the estimates computed from survey responses, 171,950 North Carolinians work in the green economy, representing 4.7 percent of total covered employment in the State<sup>2</sup>. More than half of green workers, or 54.1 percent, work in the green task area of Pollution Prevention and Environmental Cleanup. Energy Efficient Building and Assessment has the second highest number of workers followed by Education and Consulting. The remaining green task categories, Manufacturing and sustainable Products, Renewable Power, Biofuels and Energy Efficient Transportation all represented significantly smaller pieces of the larger green economy. The two major categories, Pollution Prevention and Energy Efficiency Building were also the top employment categories for all seven of the State's economic development regions.

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<sup>1</sup> The definition of a green job provided to employers surveyed was based on the Workforce Information Council's Green Jobs Study Group Final Report and definitions used in similar studies from California, Michigan, Oregon and Washington.

<sup>2</sup> Covered employment means employees covered by the State's unemployment insurance law.

## Economic Context

North Carolina, like the rest of the nation, suffered severe employment losses as a result of the national recession, which began in December 2007 and ended in June 2009. Over that period, the State's unemployment rate increased from 5.0 percent to 11.0 percent and the State's economy lost 272,600 jobs. More than half of the decline in jobs occurred in the Goods Producing sector; Manufacturing lost 88,800 jobs and Construction declined by 60,500 jobs. The Service Providing sector lost 122,300 jobs over the recession period.

The green segments of the North Carolina economy, however, may contain a potential remedy to these employment losses, particularly because recent public and private investments in this sector will likely help add jobs back to the economy. Recent research supports this assumption. For example, reports from The Pew Charitable Trusts and the North Carolina Sustainable Energy Association (NCSEA) concluded that the North Carolina economy has a large — and growing — clean energy segment. The Pew study, *The Clean Energy Economy* (2009), found that between 1998 and 2007 North Carolina's employment in clean energy-related industries grew twice as fast (at a rate of 15.3 percent) as the State's total job growth (which grew at a rate of 6.4 percent). The Pew study also reported that half of the \$82 million in venture capital attracted to the State from 2006 to 2008 was invested in clean energy.

The NCSEA study, *North Carolina Renewable Energy and Energy Efficiency Industries Census 2010*, estimates that renewable energy and energy efficiency industries in the State currently support 12,500 full-time equivalent employees, a 22 percent increase from their 2009 calculation. The NCSEA Census also shows that an estimated 32 percent of these renewable energy and energy efficiency jobs are located in manufacturing firms.

North Carolina's policymakers have similarly recognized the importance of the energy efficiency and renewable energy industries to the State's recovery and economic future. Among several recent policy initiatives in the state legislature is North Carolina's Renewable Energy and Efficiency Portfolio Standard — the first mandate in the Southeast to require renewable energy and efficiency targets in law. In addition, the North Carolina State Energy Office has led the way to greater investments in clean energy.

The Office is responsible for administering \$96.8 million in energy-related, federal American Recovery and Reinvestment Act funds to promote energy conservation, develop renewable energy resources and increase the State's energy-related jobs. Programs administered by the State Energy Office include the Recovery Act-funded State Energy Program, which added \$75.9 million in investment for programs by local governments, public schools, universities, private businesses and nonprofit agencies. Energy Efficiency and Conservation Block Grants, totaling \$20.9 million, have targeted investments to local governments and K-12 public schools. The State Weatherization Program, a division of the State Energy Office, will administer about \$131 million in additional federal Recovery Act funds.

## Conclusions

This study was designed to provide a baseline of the magnitude of green employment across North Carolina, as reflected by employers self-identifying green tasks from the definition provided. Based on this research, it appears that green jobs are diverse with respect to industry, occupation and educational requirements. The survey showed that many of the green jobs are a subset of more traditional occupations including jobs like truck drivers, production workers, construction laborers and HVAC installers.

The study shows that the differences between green and nongreen activities can often be attributed to new and changing tools, process inputs or regulatory requirements. Whereas janitors or factory workers once gathered all trash for disposal, they now separate and recycle materials. More retail stores carry green products and market them readily to consumers. Some retailers classify their entire workforce as green because the organization has committed to recycling and waste minimization goals.

Green jobs are present in every sector of the economy. These jobs range from engineers working on solar power installations to mechanics maintaining hybrid electric buses to restaurant workers recycling fryer oil. The survey reinforced that trade skills are in demand by employers — not just for conventional occupations, but for green occupations, too. Computer information technology, mechanical and electrical engineering, and other engineering disciplines are among the top skills needed for green industry activities. Equally important, however, is the finding that the majority of green jobs require no education beyond high school. Twenty-seven percent of workers gain additional skills from on-the-job training or field experience, according to employer survey responses.

## The Special Challenge in Defining a Green Job

As other studies have suggested, there are many challenges associated with defining a green job. Some analyses limited measuring green employment to energy-related firms, as did the NCSEA and PEW studies cited above, to avoid over-counting jobs that are not universally considered “green.” Other analyses took a broader view, as did many of the states that conducted green job employer surveys through their Labor Market Information (LMI) divisions in recent years. Most LMI studies had a common purpose in their analyses to determine how many green jobs are in their states. For many states, the effort to count green jobs began with their unique definition of green jobs, and the states chose to define green jobs broadly. Washington State and Kansas, for example, include more activities in their definition of green jobs than just energy-related occupations. North Carolina took a similarly broad approach in order to achieve an inclusive baseline measurement of the number of green jobs in the State.

North Carolina employers, in completing the Green Jobs Survey, were provided the following definition of a green job.

A green job is one in which the work is essential to the products or services of the business in any of the following green task categories:

1. Energy efficient building (including new construction and retrofitting) and energy efficiency assessment
2. Biofuels and energy-efficient transportation
3. Pollution prevention (including waste management and recycling) and environmental cleanup
4. Renewable energy power industry (including manufacturing of equipment used to produce power from renewable sources)
5. Manufacturing that produces sustainable products (e.g., products from previously recycled materials, CFLs or LEDs, bamboo products)
6. Providing education, consulting, policy promotion, accreditation, or similar services supporting any of the above categories

The phrase, “essential to the products and service of the business,” directed employers to make sure they were linking the work of the job to the firm’s products or services in any of the six green task areas. The organizations surveyed were instructed to count any job as green, whether it required 20 percent of the employee’s time (or even less), if the organization’s activities within the six green areas could not be carried out without that job. Responses by employers were thus subjective.

### Additional Terminology

The report uses the following terminology throughout. To provide clarity to readers, these terms are defined below.

- NAICS – North American Industry Classification System. The NAICS is the standard used by federal statistical agencies to classify business establishments for the purpose of collecting, analyzing, and publishing statistical data related to the U.S. business economy.
- SOC – Standard Occupational Classification. The SOC system is used by federal statistical agencies to classify workers into occupational categories for the purpose of collecting, calculating, or disseminating data. All workers are classified into one of 840 detailed occupations according to their occupational definition.
- O\*NET – Occupational Information Network. The O\*NET database is the nation's primary source of occupational information. It is continually updated by surveying a broad range of workers from each occupation and includes a free, publicly accessible interactive application for exploring and searching occupations. O\*NET has identified green economic sectors, green-increased demand occupations, green-enhanced skills occupations, and green new and emerging (N&E) occupations, reflected in the O\*NET-SOC system.
- CIP – Classification of Instructional Programs, developed by the U.S. Department of Education’s National Center for Education Statistics (NCES). CIP provides a taxonomic scheme to track, assess and report fields of study and program completions activity.

## Section 1: Employer Survey Results

It is important to keep in mind that the green employment estimates presented here are based on employer self-identification of green occupations within their workforces. Once survey responses were tabulated, they were weighted by Quarterly Census of Employment and Wages (QCEW) data to estimate the total green employment in North Carolina's economy.

Employers participating in the survey had the option to respond by mail, telephone, fax or online. The response data was reviewed and checked for quality, and the majority of the responses provided were accepted without independent, external verification. In addition, while every effort was made to draw a representative sample and to accurately apply sample weights to the responses, this survey was subject to sampling errors. Also, readers should note that unrounded data imply a level of accuracy that is not intrinsic to the survey estimates; data are rounded to the nearest 10 to signal that the estimates are not exact counts.

Survey response data is presented in the table below. There was a 72 percent response rate (including refusals) and a 67 percent response rate overall (excluding refusals).

**Table 1 Survey Response Data**

| Sample Summary                           | Number of Establishments |
|------------------------------------------|--------------------------|
| Original Sample                          | 24,552                   |
| Out of Business/Could Not Locate         | 839                      |
| Number of Remaining Firms in Sample      | 23,683                   |
| Completed by Phone                       | 8,890                    |
| Completed Online                         | 3,830                    |
| Completed by Mail                        | 3,215                    |
| Refused                                  | 1,108                    |
| Total Responses                          | 17,043                   |
| <b>Response Rate, Including Refusals</b> | <b>72.0%</b>             |
| <b>Response Rate, Excluding Refusals</b> | <b>67.3%</b>             |

## Green Job Employment by Industry Sectors

The Manufacturing sector reported the highest green job employment across 21 industry sectors and ranked third in total green employment statewide. Approximately 80 percent of survey responses listed manufacturing occupations in the green task categories of Pollution Prevention and Cleanup and Manufacturing Sustainable Products.

The Construction sector ranked highest in reported number of green jobs and second in total green job employment. The Pollution Prevention and Cleanup green task category accounted for 20 percent of jobs in this sector. Employers assigned construction industry-related occupations to the category of Energy Efficiency 60 percent of the time. Notably, the International Energy Agency cites energy efficiency as the most productive green activity for consumer, industrial and commercial applications. In addition to Construction, one other top industry sector report that 20 percent or more of their labor force focuses on energy efficiency.

The Public Administration sector reported the highest frequency of employment in the Pollution Prevention and Cleanup category.

The Healthcare and Social Assistance sector ranked highest in employment for Renewable Power, but had the least employment committed to the Biofuels category.

The Transportation and Warehousing sector had the highest employment in the Biofuels and Transportation category.

Pollution Prevention and Cleanup was the highest-ranking green employment activity in all industry sectors except Construction and Professional, Scientific, and Technical Services. Employers in all industries appear, based on these survey results, to have committed significant labor resources to pollution prevention activities.

Additional industry data is presented in several tables below. Table 2 ranks the top industries by NAICS for green job employment based on survey results. Table 5 shows the top industry employment in each of the six green task categories provided in the North Carolina green job definition.

**Table 2 Top Industry Sectors With Green Jobs**

| Top 10 Industry Categories by Green Employment     |                |
|----------------------------------------------------|----------------|
| NAICS Title                                        | Green Jobs     |
| (31) Manufacturing                                 | 26,580         |
| (23) Construction                                  | 25,460         |
| (92) Public Administration                         | 17,160         |
| (56) Admin. & Support & Waste Management           | 14,980         |
| (44) Retail Trade                                  | 14,240         |
| (72) Accommodation & Food Services                 | 10,880         |
| (61) Educational Services                          | 10,790         |
| (54) Professional, Scientific & Technical Services | 10,050         |
| (62) Health Care & Social Assistance               | 9,680          |
| (48) Transportation & Warehousing                  | 9,630          |
| <b>All Industries</b>                              | <b>171,950</b> |

Table 3 Distribution of Jobs by Green Task Category

| Distribution of Top 10 Green Employment Industries by Green Area |                  |                  |                       |                                  |                 |
|------------------------------------------------------------------|------------------|------------------|-----------------------|----------------------------------|-----------------|
| NAICS Title                                                      | Total Jobs       | Total Green Jobs | % of Green Employment | Major Green Area                 | % in Green Area |
| Manufacturing                                                    | 458,430          | 26,580           | 5.8%                  | Pollution Prevention, Cleanup    | 42.2%           |
| Construction                                                     | 192,770          | 25,460           | 13.2%                 | Energy Efficiency and Assessment | 59.0%           |
| Public Admin.                                                    | 242,700          | 17,160           | 7.1%                  | Pollution Prevention, Cleanup    | 74.5%           |
| Admin. & Support & Waste Mgmt Services                           | 246,860          | 14,980           | 6.1%                  | Pollution Prevention, Cleanup    | 71.4%           |
| Retail Trade                                                     | 410,290          | 14,240           | 3.5%                  | Pollution Prevention, Cleanup    | 72.1%           |
| Accommodation & Food Services                                    | 355,970          | 10,880           | 3.1%                  | Pollution Prevention, Cleanup    | 38.6%           |
| Educational Services                                             | 161,890          | 10,790           | 6.7%                  | Pollution Prevention, Cleanup    | 38.6%           |
| Professional, Scientific & Technical Services                    | 179,790          | 10,050           | 5.6%                  | Energy Efficiency and Assessment | 43.1%           |
| Health Care & Social Assistance                                  | 568,650          | 9,680            | 1.7%                  | Pollution Prevention, Cleanup    | 59.9%           |
| Transportation & Warehousing                                     | 124,160          | 9,630            | 7.8%                  | Pollution Prevention, Cleanup    | 81.9%           |
| <b>All Industries</b>                                            | <b>3,681,140</b> | <b>171,950</b>   | <b>4.7%</b>           |                                  |                 |

## Green Jobs by Industry in North Carolina's Economic Development Regions

Table 4 illustrates the top green job employment by industry sector for each economic development partnership region. The State's regional partnerships have between 14,000 and 40,000 workers with green focus activities, according to the survey. The Northeast Partnership, which is much smaller per capita than the other regions, has about 7,000 reported green jobs. The Manufacturing and Construction industry sectors have large concentrations of green occupations in each of the partnership areas.

The Manufacturing and Construction sectors were reported as key areas for green activity in four of seven regions. Pollution Prevention and Energy Efficient Building and Assessment were the primary areas of green industry activity within regions.

**Table 4 Economic Development Region Green Job Employment by Industry Sector**

| Top 5 Green Industry Sectors by EDR                     |                                               |                   |                   |               |
|---------------------------------------------------------|-----------------------------------------------|-------------------|-------------------|---------------|
| NAICS                                                   | NAICS Title                                   | Total Jobs In EDR | Green Jobs In EDR | % Jobs In EDR |
| <b>Advantage West - 22,870 Estimated Green Jobs</b>     |                                               |                   |                   |               |
| 31                                                      | Manufacturing                                 | 50,710            | 3,980             | 7.8%          |
| 23                                                      | Construction                                  | 20,110            | 3,890             | 19.3%         |
| 92                                                      | Public Administration                         | 27,570            | 3,030             | 11.0%         |
| 62                                                      | Health Care & Social Assistance               | 67,970            | 2,690             | 4.0%          |
| 72                                                      | Accommodation & Food Services                 | 43,770            | 1,920             | 4.4%          |
|                                                         | <b>Total of Top 5</b>                         | <b>210,130</b>    | <b>15,510</b>     |               |
| <b>Charlotte Regional - 36,900 Estimated Green Jobs</b> |                                               |                   |                   |               |
| 31                                                      | Manufacturing                                 | 116,840           | 5,570             | 4.8%          |
| 23                                                      | Construction                                  | 53,590            | 5,010             | 9.3%          |
| 56                                                      | Admin. & Support & Waste Management           | 73,740            | 4,640             | 6.3%          |
| 44                                                      | Retail Trade                                  | 103,590           | 4,100             | 4.0%          |
| 54                                                      | Professional, Scientific & Technical Services | 52,360            | 3,360             | 6.4%          |
|                                                         | <b>Total of Top 5</b>                         | <b>400,120</b>    | <b>22,680</b>     |               |
| <b>Eastern - 16,090 Estimated Green Jobs</b>            |                                               |                   |                   |               |
| 23                                                      | Construction                                  | 20,110            | 3,320             | 16.5%         |
| 92                                                      | Public Administration                         | 31,880            | 2,930             | 9.2%          |
| 31                                                      | Manufacturing                                 | 47,100            | 2,440             | 5.2%          |
| 56                                                      | Admin. & Support & Waste Management           | 20,940            | 1,170             | 5.6%          |
| 42                                                      | Wholesale Trade                               | 13,750            | 1,130             | 8.2%          |
|                                                         | <b>Total of Top 5</b>                         | <b>133,780</b>    | <b>10,990</b>     |               |
| <b>Northeast Piedmont- 6,880 Estimated Green Jobs</b>   |                                               |                   |                   |               |
| 92                                                      | Public Administration                         | 12,510            | 1,560             | 12.5%         |
| 44                                                      | Retail Trade                                  | 15,460            | 940               | 6.1%          |
| 31                                                      | Manufacturing                                 | 11,880            | 890               | 7.5%          |
| 72                                                      | Accommodation & Food Services                 | 14,900            | 830               | 5.6%          |
| 23                                                      | Construction                                  | 6,890             | 600               | 8.7%          |
|                                                         | <b>Total of Top 5</b>                         | <b>61,640</b>     | <b>4,820</b>      |               |
| <b>Southeast - 14,600 Estimated Green Jobs</b>          |                                               |                   |                   |               |
| 31                                                      | Manufacturing                                 | 40,180            | 2,770             | 6.9%          |
| 23                                                      | Construction                                  | 17,620            | 2,590             | 14.7%         |
| 92                                                      | Public Administration                         | 30,460            | 1,960             | 6.4%          |
| 44                                                      | Retail Trade                                  | 41,660            | 1,470             | 3.5%          |
| 62                                                      | Health Care & Social Assistance               | 63,150            | 1,350             | 2.1%          |
|                                                         | <b>Total of Top 5</b>                         | <b>193,070</b>    | <b>10,140</b>     |               |
| <b>Piedmont Triad - 34,370 Estimated Green Jobs</b>     |                                               |                   |                   |               |
| 31                                                      | Manufacturing                                 | 105,240           | 5,730             | 5.4%          |
| 23                                                      | Construction                                  | 30,450            | 4,770             | 15.7%         |
| 48                                                      | Transportation & Warehousing                  | 30,790            | 3,550             | 11.5%         |
| 56                                                      | Admin. & Support & Waste Management           | 51,730            | 3,340             | 6.5%          |
| 62                                                      | Health Care & Social Assistance               | 95,550            | 3,330             | 3.5%          |
|                                                         | <b>Total of Top 5</b>                         | <b>313,760</b>    | <b>20,720</b>     |               |
| <b>Research Triangle - 40,240 Estimated Green Jobs</b>  |                                               |                   |                   |               |
| 61                                                      | Educational Services                          | 59,350            | 6,070             | 10.2%         |
| 23                                                      | Construction                                  | 44,010            | 5,260             | 12.0%         |
| 31                                                      | Manufacturing                                 | 86,480            | 5,190             | 6.0%          |
| 56                                                      | Admin. & Support & Waste Management           | 56,140            | 3,930             | 7.0%          |
| 54                                                      | Professional, Scientific & Technical Services | 62,270            | 3,700             | 5.9%          |
|                                                         | <b>Total of Top 5</b>                         | <b>308,250</b>    | <b>24,150</b>     |               |

## Survey Results by Occupation

Each of the green jobs reported by employers was assigned to an occupation from the Standard Occupational Classification (SOC) System. The O\*NET-SOC AutoCoder, an automated occupational coding system, was used to code as many of the survey responses as possible. The remaining green jobs were coded by hand. By breaking the data into industry classifications assigned to the employers as shown above, analysts could see how jobs were distributed across industry categories. By breaking the data into occupational classifications, analysts got a more robust picture of how employer-identified green jobs fall into the standard occupational taxonomy.

Statewide, more than 200 unique SOC occupations exist in the green economy, according to the way the survey-reported green task category activities were assigned to SOC codes. Table 5 ranks the top 10 occupations by number reported.

**Table 5 Top Green Jobs by Occupation**

| Top 10 Green Occupations — Statewide |                                                                  |                  |                       |                         |                          |
|--------------------------------------|------------------------------------------------------------------|------------------|-----------------------|-------------------------|--------------------------|
| SOC O*NET                            | Occupational Title                                               | Total Green Jobs | % of Total Green Jobs | Minimum Education       | Estimated Entry Wage     |
| 37-2011.00                           | Janitors & Cleaners, Except Maids & Housekeeping Cleaners        | 7,550            | 4.4%                  | HS Diploma/GED          | Under \$20,800           |
| 41-2031.00                           | Retail Salespersons                                              | 6,180            | 3.6%                  | No Requirement          | Under \$20,800           |
| 47-4051.00                           | Highway Maintenance Workers                                      | 5,120            | 3.0%                  | HS Diploma/GED          | \$20,800-\$31,199        |
| 47-2061.00                           | Construction Laborers                                            | 4,430            | 2.6%                  | HS Diploma/GED          | \$31,200-\$41,599        |
| 49-9071.00                           | Maintenance & Repair Workers, General                            | 4,230            | 2.5%                  | HS Diploma/GED          | \$20,800-\$31,199        |
| 11-1021.00                           | General & Operations Managers                                    | 4,190            | 2.4%                  | Some College, No Degree | Not Specified            |
| 51-9199.00                           | Production Workers, All Other                                    | 3,930            | 2.3%                  | HS Diploma/GED          | \$20,800-\$31,199        |
| 49-9021.01                           | Heating & Air Conditioning Mechanics & Installers                | 3,560            | 2.1%                  | No Requirement          | \$31,200-\$41,599        |
| 35-3021.00                           | Combined Food Preparation & Serving Workers, Including Fast Food | 3,400            | 2.0%                  | No Requirement          | Under \$20,800           |
| 49-3023.00                           | Automotive Service Technicians & Mechanics                       | 3,250            | 1.9%                  | HS Diploma/GED          | Not Specified            |
|                                      | <b>All Occupations</b>                                           | <b>171,950</b>   | <b>26.7%</b>          | <b>HS Diploma/GED</b>   | <b>\$20,800-\$31,199</b> |

Janitors and cleaners are the largest occupational group, representing 4.4 percent of all green jobs. This result likely arises because many firms indicated that recycling, waste reduction and reuse activities carried out by employees at business sites were not only “greening” their locations, but fundamental to their activities as a firm. Although janitors and cleaners are perhaps not among the first occupation one thinks about when describing green occupations, the frequency with which these activities were reported by firms was an indicator of the value firms place on these tasks and indicates how firms see themselves contributing to the green economy.

Employers at retail establishments reported the second-highest number of green jobs. Because this was a somewhat unusual finding, LMI analysts contacted some retailers after the initial survey to try to better understand why these employers believed their organizations were contributing green jobs. One of the main reasons cited was corporate identity: retailers want their brand image associated with sustainability and social responsibility.<sup>3</sup>

<sup>3</sup> One or more large-scale retailers, determined to be outliers, were removed from the analysis.

Among the remaining occupation groups, six of the top 10 occupations are in some category of construction trade including Highway Maintenance Workers; Construction Laborers; General and Operations Managers; Production Workers; Heating and Air Conditioning Mechanics and Installers; and Automotive Technicians. Combined, they account for 14.3 percent of the green workforce for a total of 24,480 jobs. Table 6 categorizes the top 10 occupations by green task category.

**Table 6 Top Green Jobs by Green Task Category**

| Distribution of Top 10 Green Occupations by Green Area           |                  |                       |                                    |                            |
|------------------------------------------------------------------|------------------|-----------------------|------------------------------------|----------------------------|
| Occupational Title                                               | Total Green Jobs | % of Total Green Jobs | Green Area                         | % Employment in Green Area |
| Janitors & Cleaners, Except Maids & Housekeeping Cleaners        | 7,550            | 4.4%                  | Pollution, Prevention and Cleanup  | 94.4%                      |
| Retail Salespersons                                              | 6,180            | 3.6%                  | Pollution, Prevention and Cleanup  | 84.9%                      |
| Highway Maintenance Workers                                      | 5,120            | 3.0%                  | Pollution, Prevention and Cleanup  | 100%                       |
| Construction Laborers                                            | 4,430            | 2.6%                  | Energy and Efficiency Assessment   | 57.6%                      |
| Maintenance & Repair Workers, General                            | 4,230            | 2.5%                  | Pollution, Prevention and Cleanup  | 51.7%                      |
| General & Operations Managers                                    | 4,190            | 2.4%                  | Pollution, Prevention and Cleanup  | 50.3%                      |
| Production Workers, All Other                                    | 3,930            | 2.3%                  | Manufacturing Sustainable Products | 56.6%                      |
| Heating & Air Conditioning Mechanics & Installers                | 3,560            | 2.1%                  | Energy and Efficiency Assessment   | 68.0%                      |
| Combined Food Preparation & Serving Workers, Including Fast Food | 3,400            | 2.0%                  | Pollution, Prevention and Cleanup  | 90.1%                      |
| Automotive Service Technicians & Mechanics                       | 3,250            | 1.9%                  | Pollution, Prevention and Cleanup  | 87.8%                      |
| <b>All Occupations</b>                                           | <b>171,950</b>   | <b>26.7%</b>          |                                    |                            |

## Occupation by Green Area

Retail Sales Workers, Construction Laborers, Postsecondary Teachers and Supervisors of Construction trades are among the top five occupations in more than one green task area. General and Operations Managers are listed in three areas: education and consulting, renewable power and energy-efficient transportation.

In the survey, employers classified many occupations as green that are more often viewed as traditional jobs. Why do employers see janitors and cleaners, for example, as green task workers in pollution prevention and cleanup? Because many of these employees now use cleaning products that are better for the environment or require employees to separate recyclable materials from the trash. Increasingly, employers reported, retail stores require all employees to break down cardboard and collect plastic bags for recycling. At many food establishments, workers collect cooking oil for processing and recycling. Table 8 provides examples of green tasks that employers reported for certain occupations.

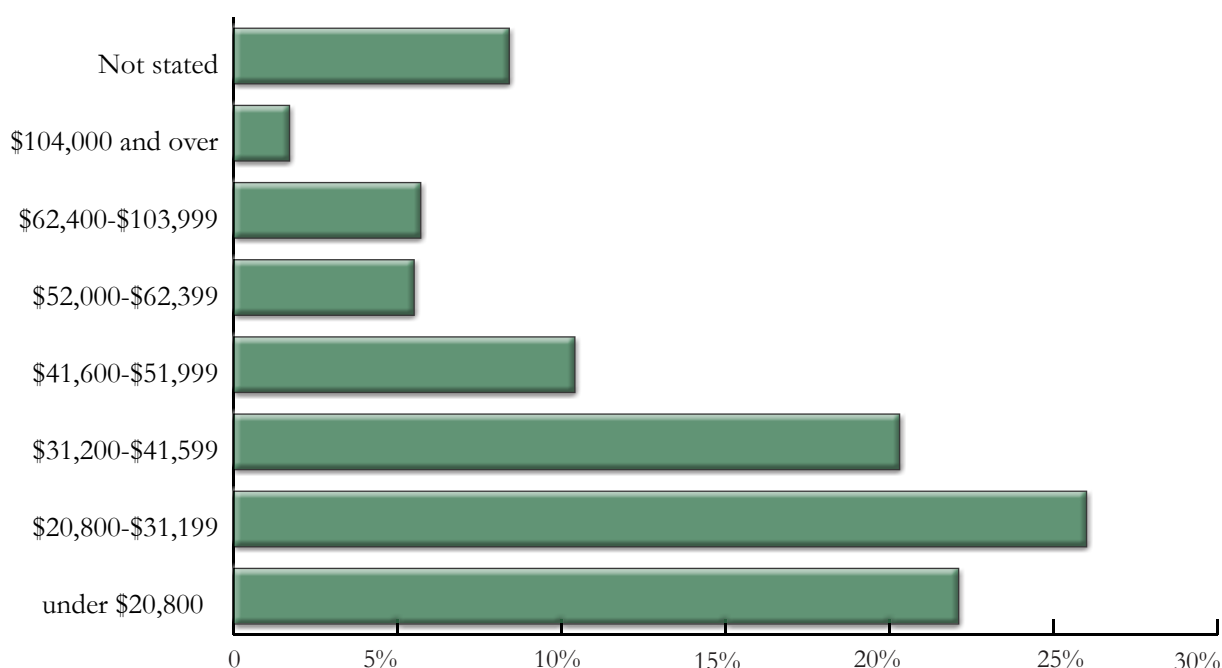
**Table 8 Tasks Employers Reported for Green Occupations**

| Selected Activities of Top Green Jobs |                                                                                          |
|---------------------------------------|------------------------------------------------------------------------------------------|
| SOC O*NET                             | Occupation                                                                               |
| 37-2011.00                            | <b>Janitors &amp; Cleaners, Except Maids &amp; Housekeeping Cleaners</b>                 |
|                                       | Responsible for cleaning of warehouse, compressing bales and recycling products          |
|                                       | Hauling X-ray film to recycling facility                                                 |
| 41-2031.00                            | <b>Retail Salespersons</b>                                                               |
|                                       | A team that is responsible for recycling plastic bags, emptying recycling bins           |
|                                       | Provides information and training of green products to customers.                        |
| 47-4051.00                            | <b>Highway Maintenance Workers</b>                                                       |
|                                       | Maintain highways, municipal and rural roads, airport runways and rights-of-way.         |
|                                       | Mow or clear brush from along road or plow snow from roadway.                            |
| 47-2061.00                            | <b>Construction Laborers</b>                                                             |
|                                       | Insulate windows, weatherstrip homes, install silt fencing                               |
|                                       | Recycle broken concrete and asphalt                                                      |
| 49-9071.00                            | <b>Maintenance &amp; Repair Workers, General</b>                                         |
|                                       | Retrofitted greenhouse with energy-efficient condensing boiler                           |
|                                       | Changed out bulbs to fluorescent for energy saving                                       |
| 11-1021.00                            | <b>General &amp; Operations Managers</b>                                                 |
|                                       | Implements energy-efficient programs                                                     |
|                                       | Meets with potential customers to discuss their recycling needs                          |
| 51-9199.00                            | <b>Production Workers, All Other</b>                                                     |
|                                       | Carpets made from bottle plastics, etc                                                   |
|                                       | Waste oil disposal                                                                       |
| 49-9021.01                            | <b>Heating &amp; Air Conditioning Mechanics &amp; Installers</b>                         |
|                                       | Work on LEED and Energy Star certified buildings and homes                               |
|                                       | Use green refrigerants                                                                   |
| 35-2021.00                            | <b>Combined Food Preparation &amp; Serving Workers, Including Fast Food</b>              |
|                                       | Separate glass bottles, coffee, tea, egg shells for recycling and composting for garden. |
|                                       | Recycle cooking oil                                                                      |
| 49-3023.00                            | <b>Automotive Service Technicians &amp; Mechanics</b>                                    |
|                                       | Remove oil from cars and reheat the building                                             |
|                                       | Prepare hybrid cars for sale                                                             |

## Occupation and Wages

Like traditional jobs, average wages in the green economy depend on occupation. Nearly 47 percent of janitors, for example, are paid less than \$10.00 per hour. Another 39.0 percent earn between \$20,000 and \$24,000 per year, or between \$9.60 and \$11.50 per hour. (Although low, this reported salary is higher than the statewide entry-level wage of \$8.08 per hour reported by the 2011 Occupational Employment and Wages Statistics survey.) The distribution of wages for construction laborers is similar, with 32.8 percent earning less than \$10.00 per hour and 39.8 percent earning between \$15.00 and \$19.00 per hour. Reflecting the range in education and responsibilities, 16.4 percent of general and operations managers earn less than \$41,600 annually, 14.4 percent receive salaries between \$41,600 and \$52,000, and 13.6 percent are paid \$104,000 or more. Forty-two percent of employers did not disclose wage information for their general and operations managers. Figure 1 illustrates the distribution of reported annual wages.

**Figure 1 Distribution of Reported Annual Wages**



## Occupation and Education

The majority of green jobs, 68.2 percent, require no education beyond high school, according to the Occupational Information Network (O\*NET). The minimum education reported by employers varies across and within occupations. For example, 42.8 percent of employers reported they do not require a minimum level of completed education for HVAC workers at their firm locations. More than 11 percent of firms require an associate degree and another 8.5 percent require at least some college for this occupation.

The more technical green jobs, such as environmental scientists and energy engineers, require four or more years of college work. Occupational health and HVAC workers are among the top five occupations for those with an associate degree. Overall, the data suggest that work opportunities in the green economy exist for all levels of education.

## Occupations by Economic Development Region

The Advantage West economic development partnership has the largest proportion of employment in occupations with green tasks compared to total employment. The Research Triangle employs the largest number of people in green task-related occupations of all the regions in the state. Table 10 lists the top occupations within each partnership. Notably, skilled trades in Manufacturing, Construction & Maintenance are represented in all areas.

**Table 10 Top Occupations by Economic Development Region**

| Top 5 Green Occupations by EDR                    |                                                                               |                   |                        |
|---------------------------------------------------|-------------------------------------------------------------------------------|-------------------|------------------------|
| SOC O*NET                                         | Occupational Title                                                            | Green Jobs In EDR | % of Green Jobs in EDR |
| <b>Advantage West - 22,870 Estimated Jobs</b>     |                                                                               |                   |                        |
| 47-2031.01                                        | Construction Carpenters                                                       | 840               | 3.7%                   |
| 39-9032.00                                        | Recreation Workers                                                            | 780               | 3.4%                   |
| 47-4051.00                                        | Highway Maintenance Workers                                                   | 740               | 3.2%                   |
| 49-9071.00                                        | Maintenance & Repair Workers, General                                         | 650               | 2.8%                   |
| 51-9199.00                                        | Production Workers, All Other                                                 | 650               | 2.8%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>3,660</b>      | <b>16.0%</b>           |
| <b>Charlotte Regional - 36,900 Estimated Jobs</b> |                                                                               |                   |                        |
| 47-2061.00                                        | Construction Laborers                                                         | 2,350             | 6.4%                   |
| 41-2031.00                                        | Retail Salespersons                                                           | 2,130             | 5.8%                   |
| 35-3021.00                                        | Combined Food Preparation & Serving Workers, Including Fast Food              | 1,280             | 3.5%                   |
| 47-4051.00                                        | Highway Maintenance Workers                                                   | 910               | 2.5%                   |
| 51-9199                                           | Production Workers, All Other                                                 | 890               | 2.4%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>7,560</b>      | <b>20.5%</b>           |
| <b>Eastern - 16,090 Estimated Jobs</b>            |                                                                               |                   |                        |
| 47-2111.00                                        | Electricians                                                                  | 920               | 5.7%                   |
| 53-7062.00                                        | Laborers & Freight, Stock & Material Movers, Hand                             | 890               | 5.5%                   |
| 47-4051.00                                        | Highway Maintenance Workers                                                   | 850               | 5.3%                   |
| 53-3032.00                                        | Truck Drivers, Heavy & Tractor-Trailer                                        | 710               | 4.4%                   |
| 11-1021.00                                        | General & Operations Managers                                                 | 710               | 4.4%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>4,080</b>      | <b>25.4%</b>           |
| <b>Northeast - 6,880 Estimated Jobs</b>           |                                                                               |                   |                        |
| 49-9071.00                                        | Maintenance & Repair Workers, General                                         | 570               | 8.3%                   |
| 47-4051.00                                        | Highway Maintenance Workers                                                   | 410               | 6.0%                   |
| 41-2031.00                                        | Retail Salespersons                                                           | 330               | 4.8%                   |
| 35-3031.00                                        | Waiters & Waitresses                                                          | 280               | 4.1%                   |
| 51-9199.00                                        | Production Workers, All Other                                                 | 270               | 3.9%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>1,860</b>      | <b>27.1%</b>           |
| <b>Southeast - 14,600 Estimated Jobs</b>          |                                                                               |                   |                        |
| 49-9021.01                                        | Heating & Air Conditioning Mechanics & Installers                             | 690               | 4.7%                   |
| 35-3031.00                                        | Waiters & Waitresses                                                          | 660               | 4.5%                   |
| 47-2111.00                                        | Electricians                                                                  | 500               | 3.4%                   |
| 11-1021.00                                        | General & Operations Managers                                                 | 440               | 3.0%                   |
| 11-1021.00                                        | First-Line Supervisors/Managers of Construction Trades and Extraction Workers | 440               | 3.0%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>2,730</b>      | <b>18.7%</b>           |
| <b>Piedmont Triad - 34,370 Estimated Jobs</b>     |                                                                               |                   |                        |
| 37-2011.00                                        | Janitors & Cleaners, Except Maids & Housekeeping Cleaners                     | 2,220             | 6.5%                   |
| 49-3023.00                                        | Automotive Service Technicians & Mechanics                                    | 1,650             | 4.8%                   |
| 11-1021.00                                        | General & Operations Managers                                                 | 1,530             | 4.4%                   |
| 41-2031.00                                        | Retail Salespersons                                                           | 1,280             | 3.7%                   |
| 47-4051.00                                        | Highway Maintenance Workers                                                   | 1,240             | 3.6%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>7,925</b>      | <b>23.0%</b>           |
| <b>Research Triangle - 40,240 Estimated Jobs</b>  |                                                                               |                   |                        |
| 51-9141.00                                        | Semiconductor Processors                                                      | 2,470             | 6.1%                   |
| 41-2031.00                                        | Retail Salespersons                                                           | 1,600             | 4.0%                   |
| 35-3021.00                                        | Combined Food Preparation & Serving Workers, Including Fast Food              | 1,440             | 3.6%                   |
| 37-3011.00                                        | Landscaping & Groundskeeping Workers                                          | 1,410             | 3.5%                   |
| 49-9071.11                                        | Maintenance and Repair Workers, General                                       | 1,170             | 2.9%                   |
|                                                   | <b>Total of Top 5</b>                                                         | <b>8,090</b>      | <b>20.1%</b>           |

## Section 2: Help Wanted Online Green Job Demand Analysis

To supplement the findings of the Green Jobs Survey, analysts reviewed approximately 327,000 online job postings from The Conference Board's Help Wanted OnLine® (HWOL) data series to try to forecast green job demand. This portion of the study asked three questions:

1. Can HWOL show real-time demand for green jobs for the county, metro or workforce investment area?
2. Using HWOL, can analysts track changes in green occupation characteristics over time?
3. How can the results of the HWOL research supplement the findings of the green jobs survey?

Analysts concluded that HWOL can be used as a tool to monitor green job demand over time. However, HWOL data did not mirror the North Carolina green job classification scheme, and it was not possible to accurately recode the online postings from HWOL's "green terms and phrases" to match North Carolina's green task categories. Therefore, HWOL data cannot be used as a proxy to update the North Carolina survey, but it may be useful in monitoring green job demand over time.

In addition, the research shows an important disparity between employer-reported educational requirements and the educational requirement of the HWOL green job postings. Further investigation is needed to determine if the HWOL data can be used to update this occupational characteristic.

### North Carolina HWOL Results

First published in 2005, HWOL collects data on a daily basis from more than 1,200 online job board sources. HWOL tracks green jobs by coding postings at the six-digit Standard Occupational Classification (SOC) level and eight-digit O\*NET level using the O\*NET-SOC AutoCoder™. The postings are further classified using the proprietary Green Job Extractor™ (GJE) taxonomy:

**Dark Green** – Jobs that are purely green in focus, activities and skills

**Medium Green** – Jobs that are primarily green in focus, activities and skills

**Light Green** – Jobs that are somewhat green in focus, activities and skills

**Near Green** – Typically nongreen jobs working in support of the green economy

**Neutral** – Jobs with no significant positive or negative impact on the green economy

**Anti-Green** – Jobs that can be in conflict with the goals of the green economy

Using the GJE approach, analysts collected approximately 327,000 job postings from HWOL between January and April 2011. (The employer survey was conducted from February to April 2011, and requested employment within the past six months, so both datasets reflect the economic conditions in the first quarter of 2011.) Less than 0.01 percent of the postings were classified by HWOL as Dark Green. About 1.9 percent of postings were classified by HWOL as Anti-Green. Neutral jobs represented 91.4 percent of the total. Taking this information, LMI analysts grouped the HWOL-classified jobs as 6.7 percent green and 93.3 percent neutral or nongreen.

The HWOL results were similar to the survey results — in that the survey showed an estimated four to five percent employment in the green economy statewide — but there are important caveats, especially with respect to occupation and demand. For example, nine of the top 10 occupations identified by the survey results, are not also represented in the HWOL top 10 occupations.

**Table 11 Top 10 Occupations Ranked by the Number of Postings Classified as Green**

| Top 10 Occupations Ranked by the Number of Postings Classified as Green               |                    |                       |                    |                       |                    |                     |
|---------------------------------------------------------------------------------------|--------------------|-----------------------|--------------------|-----------------------|--------------------|---------------------|
| Occupation Title                                                                      | % Occupation Green | Rank HWOL Green Posts | % HWOL Green Posts | Rank Survey Green Emp | % Survey Green Emp | Typical Education   |
| Landscaping & Groundskeeping Workers                                                  | 63.4%              | 1                     | 3.7%               | 11                    | 1.8%               | Some High School    |
| Heating & Air Conditioning Mechanics & Installers                                     | 66.8%              | 2                     | 3.1%               | 8                     | 2.1%               | High School/College |
| Electrical Engineers                                                                  | 47.7%              | 3                     | 2.7%               | 226                   | 0.1%               | Bachelor's          |
| Mechanical Engineers                                                                  | 26.6%              | 4                     | 1.7%               | 109                   | 0.2%               | Bachelor's          |
| First-Line Supervisors/Managers of Construction Trades & Extraction Workers           | 21.8%              | 5                     | 1.4%               | 14                    | 1.6%               | High School/College |
| Truck Drivers, Heavy & Tractor-Trailer                                                | 3.1%               | 6                     | 1.2%               | 21                    | 1.4%               | High School/College |
| Civil Engineers                                                                       | 51.9%              | 7                     | 1.1%               | 25                    | 1.0%               | Bachelor's          |
| Engineering Managers                                                                  | 26.0%              | 8                     | 0.9%               | 108                   | 0.2%               | Bachelor's          |
| First-Line Supervisors/Managers of Landscaping, Lawn Service & Groundskeeping Workers | 69.6%              | 9                     | 0.9%               | 38                    | 0.7%               | High School/College |
| First-Line Supervisors/Managers of Mechanics, Installers & Repairers                  | 11.9%              | 10                    | 0.9%               | 34                    | 0.7%               | High School/College |

Figure 2 Differences by Occupational Groups Between HWOL and the NC Green Jobs Survey

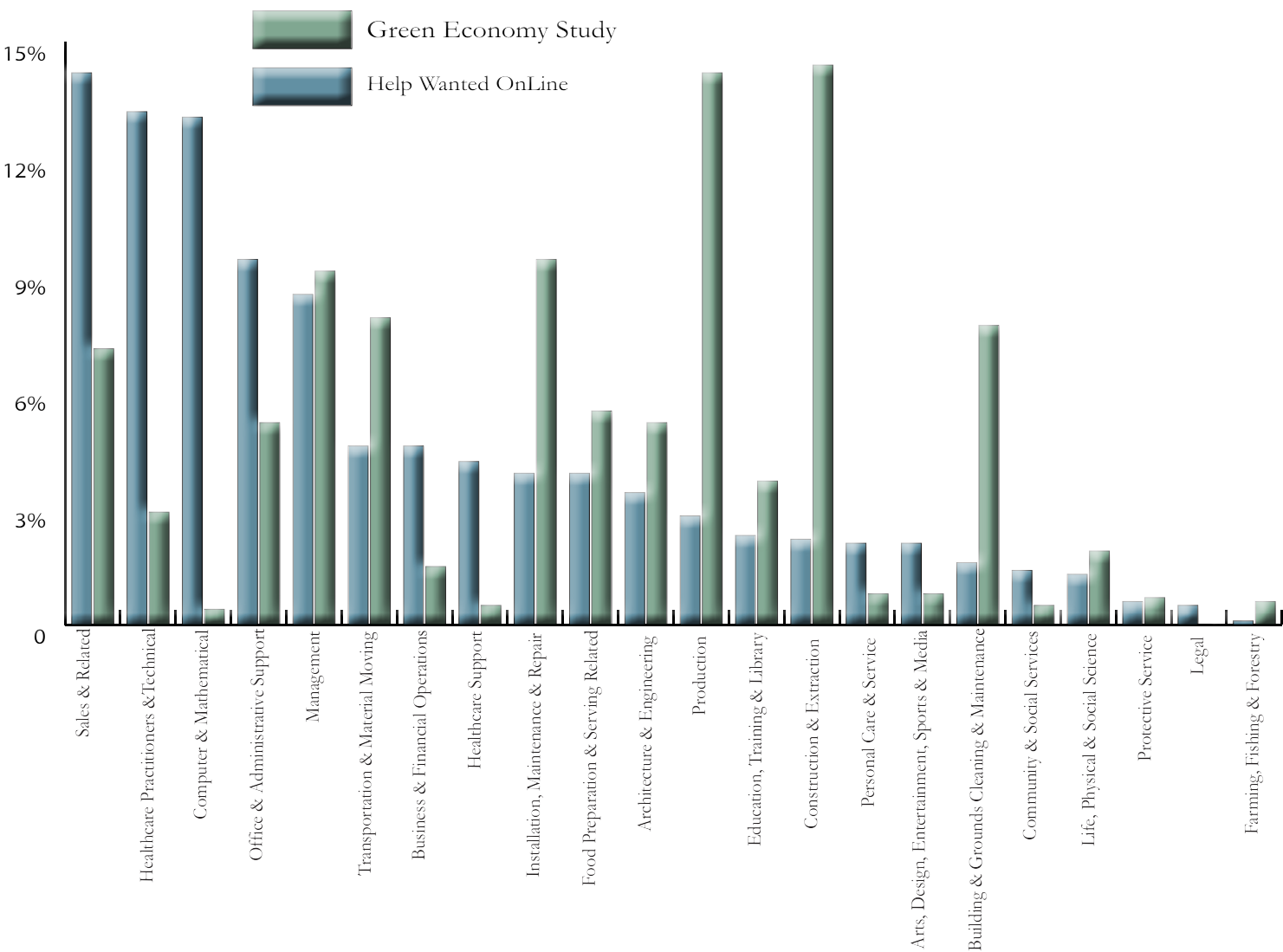


Figure 2 compares all HWOL job listing occupational groups to the survey occupational groups. There are clear differences: the green economy survey of employers identified a large number of green jobs in the construction occupation group, but HWOL data from the same period shows just a few. The most obvious reason for this discrepancy is that HWOL and the survey defined green jobs differently and employers self-selected green job activity for work that the HWOL Green Job Extractor does not reflect.

**Figure 3 Educational Requirements**

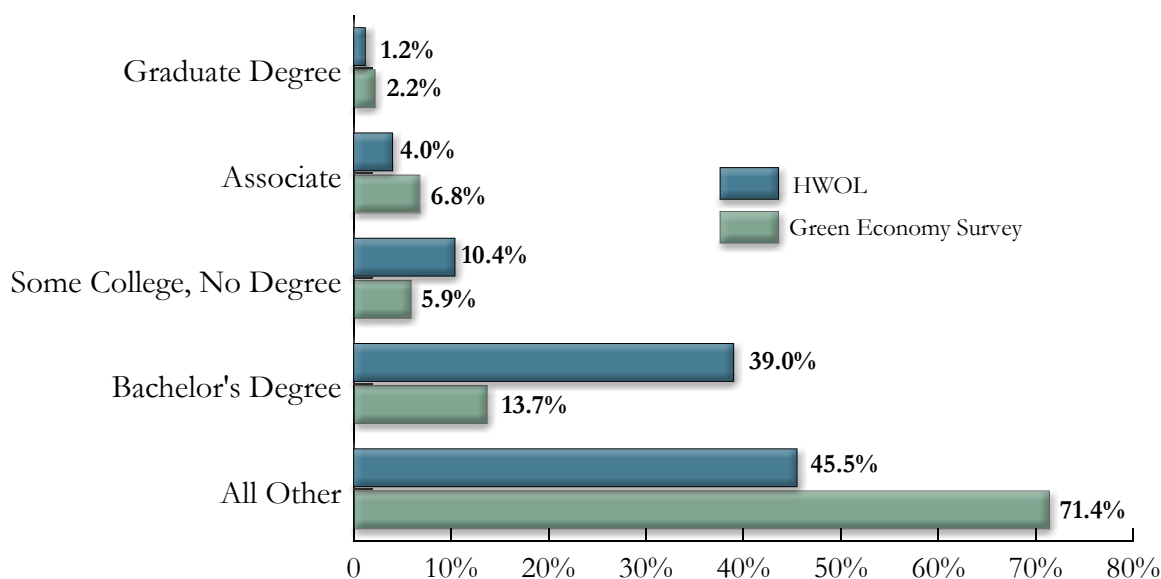


Figure 3, Educational Requirements, shows little overlap between employer-reported educational requirements in the survey and education requirements for job postings coded by the HWOL software. Further research is necessary to determine if this data is illustrative of employer expectations for educational requirements in green occupations.

There are other differences between HWOL and the survey's findings. In the survey, employers were asked: When hiring for this job, would you use the word "green" in the description? Less than 27 percent responded that they would. Given that the Green Job Extractor and other tools look for such phrases as a component, it is likely that green jobs — at least those defined by North Carolina employers — would be under-reported in online databases. Data continuity problems such as blind postings from employers, postings of similar jobs by recruiters to collect résumés, and duplicative postings also may contribute to challenges in using online postings for an analytical purpose like this one.

## Appendix 1: Study Methodology

The Green Jobs Survey and HWOL research were designed to provide a baseline of the magnitude of green employment across North Carolina. The definition of a green job provided to employers was based on the Workforce Information Council's Green Jobs Study Group Final Report, green industries information available from the BLS, and definitions used in similar studies from California, Michigan, Oregon and Washington. A secondary goal of the analysis was to determine if and how online job postings could be used to update information collected or estimated on green employment.

Data for the project was collected through three initiatives:

1. A statewide survey of nearly 25,000 firms.
2. A review of more than 300,000 online job postings using The Conference Board Help Wanted OnLine® (HWOL) database.
3. A focus group of stakeholders representing educators, policymakers, private-sector employers, workforce developers and environmental advocates.

Additionally, data on all program enrollments and completions tracked by the NC Common Follow-Up System during calendar year 2010 and an inventory of education and training programs relevant to training the green workforce was collected and will be available on the Division of Employment Security website.

## Green Economy Survey

The survey was mailed to a final sample of 24,522 employer establishments in February 2011. Recipients were randomly selected from all establishments that employ workers covered by North Carolina unemployment insurance law. The sample does not include the self-employed, members of the armed forces, unpaid family workers, domestic workers, railroad workers, certain agricultural workers, and some nonprofit employers. The employer universe from which the sample was selected included establishments recorded for the third quarter of 2009. The sample was stratified by the two-digit North American Industry Classification System code, employment size class (1-4, 5-9, 10-19, 20-49, 50-99, 100-249, 250+), and North Carolina's seven economic development regions (AdvantageWest, Charlotte, Piedmont Triad, Research Triangle, Northeast, Eastern and Southeast Partnerships).

The BLS Job Vacancy Survey Sample Allocation and Selection System (JVSSASS) was used to select the sample and create the strata weights necessary to compute the employment estimates for North Carolina's economy. The software applies the Neyman Allocation Method to select an optimal strata population. The sample dataset contained 24,993 records distributed in 1,277 strata. The returned dataset contained 24,522 records. The survey strata weights were adjusted for nonrespondents prior to computation of the employment estimates.

The survey asked employers specific questions concerning job titles, number employed, education requirements, average starting salary, demographics and anticipated job growth in one of the six green task areas. The surveys were collected by mail, fax, telephone and online. The North Carolina State Center for Urban Affairs and Community Service (CUACS) was contracted to coordinate the data collection and data entry and to provide telephone follow-up to nonrespondents. Data was collected from February through April 2011. There was a 72 percent response rate (including refusals) and a 67.3 response rate overall (excluding refusals).

### Survey Instrument

The survey instrument is based on the design used in the Oregon Green Jobs Survey. Further refinements were made with input from technical partners. Survey categories were identified based on a report from the Workforce Information Council and the survey design was very similar to green economy projects from other states. LMI professionals from Oregon, Washington, and California contributed to the final design of the instrument. The CUACS staff designed and tested the online version of the survey. Kent Miller, study director and mail survey manager of the Social and Economic Sciences Research Center at Washington State University, provided additional technical review.



## North Carolina Green Jobs Survey

COMPANY ID:  
PASSWORD:

### North Carolina Green Jobs Survey Guide

Save time and resources by responding online at <https://survey.ncsu.edu/greenjobs10>. To access your organization's online survey form, enter the company ID and password found above. If you have questions concerning the survey, visit [www.ncesc1.com/ncgreensurvey](http://www.ncesc1.com/ncgreensurvey) or contact Chiquita Douglas at (800) 862-0638 or email [ncgreensurvey@ncesc.gov](mailto:ncgreensurvey@ncesc.gov).

If you are unable to complete the survey online, please answer the questions below and return by **February 21**.

**NOTE:** All responses will be confidential. No information will be released that might identify a specific firm or its wage scale. The survey has an identifier that is used for tracking purposes only.

#### 1. Organization Overview

|                                                                                              |                          |
|----------------------------------------------------------------------------------------------|--------------------------|
| Your Organization's Name: _____                                                              |                          |
| City: _____                                                                                  | County: _____ ZIP: _____ |
| Contact name: _____                                                                          |                          |
| Telephone: _____                                                                             | Email: _____             |
| What is the average total number of employees in this location in the past six months: _____ |                          |

2. In the past six months, did any employee in your organization do work that was essential to the products or services in any of the six areas below? (SEE PAGE 2, COLUMN A FOR FURTHER EXAMPLES)

|                                                                                                                                        | Yes                      | No                       |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| 1) Energy-efficient building (including new construction and retrofitting) and energy efficiency assessment                            | <input type="checkbox"/> | <input type="checkbox"/> |
| 2) Biofuels and energy-efficient transportation                                                                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| 3) Pollution prevention (including waste management and recycling) and environmental cleanup                                           | <input type="checkbox"/> | <input type="checkbox"/> |
| 4) Renewable energy power industry (including manufacturing of equipment used to produce power from renewable sources)                 | <input type="checkbox"/> | <input type="checkbox"/> |
| 5) Manufacturing that produces sustainable products (e.g., products from previously recycled materials, CFLs or LEDs, bamboo products) | <input type="checkbox"/> | <input type="checkbox"/> |
| 6) Providing education, consulting, policy promotion, accreditation, or similar services supporting any of the above categories        | <input type="checkbox"/> | <input type="checkbox"/> |

If you answered No to **ALL** parts of Question 2, your survey is complete. Please return this paper survey in the postage-paid envelope or fax a copy of this page to (800) 443-3620.

If you answered Yes to **ANY** part of Question 2, please continue and complete Questions 3 through 15. Then please return this paper survey in the postage-paid envelope or fax a copy of pages 1, 3, and 4 to (800) 443-3620.

3. Thinking of your average total number of employees in the past six months, how many of these did work that was essential to products or services in any of the six green areas above? \_\_\_\_\_
4. Thinking of your average total number of employees in the past six months, how many of these held jobs that supported your organization's activities in any of the six green areas listed above (e.g., secretary, dispatcher), without directly producing green products or services? \_\_\_\_\_

## A. Green Areas

These are examples of activities within the six green areas of interest:

- 1. Energy-efficient building (including new construction and retrofiting) and energy efficiency assessment**  
*Examples include:* LEED certified design and construction, energy efficiency engineering, weatherization, installing insulation, energy-efficient doors and windows; installing or retrofitting with ENERGY STAR appliances and lighting
- 2. Biofuels and energy-efficient transportation**  
*Examples include:* research, development, production of biofuel; research, development, manufacture, repair of alternative fuel vehicles; planning, construction, administration, maintenance of mass transit systems
- 3. Pollution prevention (including waste management and recycling) and environmental cleanup**  
*Examples include:* collecting and processing recycling materials; preventing or reducing threats to water, soil, or air quality; controlling industrial, commercial, transportation emissions; hazardous waste clean-up; wetlands restoration
- 4. Renewable energy power industry (including manufacturing of equipment used to produce power from renewable sources)**  
*Examples include:* generating and storing renewable energy; research, development, manufacturing, installation, repair of solar panels, wind turbines, hydro-electric generators, landfill gas microturbines; geothermal drilling, wave energy research
- 5. Manufacturing that produces sustainable products**  
*Examples include:* research, development, and manufacturing of ENERGY STAR products or products with other significant green performance attributes; manufacture of products from sustainable materials, e.g., bamboo and cork flooring, kenaf paper; manufacture of products from previously recycled materials such as aluminum, plastic, glass, tires
- 6. Providing education, consulting, policy promotion, accreditation, or similar services supporting any of the above categories**  
*Examples include:* providing training curricula such as solar panel installation, energy auditing and residential consultation, maintenance of alternative fuel vehicles; providing consulting services for environmental impact/remediation, governmental compliance; providing education and awareness to the public regarding recycling and conservation programs, ENERGY STAR, and LEED

## B. Examples of Green Jobs

And these are just a few examples of green jobs, not an exhaustive list...

- Air Quality Engineers; Air Pollution Specialists; Air Resources Engineers:** Design, plan, or perform engineering duties in the prevention, control, and remediation of environmental health hazards.
- Building Performance or Retro-Fitting Specialists:** Provide green building consulting services including analysis of the potential environmental impact of materials choices; develop energy efficiency analysis proposals including budgets and work scopes.
- Civil Engineers:** Plan, produce and/or design green land development projects (project management, surveying, water/wastewater, and grading).
- Construction Managers:** Manage green construction site/activity including planning, scheduling, constructing, monitoring, forecasting, resource allocation and cost control.
- Heating and Air Conditioning Technicians and Installers (involved in green activities):** Install, service, and repair energy efficient geothermal or solar heating and air conditioning systems in residences and commercial establishments.
- Insulation Workers, Floor, Ceiling, and Wall (Weatherization Workers):** Line and cover structures with insulating materials. May work with batt, roll, or blown insulation materials.
- Landscaping and Gardening Workers:** Remove invasive species and restore native plants in wetlands and buffers
- Plumbers, Pipefitters, and Steamfitters:** Assemble, install, alter, and repair tankless hot water heaters and/or solar thermal units, as well as pipelines or pipe systems that carry water, steam, air, other liquids or gases for renewable energy.
- Remediation Technology Engineers:** Design, construct, operate, and write reports on environmental remediation systems such as groundwater treatment, bioremediation, and pesticide/herbicide impacted soils and groundwater.
- Solar Photovoltaic Panel Installers and Technicians:** Install rooftop solar panels and electric systems. Perform wiring, mounting, carpentry and handyman tasks, troubleshooting, and customer interaction.

For more examples of job titles and descriptions, visit [www.ncescl.com/ncgreensurvey](http://www.ncescl.com/ncgreensurvey)

Save time and resources by responding online at <https://survey.ncsu.edu/greenjobs10>  
PLEASE RESPOND BY February 21, 2011

[illegible]

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

All responses will be confidential. No information will be released that might

**Identify a specific firm or its wage scale.**

COMPANY ID:  
PASSWORD:

THANK YOU FOR PARTICIPATING!

Save time and resources by responding online at <https://survey.ncsu.edu/greenjobs10>

13. Are you aware of any existing programs that prepare people for green jobs? (Please check Yes or No for each and/or list others)

|                                                                                                                                    | Yes                      | No                       |
|------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|
| a) Asheville-Buncombe Technical CC's Global Institute for Sustainability Technologies .....                                        | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Caldwell Community College's Institute of Sustainable Technology .....                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Cape Fear Community College's Sustainability Technologies Curriculum .....                                                      | <input type="checkbox"/> | <input type="checkbox"/> |
| d) Central Carolina Community College's Biofuels Program .....                                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| e) Central Piedmont Community College's Sustainability Technologies Curriculum .....                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| f) Durham Technical Community College's Sustainability Technologies Curriculum .....                                               | <input type="checkbox"/> | <input type="checkbox"/> |
| g) Environmental Science Technology Program offered at several NC community colleges .....                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| h) Forsyth Technical Community College's Sustainability Technologies Curriculum .....                                              | <input type="checkbox"/> | <input type="checkbox"/> |
| i) Haywood Community College's Low Impact Development Program .....                                                                | <input type="checkbox"/> | <input type="checkbox"/> |
| j) Isothermal Community College's Sustainability Technologies Curriculum .....                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| k) Lenoir Community College's Sustainability Technologies Curriculum .....                                                         | <input type="checkbox"/> | <input type="checkbox"/> |
| l) Southeastern Community College's Natural Resources Management Program .....                                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| m) Surry Community College's Sustainability Technologies Curriculum .....                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| n) Wayne Community College's Sustainability Technologies Curriculum .....                                                          | <input type="checkbox"/> | <input type="checkbox"/> |
| o) NC Weatherization Training College Network (Wilson CC, Central Carolina, Caldwell, Haywood, Fayetteville, Rowan-Cabarrus) ..... | <input type="checkbox"/> | <input type="checkbox"/> |
| p) Other(s)-please specify: .....                                                                                                  |                          |                          |

14. Training in which of the following areas would be most helpful for existing and future employees in your organization? (Please check Yes or No for each and/or list others)

|                                                       | Yes                      | No                       |
|-------------------------------------------------------|--------------------------|--------------------------|
| a) Engineering and technology .....                   | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Mechanical (knowledge of machines and tools) ..... | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Building and construction .....                    | <input type="checkbox"/> | <input type="checkbox"/> |
| d) Computers and electronics .....                    | <input type="checkbox"/> | <input type="checkbox"/> |
| e) Plumbing .....                                     | <input type="checkbox"/> | <input type="checkbox"/> |
| f) Electrical .....                                   | <input type="checkbox"/> | <input type="checkbox"/> |
| g) Mathematics .....                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| h) Chemistry, biology, and other sciences .....       | <input type="checkbox"/> | <input type="checkbox"/> |
| i) Other(s)-please specify: .....                     |                          |                          |

15. What issues have you had finding qualified candidates for job vacancies? (Please check Yes or No for each and/or list others)

|                                                                  | Yes                      | No                       |
|------------------------------------------------------------------|--------------------------|--------------------------|
| a) Applicants do not have adequate on-the-job experience .....   | <input type="checkbox"/> | <input type="checkbox"/> |
| b) Applicants do not have required certifications/licenses ..... | <input type="checkbox"/> | <input type="checkbox"/> |
| c) Applicants do not have necessary education .....              | <input type="checkbox"/> | <input type="checkbox"/> |
| d) Not enough applicants to fill all vacancies .....             | <input type="checkbox"/> | <input type="checkbox"/> |
| e) We filled all vacancies without problems .....                | <input type="checkbox"/> | <input type="checkbox"/> |
| f) Other(s)-please specify: .....                                |                          |                          |

If more space is needed, please attach any additional pages to this page.

## Survey Data Collection

In preparation for the survey, postcards were sent to the sample group in September 2010. A web page announcing the survey and providing additional information was activated in October 2010. The primary data collection began in February 2011 with the activation of the online version of the survey and mail distribution of the survey package. Both the website and the package included instructions to aid responders.

A reminder postcard to nonrespondents was mailed in late February. The CUACS conducted telephone surveys from March through April 2011. By collection method, 53.8 percent of responses came from telephone calls, 23.7 percent from the online survey, and 22.4 percent by mail.

## Data Cleaning and Coding

The primary purpose of the study was to collect information on the current and future employment demand for green workers. Information on skill sets was included in the study to facilitate the placement of job seekers and to aid the North Carolina public workforce investment system in providing the right training to workers.

The standard reference point was the O\*NET™ 15.0 database (June 2010) for the Standard Occupation Codes (SOC). O\*NET-SOC AutoCoder™ v.9, developed by R.M. Wilson Consulting Inc., was used to standardize the occupation titles reported in the survey and in the HWOL data. The survey data was further refined using the O\*NET™ 16.0 database (July 2011), which had greater specification for green occupations. Some records were removed from reporting to protect the confidentiality of the respondents and to ensure data quality.

Since the first sample was developed using data from 2009, the survey responses for employment were also checked against the corresponding Enhanced Quarterly Unemployment Insurance file for the third quarter of 2010 and adjusted for differences.

## Employment Estimates by Occupation

The sample design provided a weight based on the total employment within each stratum. The weight was adjusted by the percentage of the expected total employment reported by respondents and by the percentage of the respondents. The adjusted weight was multiplied against the survey responses to estimate the level of green employment by occupation. The respondent sites are unique and do not necessarily have equal shares of the employment within the sample group.

After weighting, the green employment estimates were summed by occupation group and by region. Numbers may not add up due to rounding. Only estimates that met confidentiality and quality criteria were published.

## Employment Estimates by Industry

The green employment by industry estimates were computed from the sum of the occupational estimates by aggregating on the two-digit NAICS instead of the SOC for the occupation. Differences in the number of strata cells and industry groupings change the rounding such that the total green employment by industry may vary slightly from the total green employment by occupation.

## Appendix 2: Post-Survey Focus Group

Objectives of the focus group included sharing preliminary study findings, obtaining stakeholder input regarding green economy perceptions, refining the definition of green economy, and seeking input on the content and dissemination of the final report. The meeting was held on Nov. 14, 2011 at the Jane S. McKimmon Center located on the campus of North Carolina State University, Raleigh, NC. The session was moderated by Art Anthony of the Center for Urban Affairs and Community Service. Fifteen people participated, representing workforce development, education and training, emerging green technologies and energy consultant stakeholders.

**Table 12 Focus Group Attendee List**

| Name                   | Organization                                                                   | Role          |
|------------------------|--------------------------------------------------------------------------------|---------------|
| Anthony, Art           | NCSU Center for Urban Affairs                                                  | Moderator     |
| Bodane, Meihui         | North Carolina Department of Commerce                                          | Participant   |
| Davis, Edward T.       | North Carolina Department of Commerce, Energy Division                         | Participant   |
| Hughes, Mike           | Progress Energy Corporate Media Relations                                      | Participant   |
| Ivey, Janice           | North Carolina Department of Commerce, Workforce Development                   | Participant   |
| Katz, Arnie            | Advanced Energy, Senior Building Science Consultant                            | Participant   |
| McMahan, Andrew        | Central Carolina Community College, CIP Energy Sector Director                 | Participant   |
| Miller, Stew           | YES! Solar Solutions, President                                                | Participant   |
| Nance, Ryan            | Lumber River Workforce Development Energy Sector Coordinator                   | Participant   |
| Peele, Mitch           | North Carolina Farm Bureau Director Public Policy                              | Participant   |
| Scott, Katherine       | North Carolina Department of Commerce, Green Economy                           | Participant   |
| Wagner-Vinson, Christa | North Carolina Department of Commerce; Policy, Research and Strategic Planning | Participant   |
| Wall, Steve            | Biofuels Center of North Carolina                                              | Participant   |
| Douglas, Chiquita      | North Carolina Department of Commerce, Division of Employment Security         | Project Staff |
| Keener, Jackie         | North Carolina Department of Commerce, Division of Employment Security         | Project Staff |
| Woodson-Bruhn, Judy    | North Carolina Department of Commerce, Division of Employment Security         | Project Staff |

## Focus Group Observations

In a 2011 report, the Brookings Institution claimed that the clean economy is “an enigma . . . and is tricky to define and isolate.” The focus group participants seemed to agree, and their different opinions suggest that they had the same trouble with the definition that survey respondents had. Where some green economy definitions are broad, others are narrow. One participant noted, for example, that “neither agriculture nor water efficiency is captured by the [North Carolina survey] definition.”

In many ways desirable, participants were nonetheless reluctant to support a standard definition for a green job. The group unanimously agreed that the concept of a green economy or green job is not mutually shared. Many people noted that there is a particular challenge in isolating occasional green behaviors and goals from deliberate green processes that affect a company's bottom line. At the same time, the use of green technology, green processes and green business practices were universally recognized by the group to potentially have a positive environmental effect on North Carolina and would be likely to provide new business opportunities that bring much-needed jobs to the State.

The survey findings surprised some focus group participants. The broad distribution of green jobs across industries was unexpected. Likewise, the HWOL Anti-Green category was not well received. HWOL classifies many health care professions anti-green because they can produce hazardous waste and use nonrecyclable materials; many participants felt this was misleading since these professions promote public health and are in other obvious ways concerned about a clean environment.

### Acknowledgments

The 2011 North Carolina Green Economy Study presented an opportunity to define the baseline for the level of “greenness” of our State’s economy. This tremendous undertaking could not have been completed without the many collaborative efforts of our colleagues and stakeholders. A special note of appreciation is extended to the organizations that willingly completed the survey and shared key information about many facets of their businesses.

This work would not have been possible without input from the following organizations:

North Carolina Employment Security Commission, Labor Market Information Division  
North Carolina Commission on Workforce Development  
North Carolina State University Center for Urban Affairs & Community Service  
North Carolina State University McKimmon Center  
North Carolina Community College System  
North Carolina State Energy Office  
North Carolina Department of Commerce, Labor and Economic Analysis Division

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