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Green Data *for a* Growing Green Economy

*Labor Market Research of Green Jobs
in the District of Columbia,
Maryland, and Virginia*



MARC

Mid-Atlantic Regional Collaborative

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Executive Summary

Background

Established in 2008, the Mid-Atlantic Regional Collaborative (MARC) is a regional coalition committed to enhancing the regional economic and workforce vitality of the District of Columbia (DC), Maryland, and Virginia (henceforth, collectively referred to as the Mid-Atlantic Regional Consortium, or MARC, region). Knowledge of the size, sectors, geographic locations, workforce requirements, and other characteristics of the regional green economy is critical to ensuring that the MARC region is well positioned to fully capitalize on opportunities for continued job creation. The green industry, however, is particularly challenging to measure, as traditional industry and occupation data sources have not kept pace with this nascent and dynamic industry. Although none of the traditional government-collected datasets have yet captured the green economy at the requisite level of granularity, it is critical to analyze the current state of the green labor market to prepare for its expansion.

For the green economy to mature, it is important that the labor force adapt its skills to meet the growing demand for green-related employment opportunities. In this project, ICF International (ICF) estimated the demand for green jobs and characterized the current and projected labor supply. We conducted the analysis for DC, Maryland, Virginia, and the DC Metropolitan Area (DC Metro).¹ We also conducted analysis at the Workforce Investment Area (WIA) level.

Approach

Our primary data source was the MARC Regional Employer Survey, conducted by ICF in 2010. We collected nearly 10,000 responses from private and public employers and non-profit organizations in the MARC region. The survey included questions about the number of current and prospective employees, training and education, and other questions intended to gauge the employers' and, ultimately, the region's labor market opportunities and gaps. With regard to green employment, the survey asked respondents to enumerate workers engaged in producing or providing green-related products or services and to report the number of employees, job openings, and recruitment according to seven green categories defined by the Bureau of Labor Statistics (BLS).

To supplement the MARC Regional Employer Survey, we used the Economic Modeling Specialists Inc. (EMSI) model to derive wage, unemployment, and other labor market data. EMSI, a web-based labor market tool, compiles publicly available data from federal, state, and local sources. We also used WIN Strategic Compass to estimate labor supply. WIN Strategic Compass, also a web-based labor market tool, specializes in educational data and characterizing the intricate relationship between graduates and job candidates to estimate labor supply in a given region.

¹ We discuss the DC Metropolitan Area separately because it is an aggregation of the District of Columbia and counties in Maryland, Virginia, and West Virginia that represent the Washington Metropolitan Statistical Area. We do not, however, include West Virginia in this analysis because it was not included in the MARC Regional Employer Survey.

Findings

ICF identified several key characteristics of green labor markets in DC, Maryland, Virginia, and DC Metro. This information can be used by training institutions and policymakers to identify where green education and training are insufficient relative to the demand for green labor. Recent graduates, current students, and those starting new careers can use these findings for guidance on green occupations on which occupations exhibit low supply or high demand and their general training requirements. Similarly, career counselors, one-stop career centers, and other job placement organizations can use this information to direct and prepare students and workers for the growing green economy.

Green Jobs and Openings by Education Level

DC has the largest concentration of green jobs requiring a bachelor's degree. In Maryland, an associate's degree and some college (no degree) dominate the top green jobs, while green jobs in Virginia and DC Metro have a more even spread of education levels.

In terms of job openings, survey respondents from Maryland report the highest percent requiring less than a bachelor's degree followed by VA, DC Metro and, finally, DC. DC Metro has a more service- and professional-oriented green workforce relative to the other areas in the region.

In DC, many jobs require a bachelor's or higher degree, supporting the notion that green labor in DC centers on the professional and service aspects of the economy. This pattern holds true when we analyze green job openings by education level in DC, where a majority of jobs requires at least a bachelor's degree and, in most cases, work experience or a master's degree.

In Maryland, many of the top green occupations require an associate's degree, some college, or a high school diploma. The majority of green job openings in Maryland do not require a bachelor's degree. On-the-job training (OJT) is the primary form of preparation required for green openings in Maryland. These findings reflect a more production-oriented green economy in Maryland.

In Virginia, we observe a fairly even spread of educational levels in the top green occupations. The educational levels in Virginia support both a service- and production-oriented economy. This may be because the service-oriented occupations cluster in the high population density areas of Virginia, while the production occupations are more evenly distributed throughout the state.

Wages

As expected, higher education levels are associated with higher wages. In DC, jobs, openings, and expected green demand tend to cluster in the higher wages. We observe no job openings or expected demand in DC for jobs paying below \$15.00 per hour. Green job openings in DC peak at the \$20.00 to \$24.99 range, while the expected demand peaks at the \$30.00 to \$49.99 range. These findings are consistent with DC's highly educated green workforce with a focus on the service and professional segments of the economy.

In Maryland, we observe very few green jobs in the highest wage range. Most current green jobs in Maryland, however, are in the \$30.00 to \$49.99 hourly wage range (the second highest wage range). In Virginia, most current green jobs and openings are in the \$10.00 to \$14.99 range, although expected labor demand is concentrated in the \$30.00 to \$49.99 wage range.

Labor Market Tightness

Labor market tightness ratios illustrate the opportunities for unemployed workers by expressing the number of green vacancies relative to unemployment. Green job vacancies relative to unemployment are highest in the following WIAs: Frederick County, Anne Arundel County, Montgomery County, Western Virginia, and Northern Virginia. Architectural and engineering occupations show the highest ratios in all three jurisdictions and DC Metro.

In DC, current green openings and expected demand account for 5 percent of the unemployed labor force. Green opportunities in DC are available primarily for workers in search of work in architecture and engineering; farming; fishing and forestry; and installation, maintenance, and repair; among others.

In Maryland, Frederick County, Anne Arundel County, and Montgomery County have the highest ratios, with vacancies accounting for 18 to 25 percent of the unemployed population in the selected green occupations. Architectural and engineering vacancies account for about 70 percent of those unemployed in the respective occupations, while farming, fishing and forestry vacancies account for about 65 percent of the unemployed.

In Virginia, the WIAs with the highest green vacancy-to-unemployment ratios are Western Virginia, Northern Virginia, and Alexandria/Arlington. The Western Virginia and Northern Virginia green vacancies account for about 18 percent and 16 percent of the unemployed populations, respectively. The ratio for Alexandria/Arlington is just below 10 percent of their unemployed population. In Virginia, we observe a ratio above 180 percent for architecture and engineering occupations—there are more green vacancies available than unemployed workers in those occupations. Installation, maintenance, and repair vacancies account for about 80 percent of the unemployed workers in that occupation group in Virginia.

Green Labor Market Gap

We define the green labor market gap as the difference between the supply of workers and the demand for green workers. In DC, we find an over-supply of workers in several occupations that typically require a bachelor's or higher degree, including general managers. This finding likely reflects the large number of undergraduate and graduate educational institutions in DC and the highly qualified workers they produce for both the immediate region and the entire country. We see an under-supply in some of the typically high-education occupations in DC, including water/wastewater engineers and management occupations. For jobs typically requiring less than a bachelor's degree, we find an over-supply in social science research assistants and architectural drafters. Finally, we see an under-supply for life physical and social science technicians as well as maintenance and repair workers in DC.

In Maryland, we see an over-supply of general and operations managers. We see an under-supply of urban and regional planners and occupational health and safety specialists. For jobs in Maryland that do not require a bachelor's degree, we observe an over-supply of software quality assurance engineers and testers and heating and air condition mechanics and installers; on the other hand, we see a large under-supply in Maryland of water and liquid treatment plant and systems operators and craft artists.

In Virginia, we find an over-supply in most green occupations that require a bachelor's or higher degree with the exception of water/wastewater, civil, environmental, and electrical engineers. For occupations in Virginia that require less than a bachelor's degree (not including OJT), we find an over-supply of workers. For jobs in Virginia that require OJT, we find several occupations with an under-supply of workers, most notably telemarketers and outdoor power equipment and other small engine mechanics.

Green Career Pathways

Green career pathways illustrate opportunities in growing green jobs for dislocated workers and workers in slow-growth occupations. Through these pathways, we are able to identify traditional occupations that are compatible with the growing green occupations and that require limited additional training.

In DC, we find a career pathway based on compatibility of skill and knowledge from pesticide handlers, sprayers, and applicators with agricultural technicians—this represents a pathway from high-polluting, non-green jobs into green jobs. The pesticide handlers would need some training in biology and food production to transition into the green jobs, but would also receive an increase in average hourly wages of \$9.12.

In Maryland, we map two declining or slow-growing traditional occupations into a compatible high-growth green occupation. We see that crushing, grinding, and polishing machine setters, and farmers and ranchers could feed into the water and liquid waste treatment plant system operators, a green occupation. Workers from both source occupations would receive higher wages after the career transition. However, workers from both source occupations wishing to transition into the high-growth green occupation would need additional training in biology, chemistry, mathematics, and physics.

In Virginia, we map construction carpenters into drywall and ceiling tile installers. This transition to the green occupation would result in higher wages and require minimal training.

These career pathways are just examples of the many ways workers in traditional occupations could be transitioned into growing—and often better paid—green occupations.

Introduction

Background

The growing green economy provides the MARC region with a dynamic opportunity to expand its job base, attract new investment, and diversify its regional economy. DC Metro, in particular, has been a leader in the green economy since 2006. At that time, the area had the nation's second largest concentration of green jobs², and the regional green economy was expected to continue to grow by more than 8 percent annually, outpacing economy-wide average job growth.³ The region's green industries have continued to expand in spite of the recent recession, providing workers with robust and unique opportunities for continued growth.

Knowledge of the size, sectors, geographic locations, workforce requirements, and other characteristics of the regional green economy is critical to ensure that the MARC region is well positioned to fully capitalize on opportunities for continued job creation. The green industry, however, is particularly challenging to measure, as traditional industry and occupation data sources have not kept pace with this nascent and dynamic industry. None of the traditional government-collected datasets have captured the green economy at the requisite level of granularity. It is critical to analyze the green labor market to prepare for its expansion.

In June of 2009, DOL released a competitive Solicitation for Grant Applications for State Labor Market Information Improvement Grants. Eligible entities included individual or consortia of State Workforce Agencies. The Maryland Department of Labor, Licensing, and Regulation submitted a grant application on behalf of the MARC Green Consortium; the region was awarded a grant to conduct innovative Labor Market Information (LMI) activities to support the strategic and systematic expansion of a region-wide green economy. Established in 2008, MARC is a regional coalition committed to enhancing the economic vitality of the region. Members include leaders from the State Workforce Agencies from each of the three jurisdictions. MARC's mission is focused on building a globally competitive regional talent development system to drive and fuel regional prosperity.

The MARC members established an LMI Directors' Steering Committee to provide meaningful and substantive input throughout the project. The Steering Committee provided oversight to the project, worked with project members to engage other key stakeholders, design the survey instrument, and analyze and interpret the results. The Steering Committee provided quality assurance for project deliverables.

ICF supported the analysis of green employment in the region through the creation of a comprehensive three-jurisdiction green jobs survey, detailed analysis of the collected data at various geographic levels (including at the WIA level), and state-specific related research on the green workforce. A survey was

² "Current and Potential Green Jobs in the U.S. Economy." October 2008. The United States Conference of Mayors and the Mayors Climate Protection Center.

³ "Greater Washington 2009 Regional Report." August 2009. Greater Washington Initiative.

needed because traditional information sources and databases on industries and occupations are not specific enough to accurately measure the number of green jobs in the economy.

Organization of the Remainder of the Report

The remainder of the report is organized into three sections: approach, findings, and conclusions. The approach section describes the data sources used to estimate the supply and demand of green jobs. It also outlines some data limitations and the measures we took to compensate for these limitations. The findings section is organized into five subsections:

1. Educational attainment for green jobs and openings,
2. Wages in occupations with green segments,
3. Green labor market tightness ratios,
4. Green labor supply gaps, and
5. Green career pathways.

We conclude with the overall findings and implications of the green labor market research.

Approach

Defining Green Jobs for the MARC Region

To develop the MARC Region Employer Survey, ICF adopted a definition for green jobs. To do this, we first reviewed the definitions used by other state green jobs studies (California, Michigan, Minnesota, Oregon, and Washington) as well as the “Principles for Developing a Measurable Definition of Green Jobs” section in the Workforce Information Council (*WIC*)⁴ *Green Jobs Study Group Final Report*. We also reviewed the new BLS definition for green employment and training activities that was issued for public comment in the *Federal Register* on March 16, 2010 and finalized in the September 21, 2010 *Federal Register*.⁵

Our review of existing green job definitions confirmed that there were many different—sometimes competing—definitions of green jobs, green businesses, and green industries. In addition to reviewing current definitions, we wanted to ensure that the definition was specific enough so that it was defensible and reproducible, but not so broad as to include any industry or job that is remotely related to environmental sustainability. This approach allows the list of applicable industries/occupations to be expanded or refined over time depending on industry trends.

Finally, we considered that many traditional occupations have green components, such as architecture and production occupations, and that a worker’s job may not be dedicated entirely to green activities. Therefore, the definition needed to address the portion of time an employee dedicates to green tasks for that job to be considered green.

After we evaluated the existing definitions and took into account the above considerations, we decided to define green industries and occupations relatively broadly but to provide specific examples of each sector to clarify applicable industries and occupations. Ultimately, we chose an output definition (versus a process definition), defining a job as green when *any* portion of an employee’s workload includes producing a product or supplying a service in one or more of the following seven core areas identified by BLS in March 2010:

1. Renewable energy and alternative fuels.
2. Energy efficiency and conservation.
3. Greenhouse gas reduction.
4. Pollution reduction and cleanup.

⁴ The Secretary of Labor, through the BLS, acts with other Federal agencies and State employment statistics agency representatives elected by their peers. Collectively known as the WIC, this group works together to plan, guide, and oversee the nationwide workforce information system.

⁵ On September 21, 2010, BLS published responses to comments they had received on the draft definition as well as the final definition of green jobs. Our definition closely matches and is easily cross-walked with the final BLS definition.

5. Recycling and waste reduction.
6. Sustainable agriculture and natural resource conservation.
7. Education, compliance, public awareness, and training directly related to activities 1-6 above.

The following table of examples provides context for what is considered to be a green job in this study. The table, however, is not comprehensive and not all green activities are listed.

Table 1. Green Job Categories and Examples

Number	Green Job Category ⁶	Examples
1	Renewable energy and alternative fuels	Activities related to manufacturing, production, construction, design, research, delivery, operation, storage, maintenance and distribution of energy (electricity, heat, and fuel) from renewable sources, including wind, solar, biomass, hydrogen fuel cells, alternative transportation fuels, geothermal, ocean, methane, and waste incineration as a fuel source.
2	Energy efficiency and energy conservation	Manufacturing, construction, installation, production of energy efficient products (such as Energy Star rated appliances, more efficient lighting), energy efficiency services, weatherization, building retrofitting/efficiency, energy efficient production processes, energy distribution improvements (smart grid), transportation technology, and battery development and storage improvement. Overall increasing the energy efficiency of production processes, distribution, construction, installation, and maintenance.
3	Greenhouse gas reduction	Includes controlling and reducing emissions of CO ₂ , other greenhouse gases, waste water, and other pollutants through approaches other than renewable energy generation and energy conservation. Includes generation of electricity from nuclear sources and reduction of greenhouse gas emissions in electricity generation from fossil fuels.
4	Pollution reduction and cleanup	Activities related to controlling commercial, transportation, and industrial emissions and pollution; water treatment, recycling operations, waste product management and treatment, activities to remove pollutants and hazardous waste from the environment.
5	Recycling and waste reduction	Environmental remediation including the cleanup and disposal of pollution, waste, waste water, and hazardous materials; Superfund/Brownfield redevelopment; and landfill restoration.
6	Sustainable agriculture and natural resource conservation	Products and services to conserve, maintain, and improve natural resources and environment, including low carbon agriculture, land management, water management and conservation, wetlands restoration, and environmental conservation. Includes bioscience related activities. Includes reducing the environmental impact of agricultural production and improve natural resources conservation, including reducing use of chemical fertilizers and

⁶ As mentioned above, our definition is easily cross-walked to the final definition of green jobs issued by BLS. Our categories 1 and 2 map directly to BLS categories 1 and 2. Our categories 3, 4, and 5 maps directly to the three sub-sections in the BLS category 3: Pollution reduction and removal, greenhouse gas reduction, and recycling and reuse. Finally, our categories 6 and 7 map to BLS categories 4 and 5.

Number	Green Job Category ⁶	Examples
		pesticides, soil and water conservation, sustainable forestry, land management, and wildlife conservation.
7	Education, compliance, public awareness, and training directly related to green jobs	Activities to educate the public, business, and government on energy efficiency, renewable energy, energy rating systems certifications (Energy Star, LEED), and more efficient energy consumption. Also informing appropriate parties and enforcing compliance requirements and regulations, promoting state energy standards and plans, and training on effective use of energy related products and processes. In theory, energy trading could include buying and selling of power or fuels related to energy efficiency and renewable energy as well as cap and trade activity to control pollution.

Survey Data Collection

The MARC Regional Employer Survey collected data from employers in the region using a mixed-mode approach. Specifically, we collected data via web- and paper-based surveys and phone outreach and support. As noted by de Leeuw (2005)⁷, mixed-mode surveys have become ubiquitous as survey managers seek to use collection procedures that produce the best possible data within existing constraints of time and budget. According to a BLS (2008) article titled *Challenging Research Issues in Statistics and Survey Methodology at the BLS*,⁸ “one of the most recent, significant innovations is the Internet, and federal statistical agencies are increasingly attempting to move surveys to the Internet, or to offer it as a reporting option.” Therefore, we used mixed-modes for the employer survey to provide respondents with multiple options for response.

We distributed approximately 35,000 surveys to private and public employers (federal, state, local) and non-profit employers in the MARC region. The survey included organization-wide questions about whether the organization was still functioning in an identified city or county, the number of employees regardless of location, and revenue. Also, the survey asked establishment- or site-specific questions about the organization’s employees, green jobs, training and education, and other questions intended to gauge the employers’ and, ultimately, the region’s labor market opportunities and gaps. With regard to green employment, the survey asked respondents to include workers engaged in producing or providing any green-related products or services and to report the number of employees, job openings, and recruitment according to the seven green categories discussed above.

In addition to the paper-based survey, we developed a web-based survey available to participants approximately two weeks after the distribution of the first paper survey. We reminded respondents to complete the web survey via a postcard. Both versions of the survey asked the same questions. The web-

⁷ de Leeuw, E. D. (2005). To Mix or Not to Mix Data Collection Modes in Surveys. *The Journal of Official Statistics*, 21(2), 233-255.

⁸ Bureau of Labor Statistics. (2008). Challenging Research Issues in Statistics and Survey Methodology at the BLS. Retrieved on October 10, 2010 from http://www.bls.gov/osmr/challenging_issues/mixedmode.htm.

based survey, however, structured the questions in a manner that was more conducive to completing the survey online. For example, skip patterns were incorporated into the web-based version to reduce confusion and time required from respondents. Overall, a majority of the respondents completed the survey via the paper-based option. Specifically, 7,557 respondents returned the survey on paper and 2,335 respondents completed the survey on the web.

Labor Demand Data

To calculate the labor demand for green jobs in the MARC region, we first needed to estimate the number of current green jobs, green job openings, and expected need for green workers in subsequent years. A “job opening” represents an unfilled job position. We derived all estimates of current green jobs, green job openings, and expected hires from the MARC Regional Employer Survey. The projected need for green workers and current opening data should be considered a conservative estimate of green job availability because the survey was conducted during a recession. It is possible that the recession reduced the number of current openings and may have tempered employers’ future expectations. The opening and expected hiring data also do not reflect businesses moving into the MARC region or new startups that were not captured by the survey. Furthermore, growth in the region’s green economy may encourage additional businesses to relocate to the area, compounding its growth.

While employment data were available from numerous state and federal agencies, integrating the data across the various sources was challenging. An extensive and consolidated database was necessary to effectively project employment gaps. While we could reliably depend on the MARC Regional Employer Survey for the current jobs, openings, and expected demand data, we needed a means to identify wages and unemployment for each occupation. Thus, we used a tool provided by Economic Modeling Specialists Inc. (EMSI), an analytics firm that provides labor market information data via its tailored software package.

EMSI developed its dataset from nearly 90 federal, state, and private sources. The federal sources include the U.S. Department of Commerce’s Bureau of Economic Analysis and Bureau of the Census, the U.S. Department of Labor’s Bureau of Labor Statistics, the Employment and Training Administration, the U.S. Department of Education, the National Center for Education Statistics, the U.S. Postal Service, the Internal Revenue Service, and the U.S. Railroad Retirement Board.⁹ EMSI derives its private data primarily from

⁹ The Bureau of Economic Analysis data includes state personal income and employment, local area personal income and employment, and industry economic accounts, benchmark and annual input-output accounts. The U.S. Census Bureau data includes the American Community Survey, County Business Patterns, ZIP Code Business Patterns, nonemployer statistics, Local Employment Dynamics (LED), TIGER/Line File, population estimates, U.S. national and state population projections. The Bureau of Labor Statistics data includes the Quarterly Census of Employment and Wages (QCEW), Current Employment Statistics (CES), the Current Population Survey (CPS), the Local Area Unemployment Statistics (LAUS), the National Compensation Survey, the National Industry-Occupation Employment Matrix, the Occupation Employment Statistics (OES), and the Occupation Education and Training Projections. The Employment and Training Administration data includes the characteristics of the insured employed and the National O*NET Consortium, O*NET Production Database. The Department of Education data includes the Integrated Postsecondary Education Data System (IPEDS) and the Office of Educational Research and Improvement for the CIP, 2000 Standard Occupation Classification Crosswalk to 2000 Classification of Instructional Programs. The U.S. Department of Health and Human Services data is derived from the Health, United States dataset provided by the National Center for Health Statistics. U.S. Postal Service data includes the Address Information Systems (AIS) Delivery Statistics, 5-Digit Zip, and City State Products. The Internal Revenue Service data includes Statistics

Indeed.com, a job-posting search engine, and Nielsen Claritas Business-Facts®, which includes the industry codes, business names, local employees, and locations of more than 13 million U.S. firms. EMSI obtained state data through state and sub-state industry projections made available from the 50 states.

Based on the results of the MARC Regional Employer Survey, we identified the relevant green Standard Occupational Classification (SOC) codes and North American Classification Industry System (NAICS) codes. Appendix A lists the identified green NAICS codes and Appendix B lists the green SOC codes. The survey identified 50 green occupations in DC, 188 in Maryland, and 214 in Virginia. Using the survey results, we then generated the total number of current green jobs, the total number of green job openings, and the projected need for new green workers through 2012.

Throughout our analysis, we needed to aggregate the EMSI data so that it aligned with our survey data. Our approach to this data aggregation is explained in detail in Appendix E, Detailed Methodology for Labor Demand Data. We then ran queries within EMSI for each region of analysis: DC, Maryland, Virginia, and DC Metro. As each region did not necessarily employ workers for every green O*NET-SOC code, we tailored the O*NET SOC code universe for each EMSI regional query to match the types of green jobs found in each region. For each query, we obtained the average hourly wages and the most common level of education required for each job. It is important to note that the EMSI jobs data encompass the entirety of the occupations and not just the green segments of interest. Equally important is the fact that the occupational earnings figures are based on the 2010 U.S. Bureau of Labor Statistics' *Occupational Employment Statistics* data and the U.S. Census Bureau's *American Community Survey* data. The occupation earnings data do not include benefits.

We then examined the levels of education for each job of interest to gain additional insight into the green workforce. While EMSI did provide the education attainment levels for each SOC code, we searched the O*NET Online database to find educational backgrounds of workers within the green occupations. EMSI is not the ideal source of education data because it only provides the most commonly reported education level per occupation. For instance, an occupation that reports 45 percent bachelor's degree, 25 percent moderate on-the-job training (OJT), and 30 percent long-term OJT, and an occupation that reports 90 percent bachelor's and 10 percent moderate OJT would report identical educational attainment levels, even though they have very different educational implications.

In contrast, O*NET Online provides data on various levels of education in percentages for each occupation.¹⁰ One drawback of the education data from O*NET Online, as well as the EMSI data, is that they encompass the occupations as a whole, not just the green segments of the occupation. It is possible that the education levels for the green segment could vary significantly from the traditional segment. In cases where EMSI failed to provide education data on the less-specific SOC codes, such as the 6-digit or 5-digit codes, we examined the education data of the more-specific SOC codes and determined whether

of Income Division, County-to-County Migration Data. The U.S. Retirement Board data includes the Annual Railroad Retirement Act and Railroad Unemployment Insurance Act Statistical Tables.

¹⁰ The possible education levels include: less than high school diploma, high school diploma or equivalent, some college (no degree), associate's, bachelor's, master's, and Doctoral or professional degree.

the majority of the workers in the occupational category had bachelor's or higher degrees. We then classified the less-specific SOC codes as either bachelor's or non-bachelor's degrees. It is important to note that on-the-job training (OJT) can be classified as short, moderate, or long. Short-term training can last up to one month, moderate training can last up to one year, and long-term training can last up to five years

To project the expected green demand, we focused on a two-year projection for jobs, as specified in the survey. Specifically, survey question 10 asked, "How many more NEW employees will you need for this position in the next 2 years?" We defined the current year as 2010 and assumed the two-year inclusive time frame from 2011 to 2012. We then took the 8-digit SOC code provided in response to this question and matched it to the 6-digit EMSI SOC-code equivalents compiled from EMSI.

Labor Supply Data

To estimate the current labor supply, we used WIN Strategic Compass™, a web-based tool for analyzing workforce indicators with state and regional economic trends. WIN Strategic Compass uses the U.S. Department of Education's *Integrated Postsecondary Education Data System* (IPEDS) to provide a robust estimate of the current labor supply.

Completers data include information on completion rates for educational programs; "completers" are designated as participants who complete a given program. Although EMSI does provide completers data for occupations, we choose to use WIN Strategic Compass because of the intricate approach needed to define supply data. The crosswalk described below maps educational programs into occupations. It is important to note, however, that one program can map into multiple occupations, and one occupation can have multiple educational programs supplying workers. Because of this many-to-many relationship between education programs and occupations, defining labor supply from completers data alone would over-estimate the supply of workers. WIN Strategic Compass incorporates this many-to-many relationship and adjusts the estimates accordingly to provide a supply estimate.

Our primary tool in the supply projection analysis was IPEDS, the central postsecondary education data collection system for the National Center for Education. Using IPEDS, we downloaded the Completions Surveys files from 2005 to 2009, which contain data on the number of awards and degrees conferred on individuals by program in a given area. We also downloaded the 2009 Institutional Characteristics Survey, which provides the directory information for each of the programs in the Completions Surveys. The occupation data found in the surveys were classified according to the National Center for Educational Statistics' *2000 Classification of Instructional Program* (CIP) code, while the occupations of interest were reported according to the Bureau of Labor Statistics' *2000 Standard Occupation Classification* (SOC) code.

The first step in the mapping process was to match the 2009 Institutional Characteristics Survey with each entry in the Completions Surveys from 2005 to 2009. The matching entailed comparing educational institution identification numbers and extracting state abbreviations from the Institutional Characteristics Survey. The IPEDS database generated a universe of institutions that included 274 postsecondary

schools, colleges, and universities.¹¹ We then linked the CIP codes found in the institutional data to the SOC code for each entry using the *2000 SOC Crosswalk to 2000 CIP*. The SOC-CIP crosswalk allows the CIP data from the Completions Survey to link to the SOC codes of the MARC Regional Employer Survey. The SOC-CIP crosswalk is provided by the National Crosswalk Service Center, a federally-funded “national clearinghouse for classification information about occupations, training programs, and industries.”¹² This crosswalk identifies the prerequisite instructional programs, classified by CIP code, necessary for employment in 1,364 specific occupations, which are in turn classified according to SOC code.

Within each regional file, we compiled the linked SOC codes to generate the number of total completers for each occupation for every year. As the data obtained from IPEDS only covered through the year 2009, we implemented an exponential smoothing function to predict the growth for 2010, 2011, and 2012. These results, however, must be comparable to the two-year projection data collected by the MARC Regional Employer Survey. Therefore, we summed the number of completers associated with each SOC code for 2011 and 2012 to match the data generated from the survey question, “How many more NEW employees will you need for this position in the next 2 years?” After this was finished, we now had projected green demand and completers data for 2012.

Conducting the Gap Analysis

To conduct the gap analysis, we subtracted the pipeline of completers (the supply estimates) from the estimated green demand for labor. The resulting figure, the green gap, reflects the potential under- or over-supply of labor in the green labor markets. A positive gap indicates that there are more completers than job vacancies while a negative gap implies an insufficient number of completers to fill the green vacancies.

In order to better analyze and present the supply and demand data, and resulting labor gaps, we chose to use “spider diagrams” to reflect the skill, knowledge, and ability sets of workers in each green occupation. To create these diagrams, we first identified the regional negative gaps where the supply of workers failed to meet the demand as target occupations for analysis. We ran an EMSI compatibility module called “Into Occupation,” which is designed to help analysts generate strategies for transitioning workers from declining or slow-growing occupations into growing occupations. One drawback of this module is that it does not allow us to specify the green segment of each occupation. The module generated the top 20 occupations into which a worker from a target occupation could transfer.

For each target occupation's top 20 transition occupations, we identified those experiencing the greatest negative growth as potential source occupations. In particular, we selected only the negative growth occupations that also maintained a 90 percent or above compatibility with the target green occupation. Having identified both the source and target occupations, we then compared the median wages for both groups. It is important to note that because the SOC codes used in our analysis categorize traditional jobs

¹¹ The 274 institutions include 24 from DC, 94 from Maryland and 156 from Virginia.

¹² “NCSC Information,” *National Crosswalk Service Center*. 09 Dec 2010. Web. 01 April 2011
<http://www.xwalkcenter.org/index.php?option=com_content&task=view&id=36&Itemid=41>.

with identified green segments, the wage data provided were for entire occupations and not only for the green segments.

Labor Market Tightness Ratios

We also evaluated the current unemployment levels in green occupations. For this analysis, instead of looking at a supply gap, we estimated a labor market tightness ratio. This ratio compares the total green vacancies, both current and expected, to the pool of unemployed workers. A higher ratio indicates more green job opportunities for unemployed workers.

Findings

General Findings

The labor market data reveal several key trends in the green labor markets for DC, Maryland, Virginia, and DC Metro. First, there is a strong presence of service and professional green jobs in DC, while more production and construction jobs are located in Maryland and Virginia. Our labor market tightness analysis reveals that there are several WIAs and particular occupations that could provide employment opportunities for unemployed workers, such as architectural or engineering workers across the MARC region or overall green opportunities in the Frederic County and Anne Arundel WIAs in Maryland or the Western Virginia and Northern Virginia WIAs. We identified several occupations with an under- or over-supply of recent graduates, such as an under-supply of electrical engineering technicians and an over-supply of software and quality assurance engineers and technicians in DC Metro. Finally, there were several traditional occupations, such as ranchers and farmers, which are currently facing economic hardships. By mapping the dislocated workers into growing green occupations, such as heating and air conditioning mechanics and installers, we were able to find opportunities for workers to transition into green jobs and earn potentially higher wages.

Green Jobs and Openings by Education Level

The following section characterizes current jobs and openings by education level. The number of current jobs and openings is derived from the survey, while the education distributions and the reported education levels come from O*NET and EMSI data, respectively.

We present two figures of our findings for each geographic region of analysis. The first figure for each region ranks the top current green jobs and breaks down those jobs by education level. Because the O*NET education percentages are available at the 6-digit SOC code, jobs are reported at the 6-digit code. This analysis seeks to identify which occupations comprise the most green jobs, and which education levels correspond to those top jobs.

The second figure for each geographic region breaks down the reported education levels by total job openings. The reported education levels originate from EMSI and reflect the most common education level for each occupation.¹³

District of Columbia

Survey respondents in DC reported the largest number of green jobs among door-to-door sales workers and news and street vendors and related workers at approximately 1,200, followed by communication

¹³ When EMSI did not provide an education level, education levels were assigned to a general 6-digit SOC code when a clear majority of SOC codes within the hierarchy of the general SOC code fell in either non-bachelor's or bachelor's related occupations. The category "Non-bachelor's – other" captured those occupations where the majority of 6-digit SOC codes did not require a bachelor's degree. Without more information, we were unable to break that category down into associate's, OJT, vocational, or work experience. General SOC codes requiring a bachelor's or higher degree are included in the "bachelor's" category.

teachers and first-line supervisors/managers of office and administrative support workers. Although some green jobs require less than a bachelor's, the majority of green jobs in DC require a bachelor's or higher degree. These findings coincide with findings from the survey that the DC region has more jobs with higher education levels. This is not surprising given that we see more green jobs in service and professional occupations in DC, while we see more green jobs in construction and production related occupations in Maryland and Virginia.

**Figure 2. Top Green Jobs by Education Level
(2010, DC)**

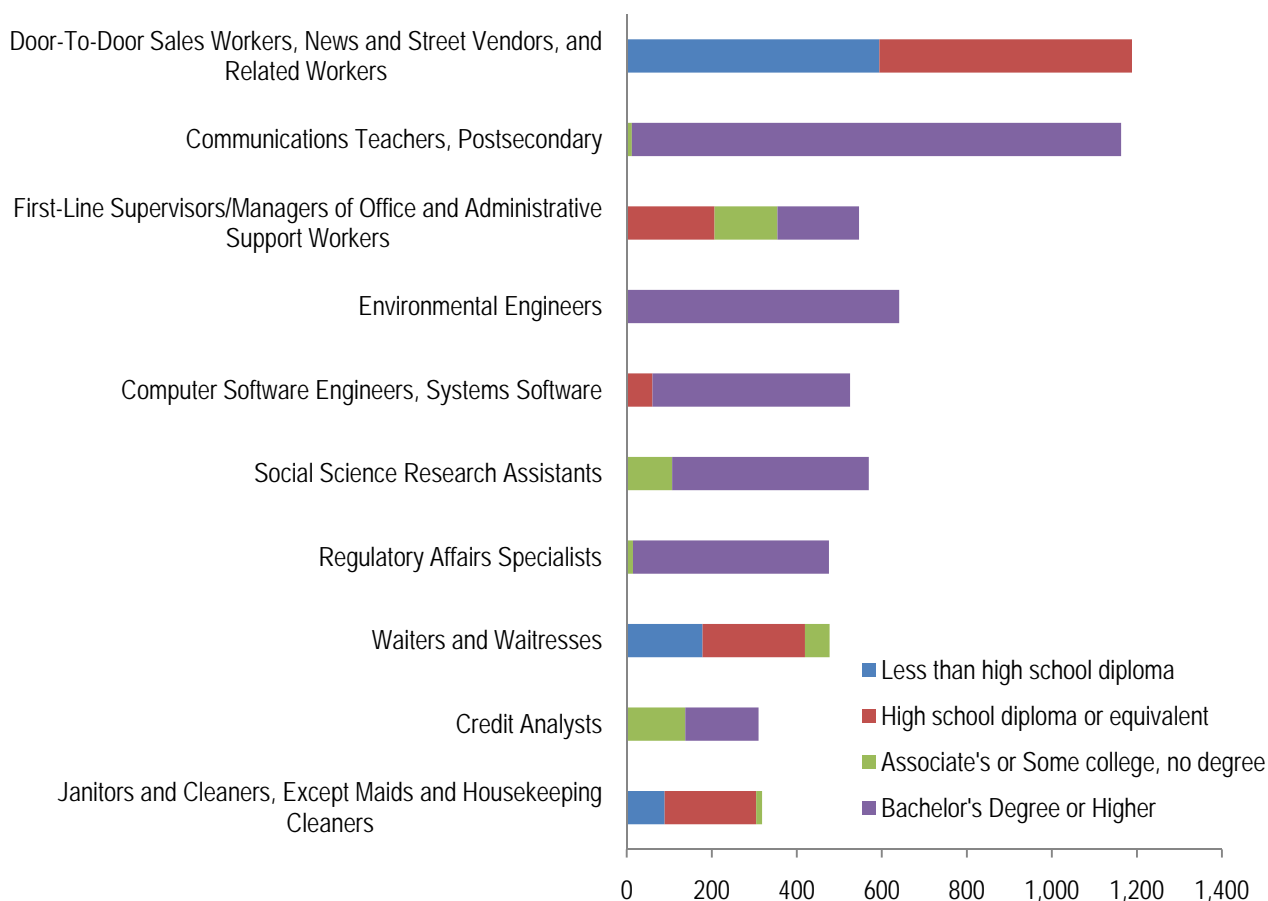
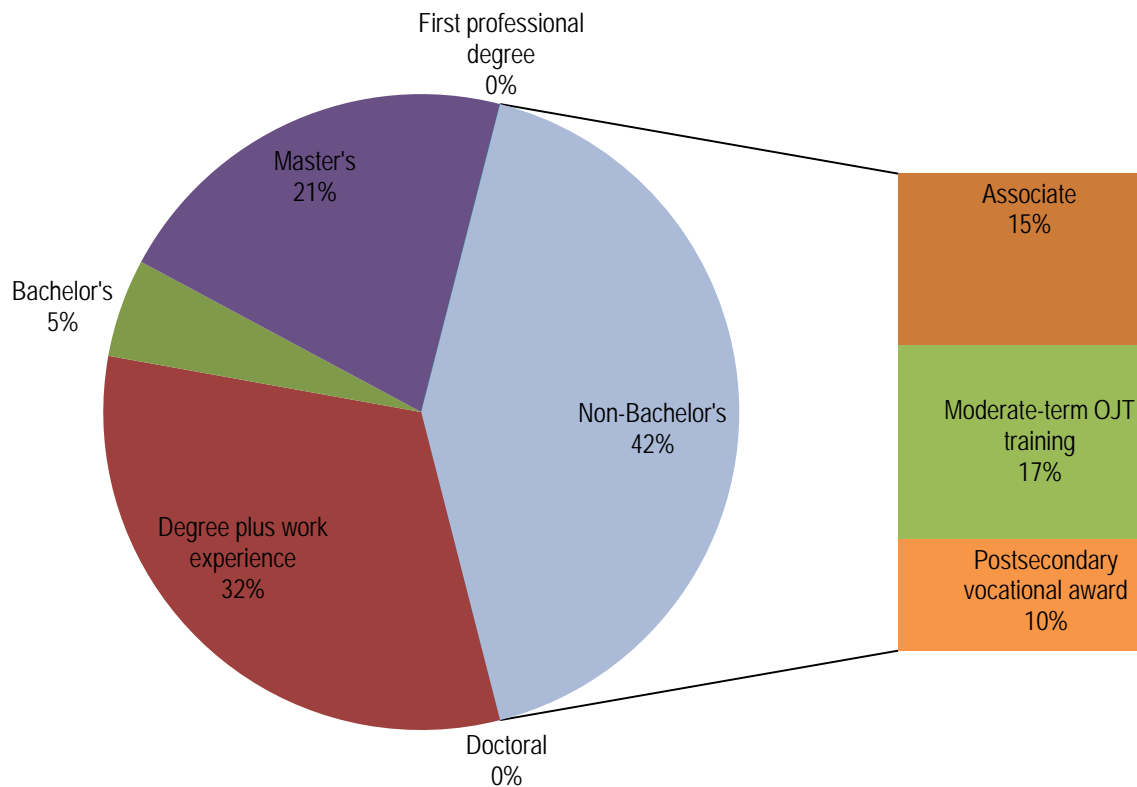


Figure 3 presents green jobs openings by education level. It reinforces the finding that DC's green workforce consists of mainly service and professional occupations. Service and professional occupations generally require higher levels of education and training and tend to congregate in or around large cities. Roughly 58 percent of green openings in DC require a bachelor's or higher degree. The percent of openings not requiring a bachelor's is lower in DC than in MD, VA, and DC Metro. In addition to the low percentage of non-bachelor's degree openings in DC, the percentage of job openings that require only a bachelor's (5 percent) is also lower in DC than in the other regions. These data imply that not only do the DC green job openings require bachelor's degree-level workers, but also that the openings tend to require either a master's degree or work experience in addition to a bachelor's degree.

Figure 3. Green Job Openings by Education Level
(2010, DC)



Maryland

Figure 4 presents the current Maryland green jobs education level. In Maryland, a large number of green jobs are in heating and air conditioning mechanics and installation occupations (over 8,000 jobs), followed by architectural drafters and laborers and freight, stock, and material movers (hand). Unlike DC, Maryland employers with green jobs report far more job opportunities for those holding an associate's or high school diploma, accounting for 49 percent of the total green jobs in the top green job occupations.

Figure 4. Top Green Jobs by Education Level
(2010, Maryland)

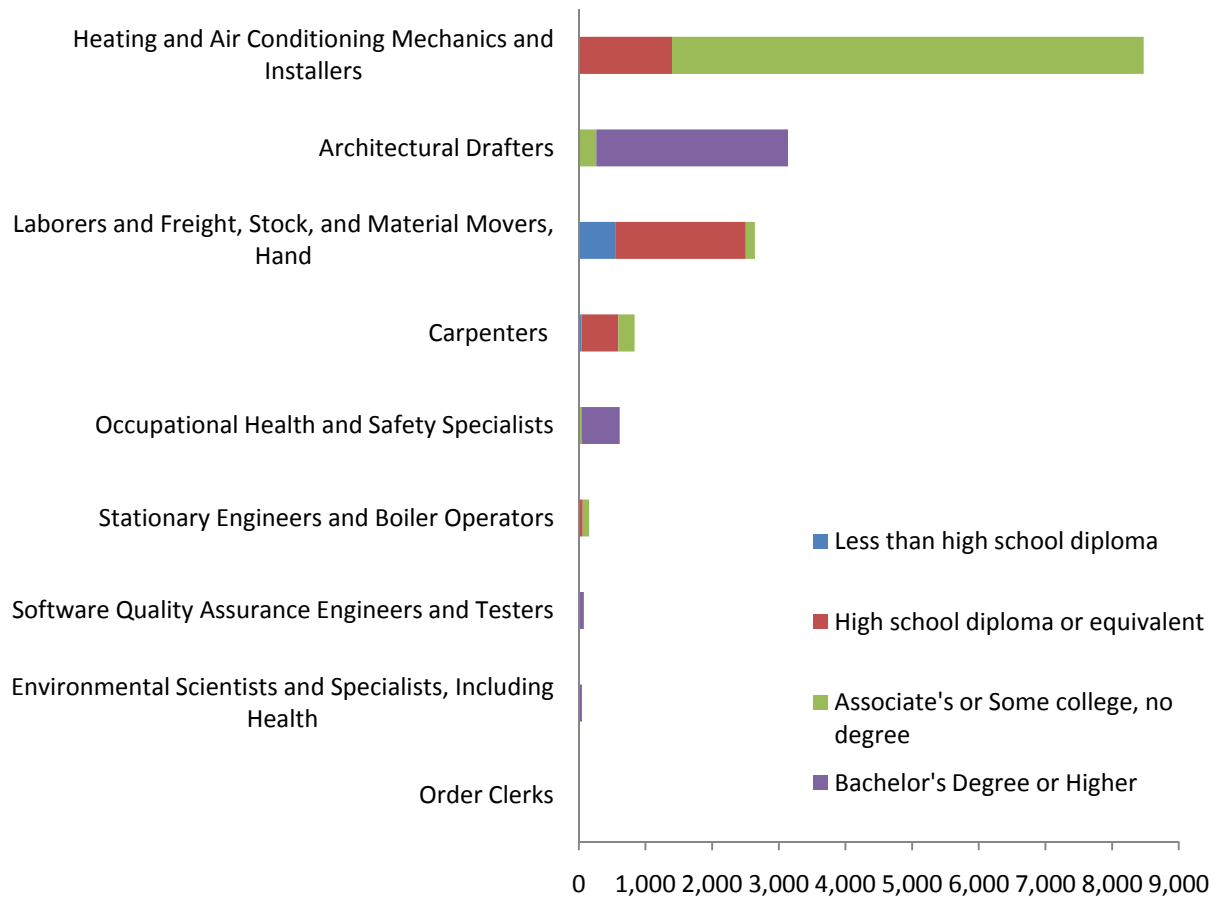
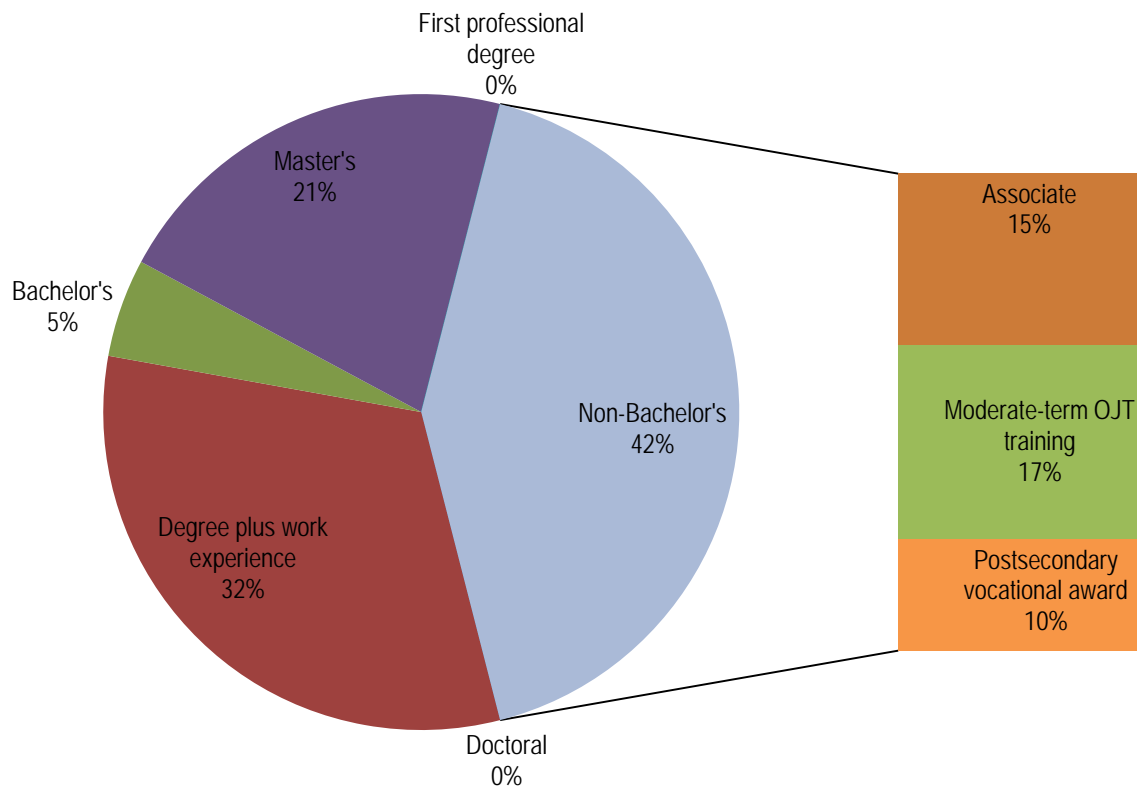


Figure 5 presents Maryland's green job openings by education level. The findings highlight major differences between the education levels required in DC and Maryland. In Maryland, 76 percent of all green job openings do not require a bachelor's degree. With 76 percent of the openings not requiring a bachelor's, Maryland has the highest percent of openings for workers with less than a bachelor's degree in the MARC region.

In Maryland, approximately 45 percent of green job openings require some form of on-the-job training (OJT), ranging from short-term OJT to long-term OJT. The combined OJT levels amount to 59 percent of the jobs not requiring a bachelor's degree. Thus, OJT is the most frequently required job qualification for green jobs that require a bachelor's and for jobs that do not require a bachelor's.

Figure 5. Green Job Openings by Education Level
(2010, Maryland)



Virginia

The occupation in Virginia with the largest number of green workers is education, training and library, which amounts to about 9,000 jobs, followed by laborers and freight stock and material movers (hand) and heating and air conditioning mechanics and installers. These occupations are similar to Maryland's top occupations with both the heating and air conditioning and laborers and freight stock material movers being ranked within the top three occupations.

Of the four education levels, no single level predominates among current green jobs in Virginia. Although 6 percent of top jobs require less than a high school diploma, 37 percent require a high school diploma or equivalent, 23 percent require an associate's degree or some college, and 33 percent require a bachelor's or higher degree.

**Figure 6. Top Green Jobs by Education Level
(2010, Virginia)**

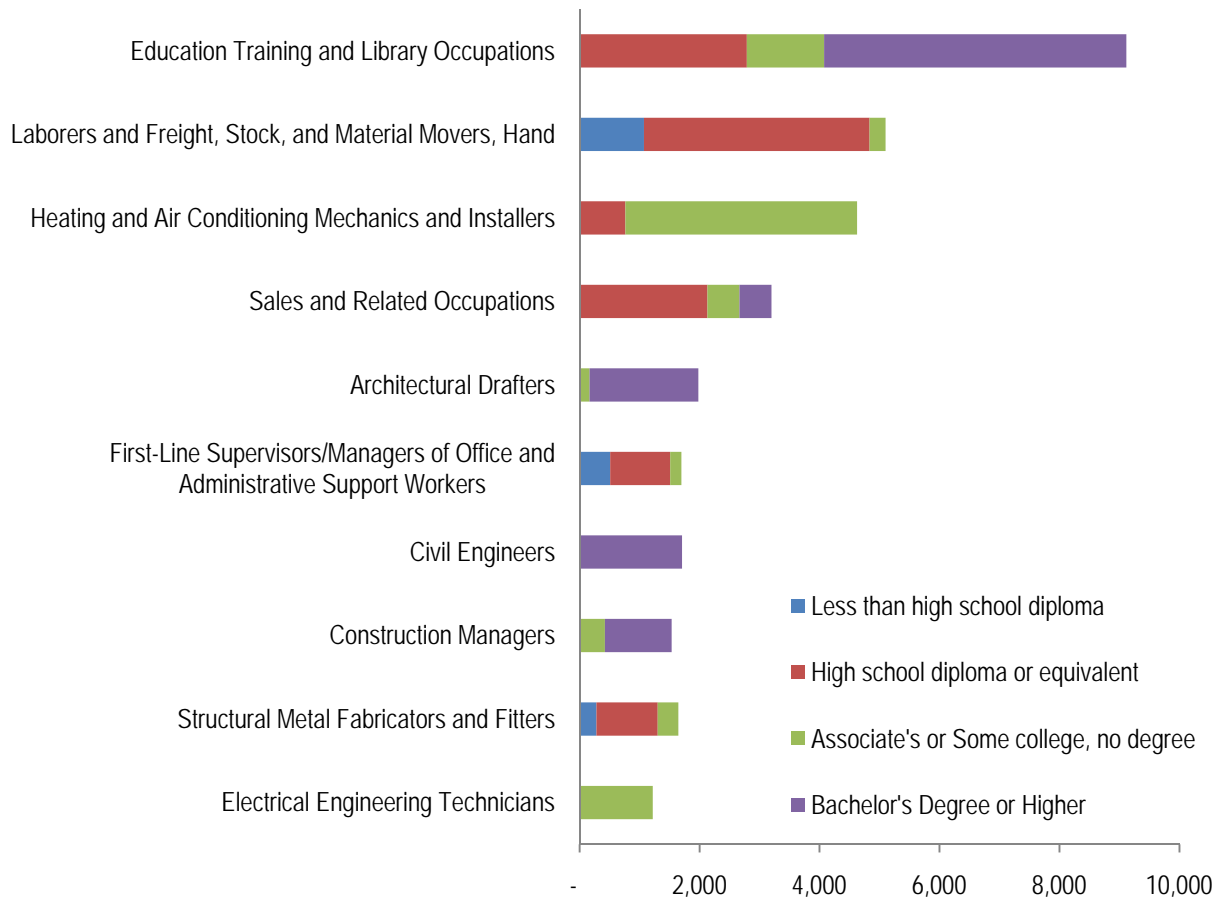
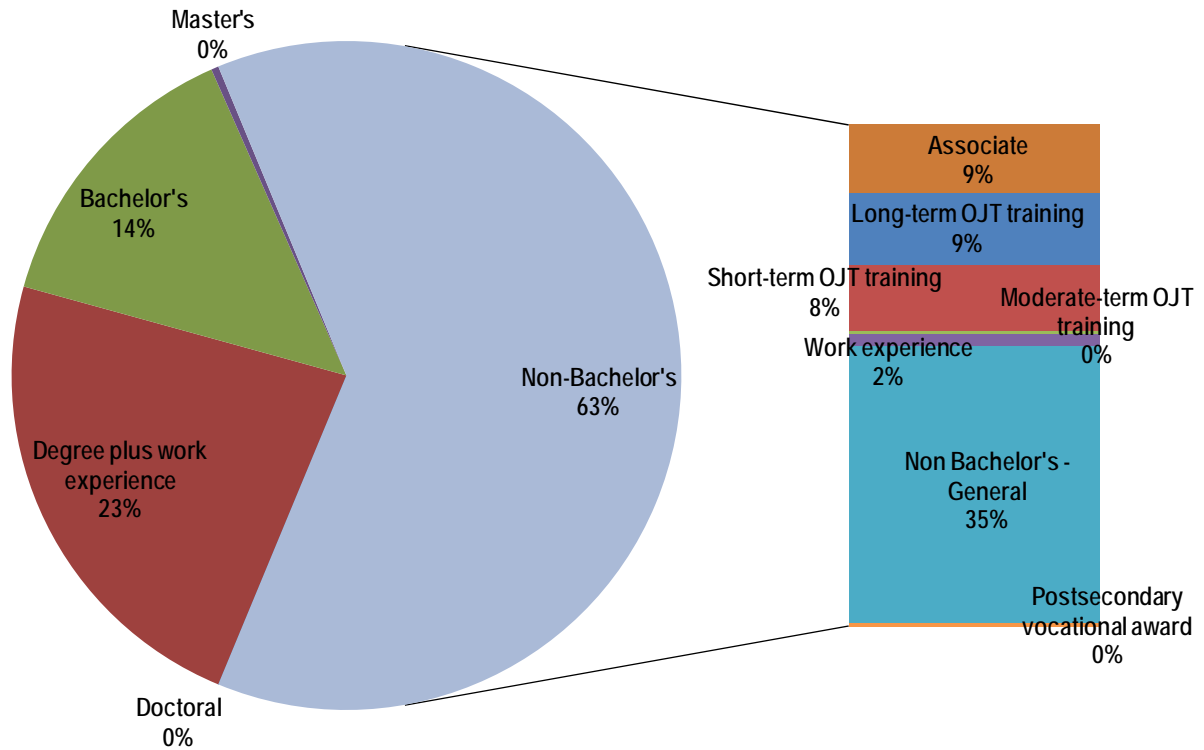


Figure 7 breaks down the education level associated with each green opening in Virginia. The percent of openings in Virginia that require less than a bachelor's degree (63 percent) falls between the non-bachelor's degree values found in Maryland and DC. In Virginia, similar to Maryland, the education levels of those occupations not requiring a bachelor's degree cluster around OJT, with 27 percent of openings with less than a bachelor's degree requiring some form of OJT. In total, 17 percent of all green job openings require OJT.

Figure 7. Green Job Openings by Education Level
(2010, Virginia)



DC Metropolitan Area

Figure 8 highlights the top green jobs in DC Metro. The occupation with the largest number of green workers in DC Metro is heating and air conditioning mechanics and installers, which also ranks highly in MD and VA. The next highest ranked green occupations in DC Metro are architectural drafters and landscaping and groundskeeping workers.

Similar to VA, DC Metro green jobs are distributed relatively evenly across the four education levels. The two least-represented categories included less than a high school diploma and high school equivalent at 14 percent and 23 percent, respectively, followed by a bachelor's or higher degree at 24 percent and an associate's degree or some college at 40 percent.

**Figure 8. Top Green Jobs by Education Level
(2010, DC Metro)**

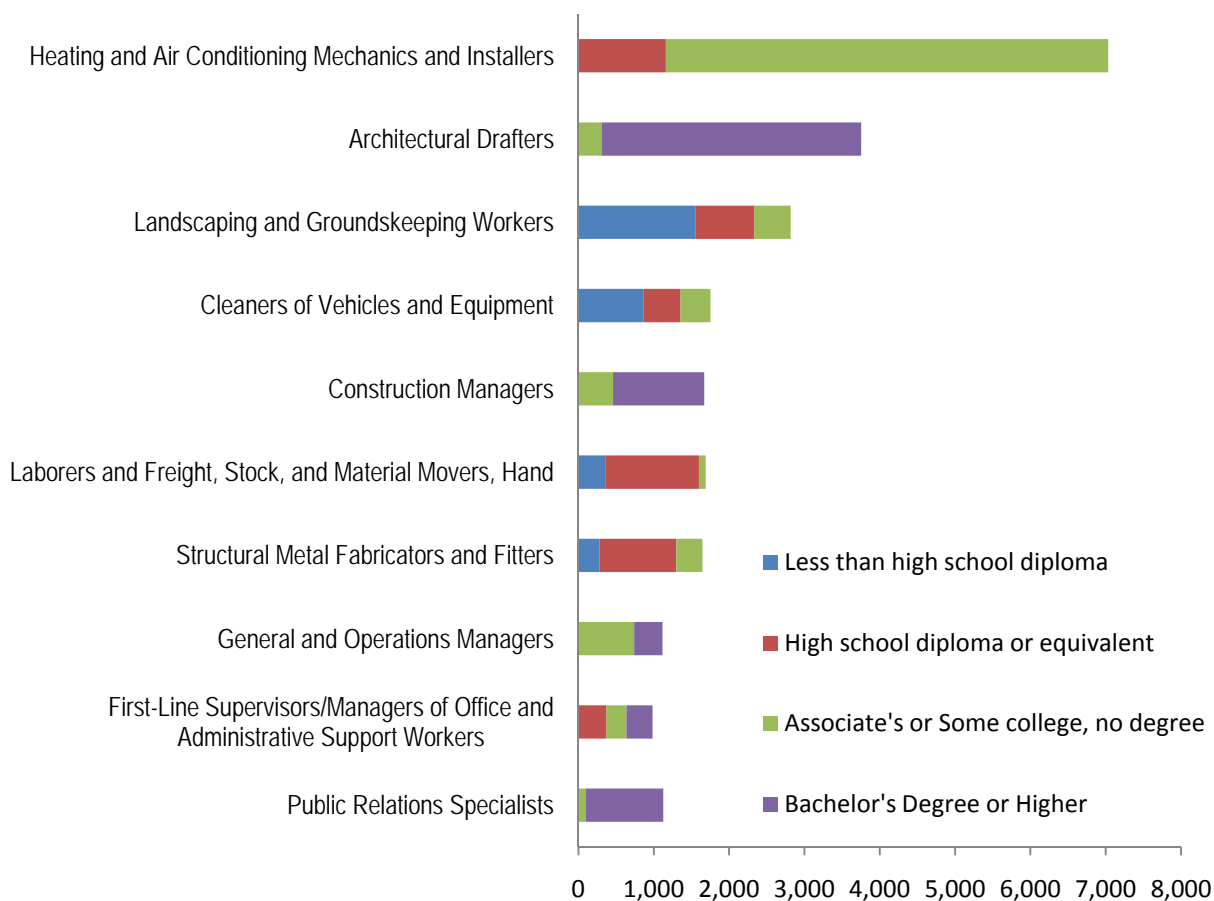
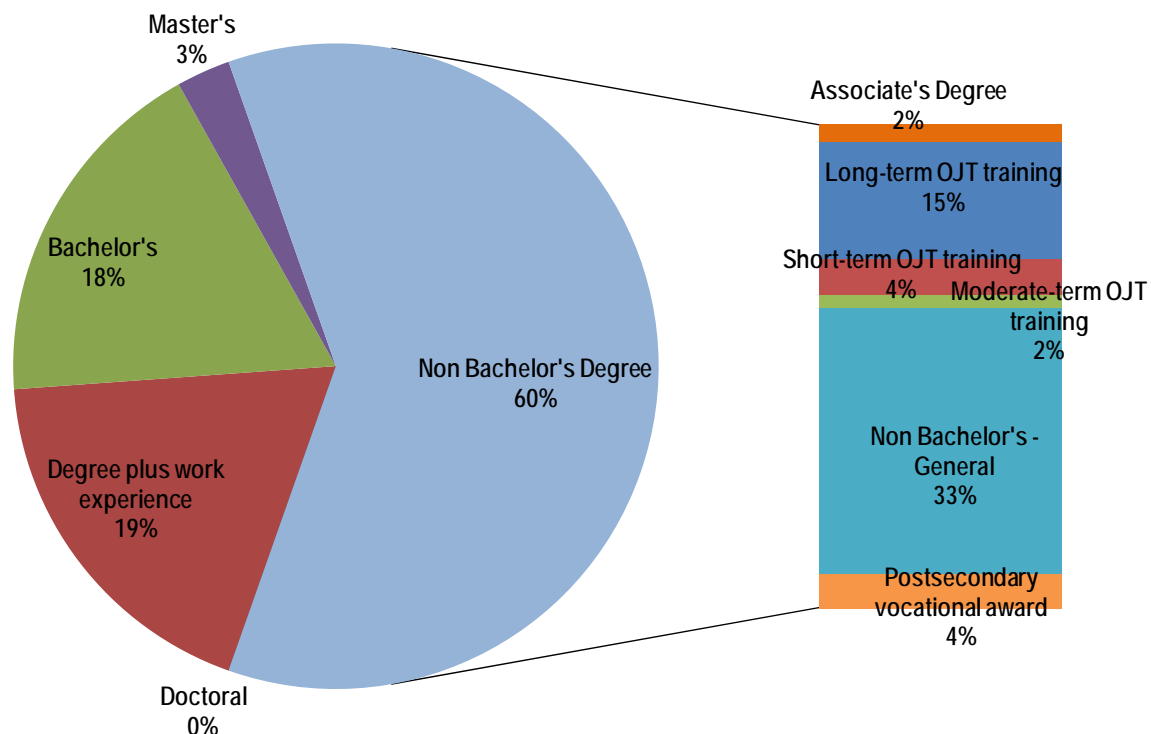


Figure 9 breaks down the current openings by education level for DC Metro. Green job openings that require less than a bachelor’s degree make up 60 percent of the total with over one-third of those jobs requiring some form of OJT. At 21 percent of total jobs, OJT is the most commonly required training for green job openings in DC Metro.

Figure 9. Green Job Openings by Education Level
(2010, DC Metro)



Conclusion

Breaking down current green jobs and openings by education level reveals several patterns in the MARC region. The highest concentration of green jobs requiring a bachelor's degree occurs in DC. For Maryland jobs, an associate's degree and some college (no degree) dominates the top green jobs, while a more even spread in educational requirements exist in Virginia and DC Metro.

In terms of green job openings, Maryland reports the largest percentage requiring less than a bachelor's degree, followed by VA, DC Metro and, not surprisingly, DC. Clearly, DC Metro has a more service- and professional-oriented green workforce relative to the other areas in the region. We identified a second pattern for green job openings: the openings that do not require a bachelor's degree tend to require OJT.

In DC, we observe many jobs where workers currently report a bachelor's or higher degree, supporting the notion that the green labor in DC centers on the professional and service activities of the economy. This pattern continues when we broke down green openings by education level; in DC, a majority of green jobs report at least a bachelor's degree and, in most cases, report either work experience or a master's degree in addition to a bachelor's degree.

In Maryland, many of the top green occupations report an associate's degree, some college, or a high school degree. The majority of green openings in Maryland, similar to the top green jobs, do not report a bachelor's degree. A large volume of the openings in Maryland report OJT as the primary source of training. These findings support a more production oriented economy in Maryland.

In Virginia, we observe an even spread of education attainment levels in the top green occupations. In regards to openings in Virginia, the majority of occupations not reporting a bachelor's or higher degree report OJT. The educational levels in Virginia support both a service and production oriented economy. This may be due to the fact that the service oriented occupations cluster in the high density cities, such as the northern Virginia portion of the DC metro and Richmond while the production occupations scatter throughout the region.

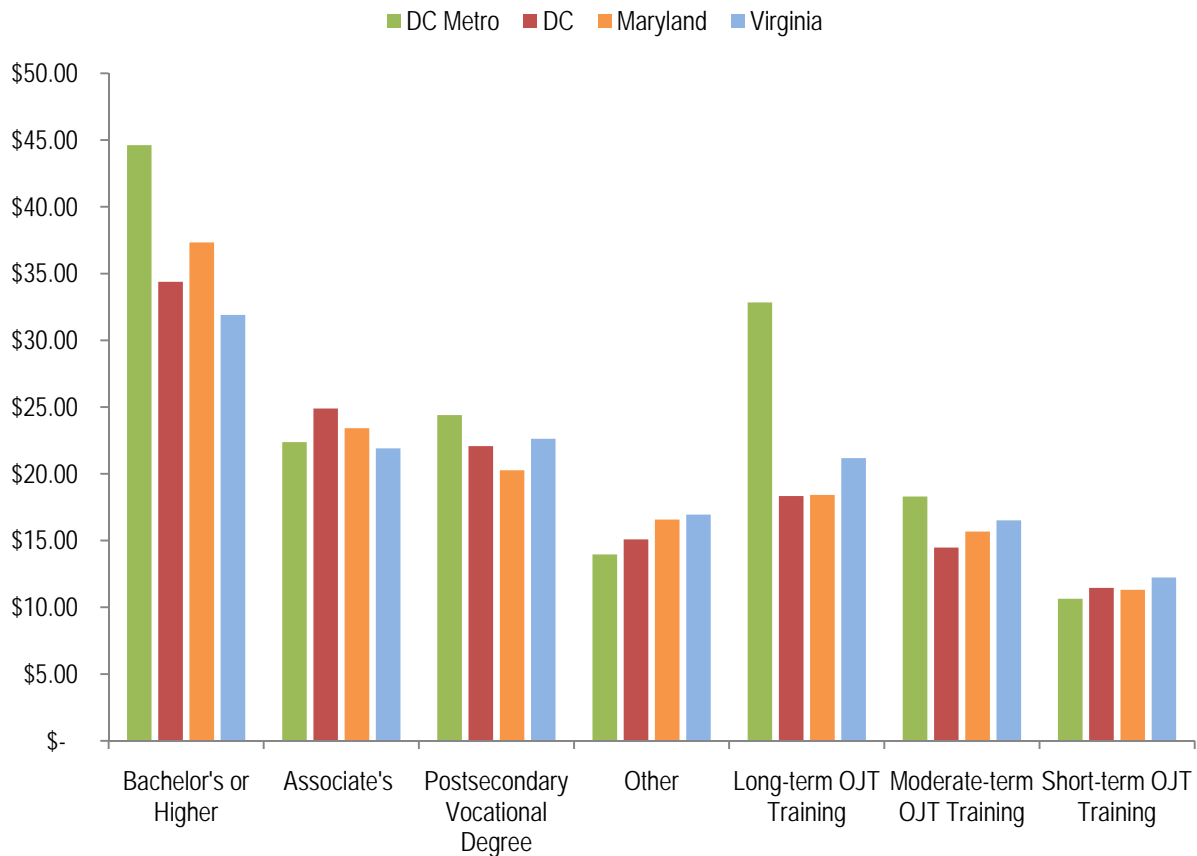
Wages

In this section, we describe how wage levels differ by educational attainment and estimate the distribution of wages across the region. Our wage findings correspond to the SOC definition of occupations, and thus the wages we use represent the median wage for the whole occupation, both traditional and green segments. The analysis considers those occupations identified by the survey as green and maps them into the median wage rate for the entire occupation.

MARC Region

Figure 10 presents the median wage levels by education or training level. As expected, workers with higher degrees receive higher wages throughout the region. DC Metro reports the highest wages for workers holding a bachelor's or higher degree, postsecondary vocational degree, and long-term and moderate-term OJT. After DC Metro, Virginia has the highest median wages for workers with OJT.

Figure 10. Median Wage Rate by Education/Training Level
(2010, MARC Region)



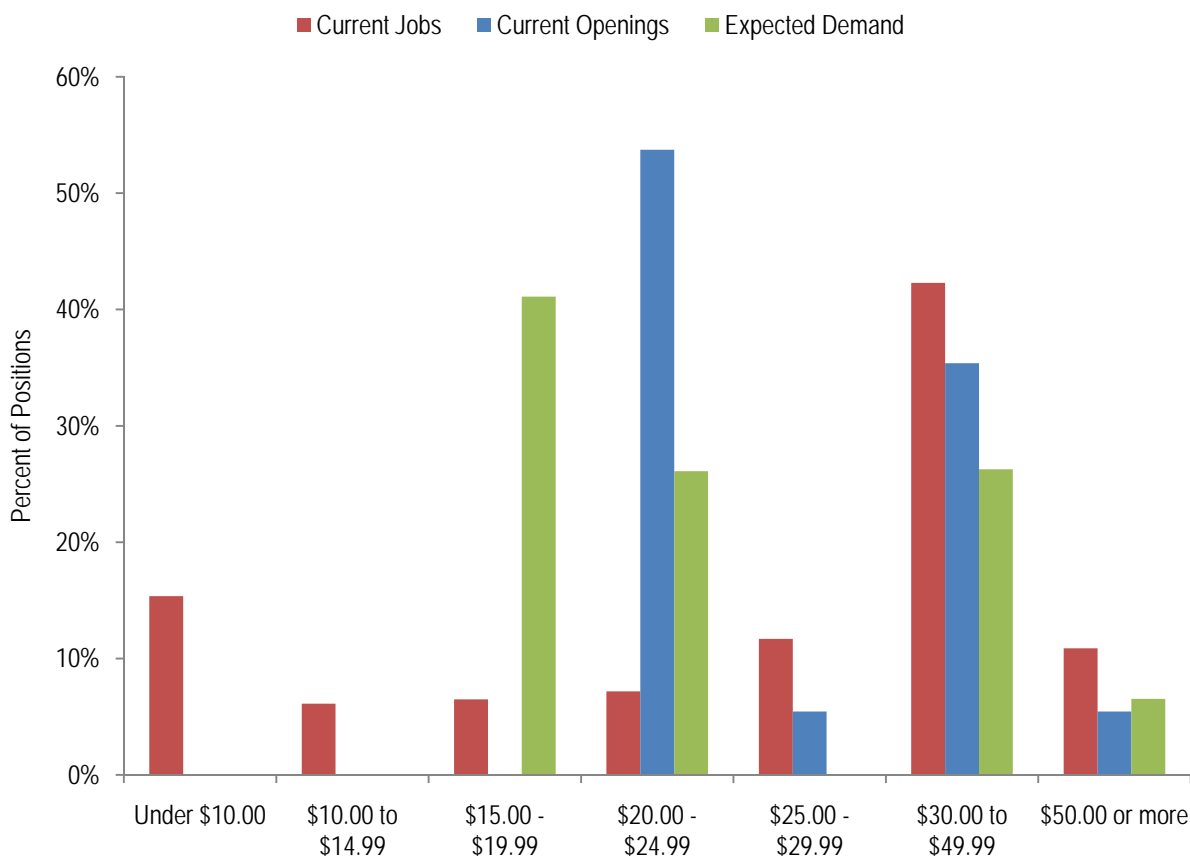
We separated the median wages for each region into seven wage categories. This classification allowed us to break down the survey data and show the distribution of current jobs, current openings, and expected green demand over a range of median wages. We weighted each wage by the number of positions to estimate a weighted average of median wages by wage level. We weighted the wages by current jobs, current openings, and expected green demand to compare differences among them. For each occupation, we grouped these wages into the seven hourly wage ranges, with under \$10.00 at the low end and over \$50.00 at the high end. The following sections present the findings for DC, Maryland, Virginia, and DC Metro.

District of Columbia

In the preceding section, we saw that DC has the largest number of current green jobs and openings that require a bachelor's or higher degree. As expected, these patterns translate into higher wage clusters for the District. For DC, there are no green openings or expected demand for jobs with median wages under \$15.00. Although there is a spread of current jobs with median wages below this threshold, the majority of green jobs are clustered at the \$30.00 to \$49.99 range. For current openings, there is a bimodal distribution with job openings clustered at the \$20.00 to \$24.99 range and at the \$30.00 to \$49.99 range.

Expected two-year green demand peaks at the \$15.00 to \$19.99 range and drops off as the wage ranges increase.

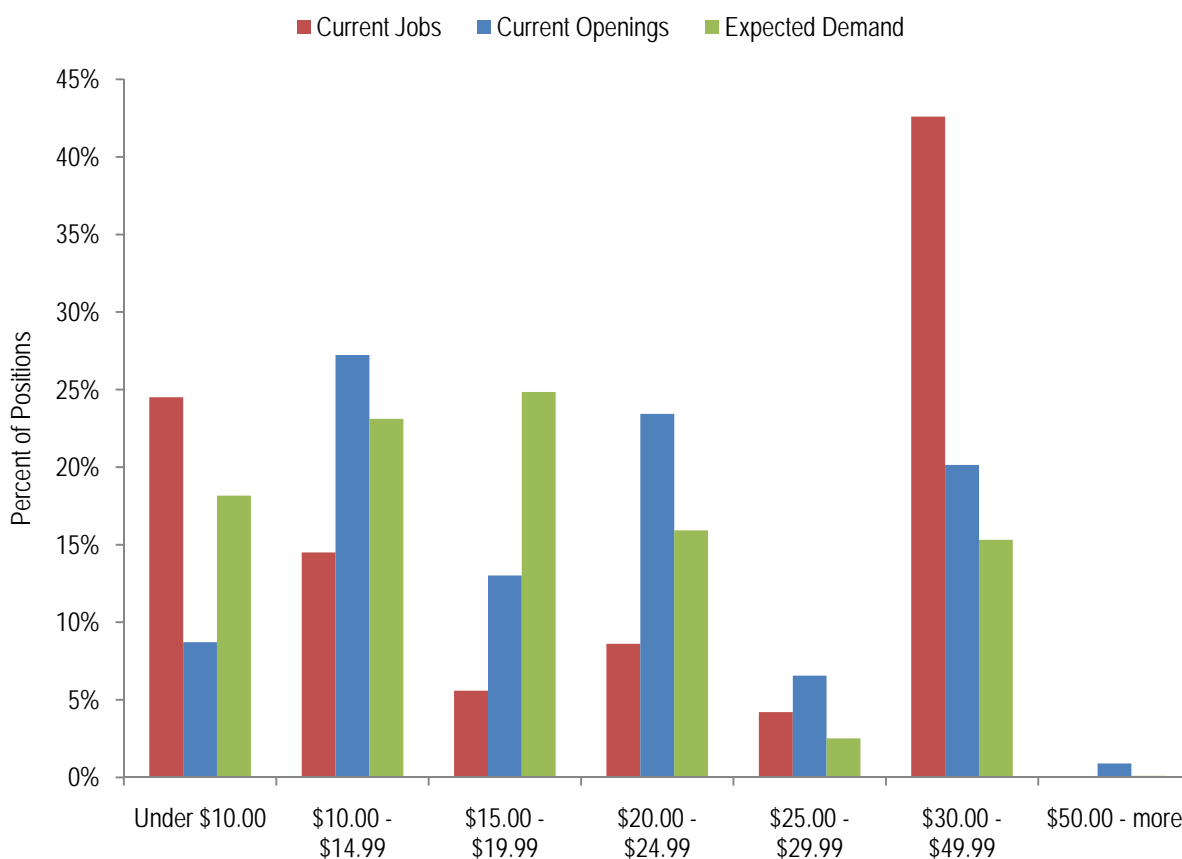
**Figure 11. Green Positions by Median Wage
(2010, DC)**



Maryland

Figure 12 presents the wage distribution in Maryland for current green jobs, current openings, and expected demand. Compared to DC, there is greater variability among the wage categories in Maryland. The current green jobs in Maryland follow a bimodal distribution with jobs clustering in the under \$10.00 region and in the \$30.00 to \$49.99 region. Together, these two wage categories account for more than 65 percent of current jobs. Current openings in Maryland peak at \$10.00 to \$14.99, while expected demand peaks at \$15.00 to \$19.99. Very few green jobs in Maryland, including both current and projected, are at the \$50.00 or higher range.

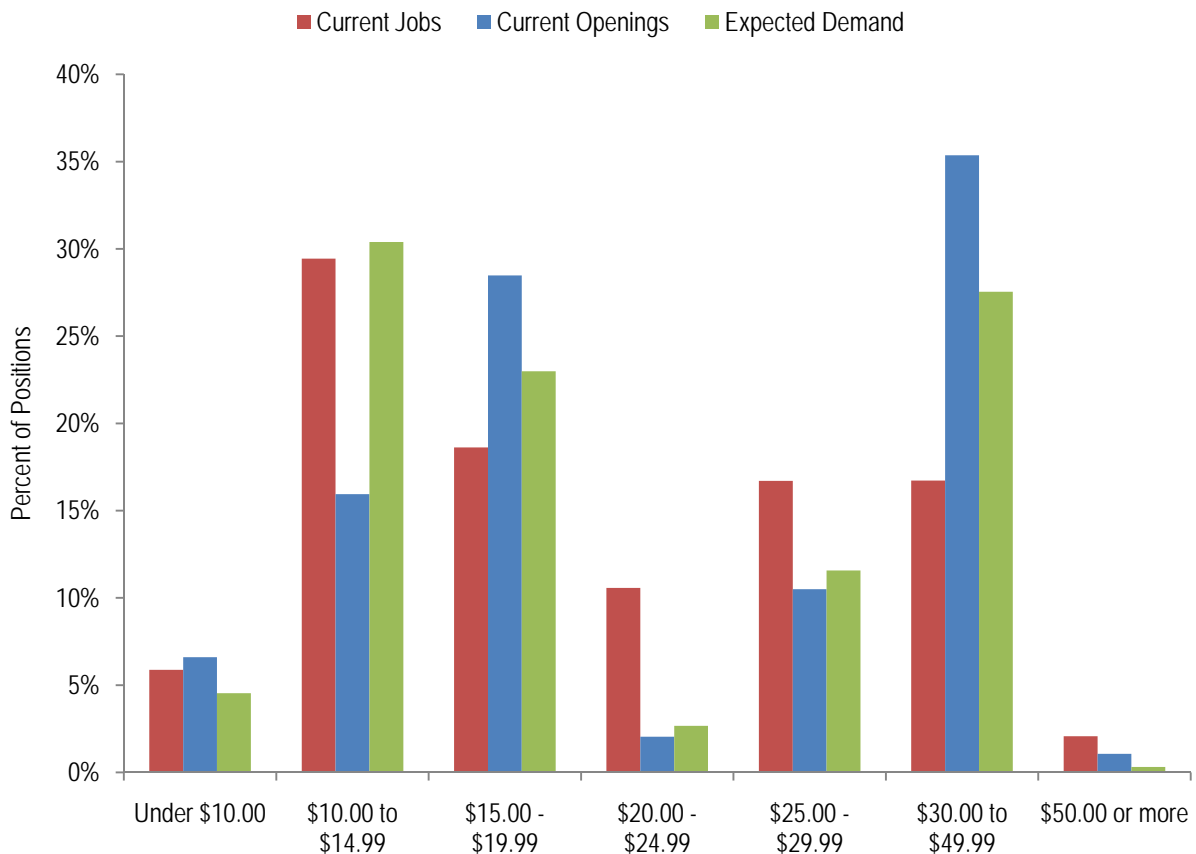
Figure 12. Green Positions by Median Wage
(2010, Maryland)



Virginia

Figure 13 presents the distribution of wages for the current green jobs, current openings, and expected demand in Virginia. Current green jobs in Virginia are clustered at the \$10.00 to \$14.99 range. Less than 5 percent of current green job openings fall into the under \$10.00 range, whereas more than 25 percent fall into the \$15.00 to \$19.99 range. A similar but more pronounced pattern emerges for the \$20.00 to \$24.99 range and the \$30.00 to \$49.99 range, which have 3 percent and 35 percent of current green openings, respectively.

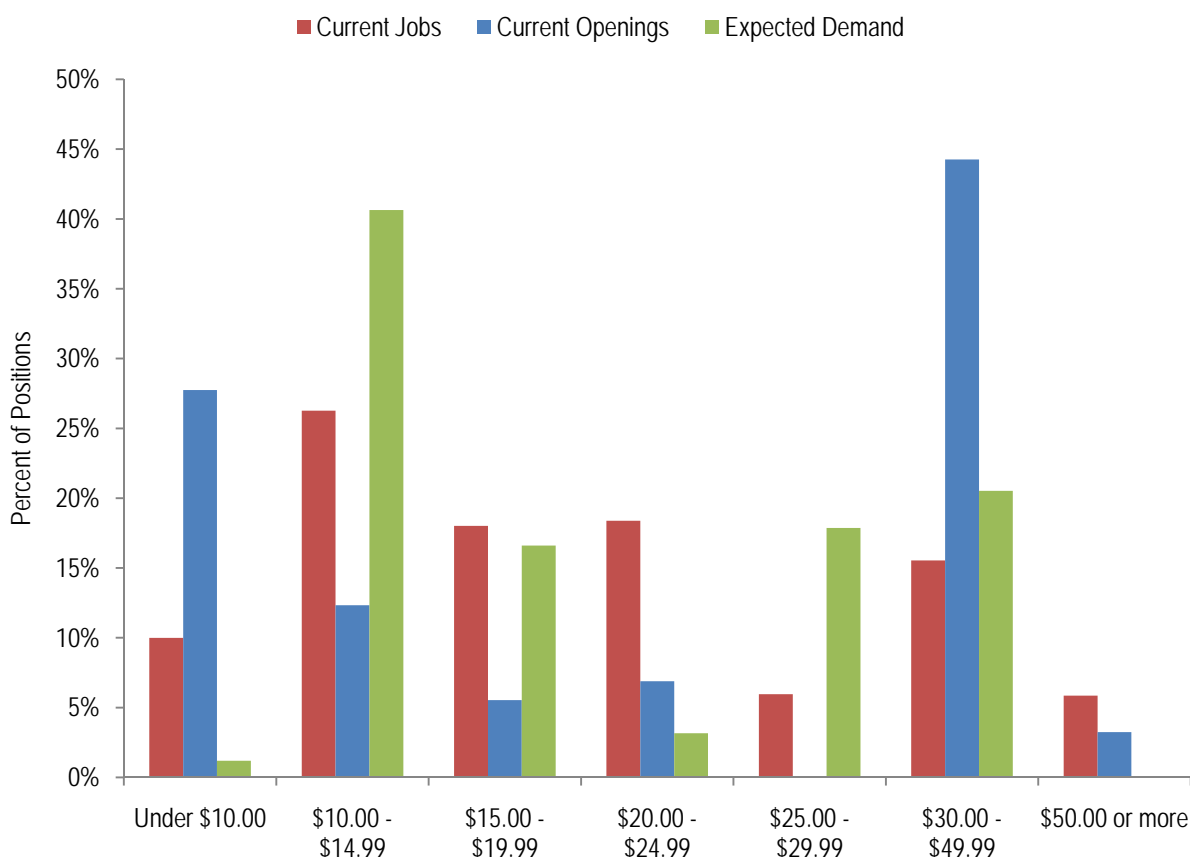
Figure 13. Green Positions by Median Wage
(2010, Virginia)



DC Metropolitan Area

Figure 14 presents the wage distribution for DC Metro. More than any other region, DC Metro median wages for current green jobs are distributed evenly across the seven wage ranges. However, this is not the case for green openings and expected demand in DC Metro. The current green openings are clustered around the under \$10.00 range and the \$30.00 to \$49.99 range, which accounts for approximately 70 percent of all green job openings. The expected green demand is clustered around the lower range of \$10.00 to \$14.99.

Figure 14. Green Positions by Median Wage
(2010, DC Metro)



Conclusion

We observe higher wages for higher education levels and, in general, higher wages for DC and DC Metro. One deviation, ignoring DC Metro wages, is that Virginia reports the highest wages for OJT. We observe no current openings or expected demand for low wages in DC and very few, if any, openings, expected demand, and jobs in the highest wage range for Maryland.

In DC, jobs, openings and expected green demand cluster in the higher wage ranges. We observe no openings nor expected demand under the \$15.00 wage range. Openings in DC peak at the \$20.00 to \$24.99 range while the expected demand peaks at the \$30.00 to \$49.99 range. The wage findings are consistent with a highly educated green workforce in DC, with a focus on the service and professional segments of the economy.

In Maryland, we observe little to no green jobs in the highest wage ranges, but most current jobs in the \$30.00 to \$49.99 range. Current green job openings peak at the \$20.00 range while expected demand falls to the \$15.00 range. With a green labor force more oriented to OJT, we should expect to see more openings in the lower wage ranges and, as workers receive more training, higher wages in the current jobs.

In Virginia, we observe high wages for workers receiving primarily OJT. Most current green jobs and openings in the state are in the \$10.00 to \$14.99 range while expected demand jumps to the \$30.00 to \$49.99 range.

Labor Market Tightness

Labor market tightness refers to the relationship between job opportunities and unemployed workers. The ratio provides a snapshot of the number of vacancies that exist for the unemployed in a given labor market. In this section, we define a labor market tightness ratio in order to examine the green vacancies relative to the unemployed population. A ratio of exactly one implies that one green job exists for every unemployed worker, while a ratio of zero implies that no green jobs are available for the unemployed. Ratios are not restricted to the zero to one range; a ratio greater than one implies that there are more job vacancies than unemployed workers. Because we restrict ourselves to a segment of total vacancies (i.e., green vacancies), we rarely observe a ratio greater than one.

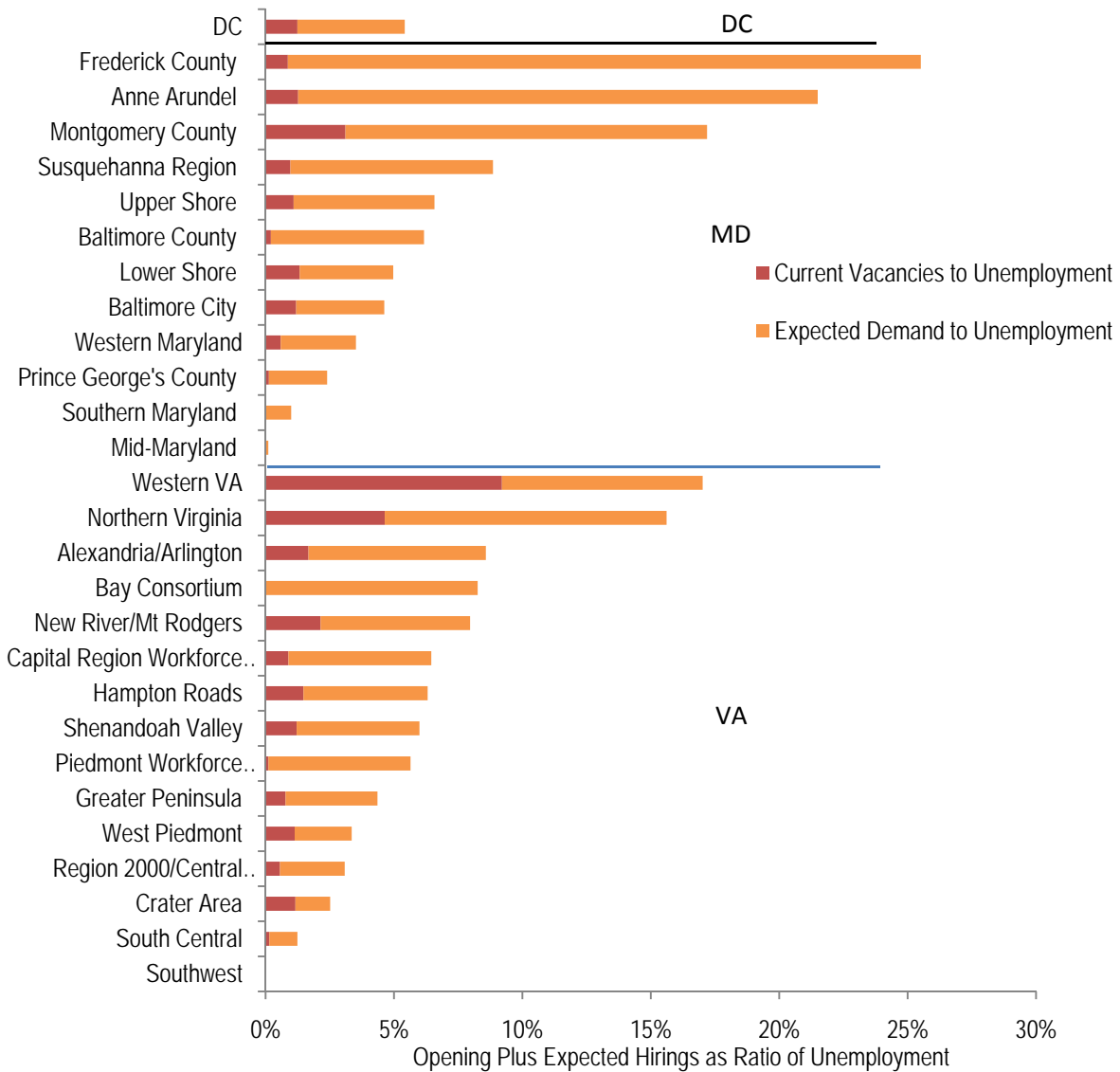
To paint a full picture of the labor market tightness, we look at a combined ratio of current green openings and expected green demand in relation to the current unemployed population. We determined this ratio for DC, each WIA in Maryland and Virginia, and by occupation in DC, Maryland, Virginia, and DC Metro. When we analyzed the labor market tightness for occupations, we used 2-digit SOC codes and their associated unemployment by occupation data.

For this analysis, we consider labor supply to be workers without a job and actively looking for employment. Later in the report, we assess labor supply considering the pipeline of completers from local education programs.

MARC Region

Figure 15 below highlights the labor market tightness for the entire region by WIA (DC is a WIA by itself). The areas with the highest combined ratio, meaning that there is a close match between job seekers and open positions, include Frederick County, Maryland; Anne Arundel County, Maryland; Montgomery County Maryland; Western Virginia, and Northern Virginia. The top three regions are in Maryland, with Western and Northern Virginia close behind. Looking at the breakdown of current vacancies and expected green demand, the WIAs in Virginia have more current openings while the WIAs in Maryland have more expected green demand. DC's ratio is relatively low compared to several of the WIAs in both Maryland and Virginia. This means that in DC there are more unemployed workers relative to green job vacancies than in other parts of the region.

Figure 15. Green Labor Market Tightness by WIA
(2010-2012, MARC Region)



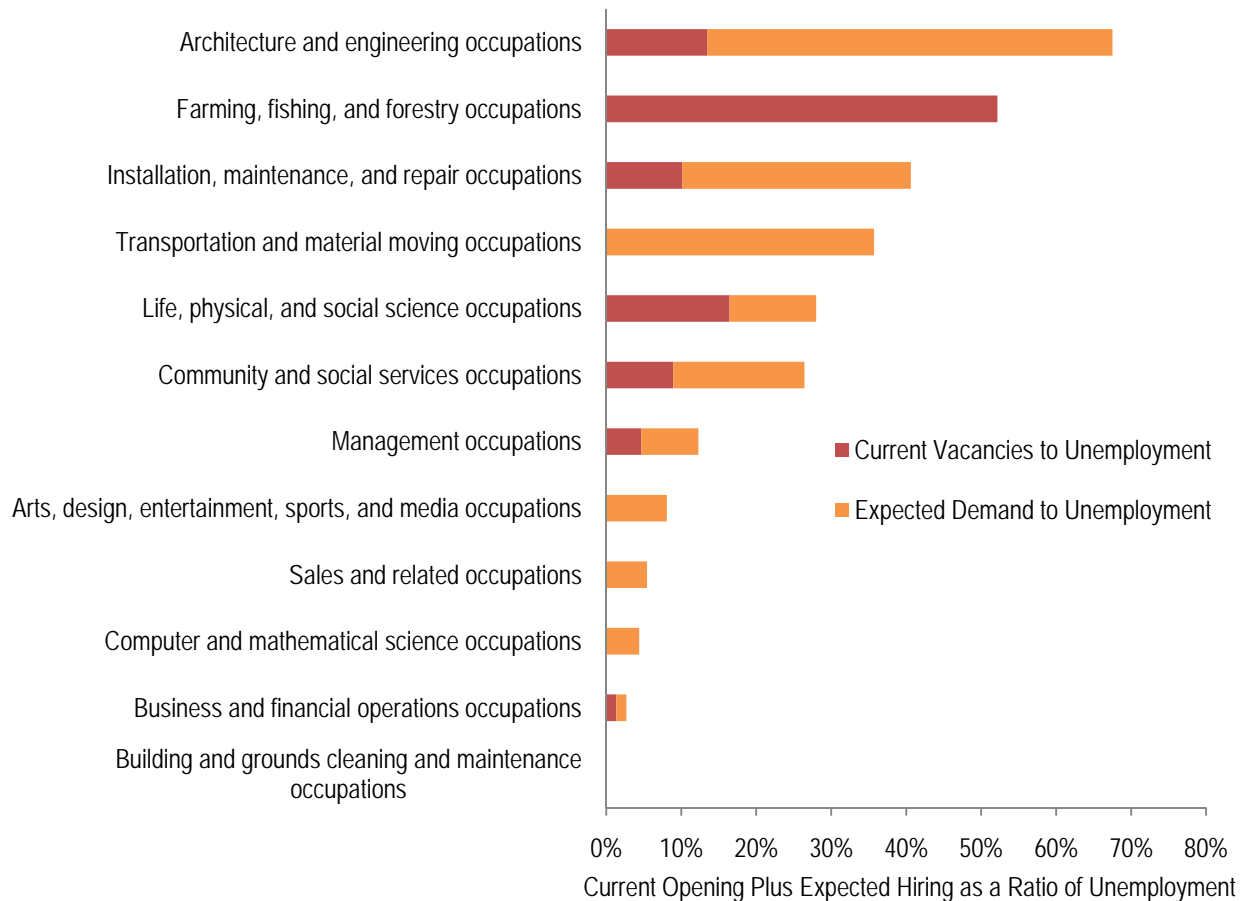
District of Columbia

Breaking down the labor market tightness ratio by occupation for DC, architecture and engineering occupations have the highest tightness ratio at 70 percent, followed by farming, fishing, and forestry occupations at over 50 percent. For installation, maintenance, and repair occupations, the ratio is slightly above 40 percent in DC.

As Figure 16 illustrates, all the occupations except farming, fishing, and forestry have a substantial expected green demand component in the ratio. This indicates that the expected growth may create green jobs for workers currently unemployed in the region. The farming, fishing, and forestry occupation is the

only occupation across the three regions that reports positive current openings with no expected green demand.

Figure 16. Green Labor Market Tightness by Occupation
(2010 - 2012, DC)

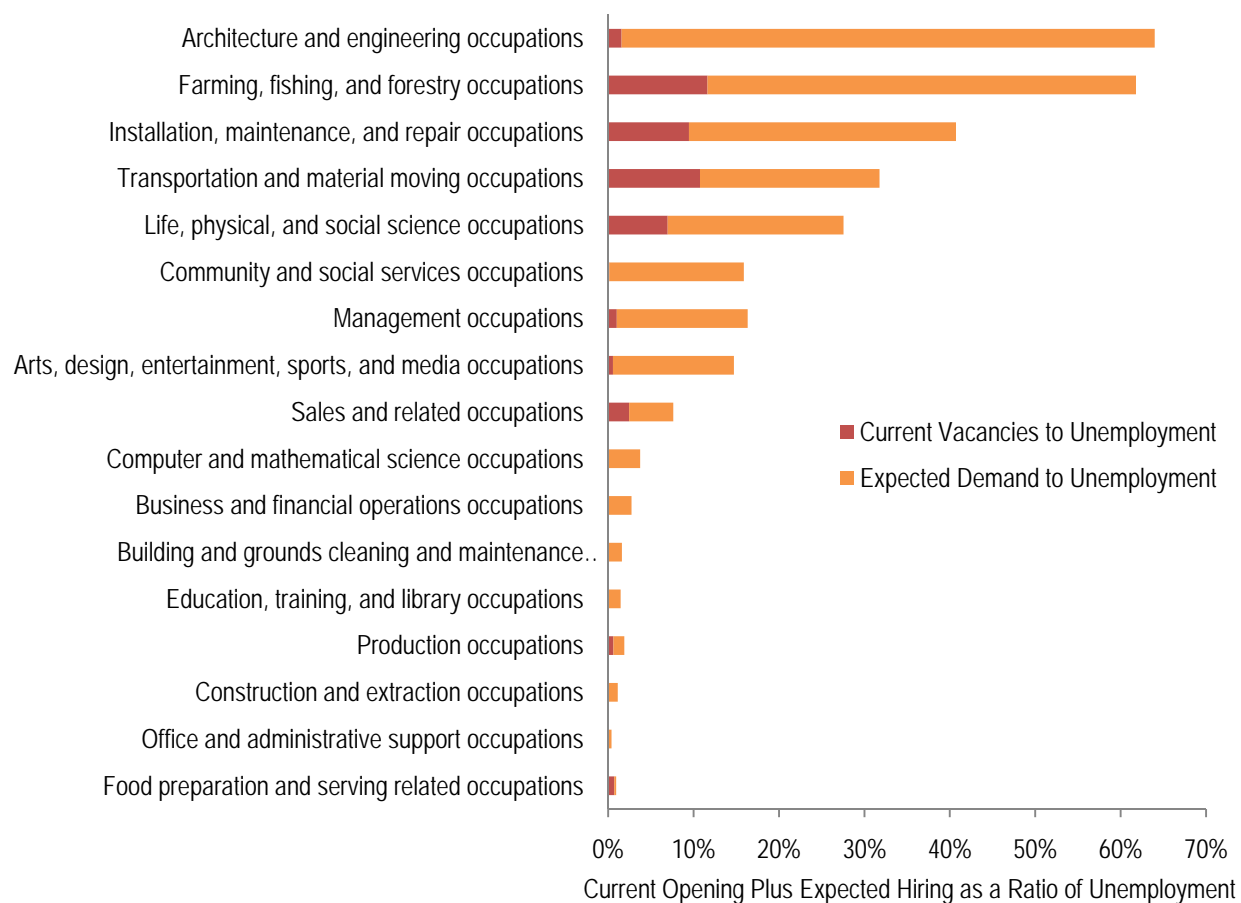


Maryland

The highest tightness ratios in Maryland mirror those in DC with architectural and engineering occupations at about 65 percent, followed by farming, fishing, and forestry occupations at 70 percent, and installation, maintenance, and repair occupations at 40 percent. In Maryland, expected green demand dominates a large portion of the ratio, especially because some occupations report no current openings but positive expected demand. At approximately 65 percent, the ratio for architectural and engineer occupations in Maryland implies that there are 0.65 jobs for each unemployed worker.

Figure 17. Green Labor Market Tightness by Occupation

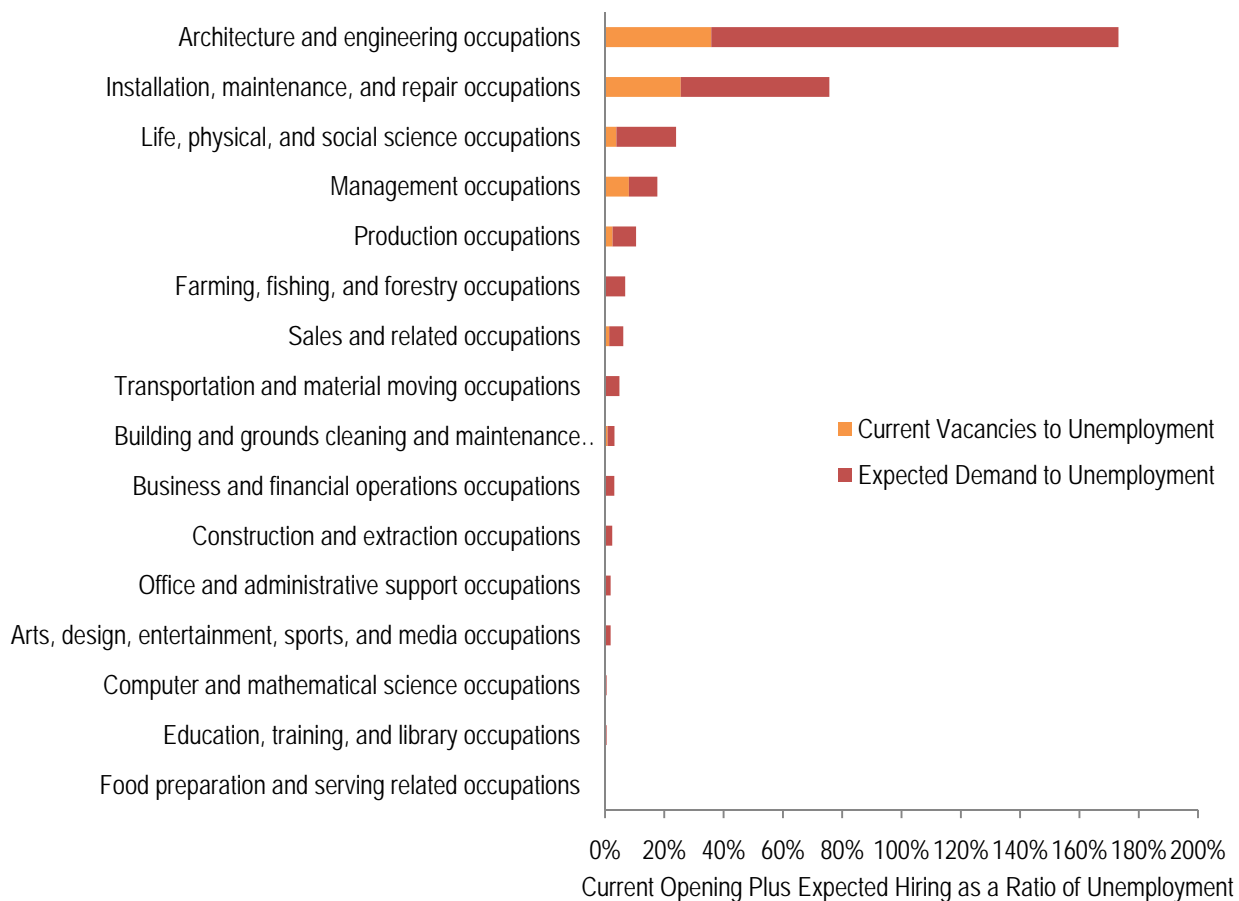
(2010 - 2012, MD)



Virginia

Although Virginia does not have farming, fishing, and forestry in the top three ratios, the top two ratios—architecture and engineering occupations, and installation, maintenance, and repair occupations—are in both DC and Maryland’s top three ratios. The architecture and engineering tightness ratio of 1.7 implies that approximately 1.7 green positions exist for each unemployed worker. In Virginia, the ratio for the top two occupations is higher than for the other occupations. The third highest-ranked occupation—life, physical, and social science occupations—has a ratio of over 60 percent, while the remaining occupations are all below 25 percent. Although this concentration in only a few occupations appears in both DC and Maryland, Virginia shows a more extreme separation between the high-ratio and low-ratio occupations.

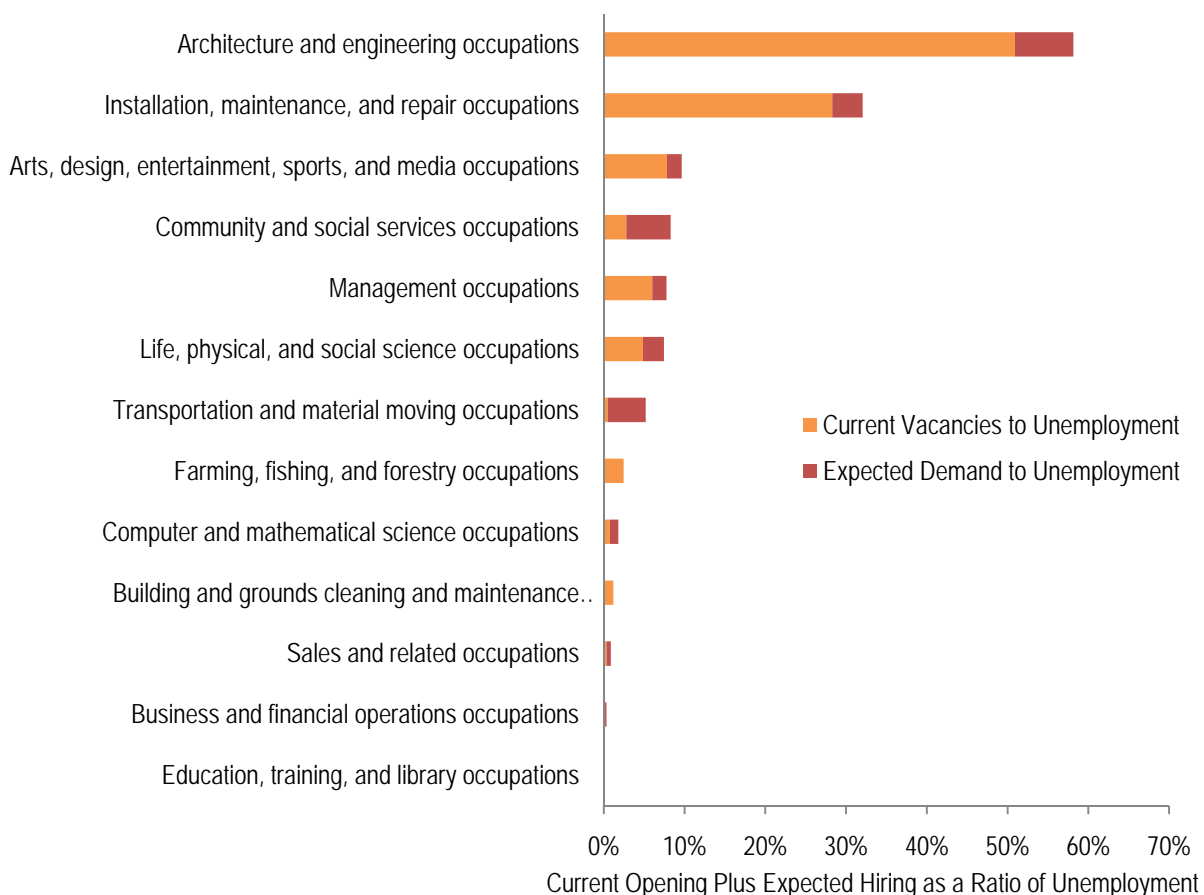
Figure 18. Green Labor Market Tightness by Occupation
(2010 - 2012, VA)



DC Metropolitan Area

As Figure 19 illustrates, architecture and engineering occupations have the highest labor market tightness ratios among green occupations in DC Metro. Installation, maintenance, and repair occupations have the second highest ratios. In DC Metro, art, design, entertainment, sports, and media occupations rank third, which is substantially higher than in the other regions. Finally, the expected green demand portion of the ratios dominates the openings portion in the other regions. In DC Metro, however, this relationship reverses and green openings dominate expected green demand.

Figure 19. Green Labor Market Tightness by Occupation
(2010 - 2012, DC Metro)



Conclusion

The ratios of vacancies to unemployment illustrate the relative opportunities for unemployed workers. Green job vacancies relative to unemployment are highest in Frederick County, Anne Arundel County, Montgomery County, Western Virginia, and Northern Virginia. In terms of occupations, architectural and engineering occupations maintain the highest ratio in all three jurisdictions as well as in DC Metro. Finally, the breakdown of the tightness ratio demonstrates that different regions and occupations have more expected green job vacancies than current openings and vice versa. Current openings dominate the green job vacancies in DC Metro, and the job opportunities in farming, fishing and forestry occupations in DC and DC Metro.

Dominated by expected demand, the DC ratio reaches roughly 5 percent. This implies that current openings and expected demand account for 5 percent of the unemployed labor force with potential to work in green occupations. When these ratios are broken down by occupation clusters, however, the total number of vacancies exceeds 70 percent of the unemployed. In DC, green opportunities exist for those

seeking architecture and engineering occupations; farming, fishing and forestry occupations; and installation, maintenance, and repair occupations; among others.

In Maryland, Frederick County, Anne Arundel County, and Montgomery County have the highest ratios with vacancies accounting for 18 to 25 percent of the unemployed population. Architectural and engineering vacancies in Maryland account for about 70 percent of those unemployed in the occupation while farming, fishing, and forestry vacancies account for about 65 percent.

In Virginia, the WIAs with the highest ratios include Western Virginia, Northern Virginia, and Alexandria/Arlington. The Western Virginia and Northern Virginia green vacancies account for roughly 18 percent and 16 percent of the unemployed populations, respectively. In Virginia, we observe a ratio of over 180 percent for architecture and engineering occupations—there are more green vacancies available in Virginia than unemployed workers in that occupation. Installation, maintenance, and repair vacancies account for about 80 percent of the unemployed workers in Virginia in that occupation.

Green Labor Market Gap

In the previous section, we described the supply of unemployed workers relative to the openings and expected demand for green jobs. In this section, we examine another element of labor supply—the pipeline of completers from secondary education programs, community colleges, universities, and other forms of training. We estimate the green gap by subtracting the pipeline of completers from the green demand, both for current and expected supply and demand. A positive gap indicates an over-supply of workers, while a negative gap indicates an under-supply of workers.

To characterize this gap, we take the difference between the labor supply and demand in each green occupation. Where possible, we calculate the gap separately for the current openings and the expected green demand to define a current green gap and an expected green gap. For this analysis, we only include occupations with positive openings in the survey data. Where there is no positive demand, the gaps only account for education completers and, by default, indicate an over-supply. Our objective is to characterize how education and training programs meet green demand, both current and expected, so we limit the analysis to occupations with a positive demand.

For each region, we break down the labor market gap into three education categories: bachelor's or higher degree; associate's degree; and vocational degree and other; and long, moderate, and short-term OJT. This process, however, systematically overestimates the supply of workers because completers have the option to pursue either a green or a traditional occupation, while we consider the green demand only. This gap analysis is intended to describe the landscape of qualified candidates. In essence, an under-supply in this analysis would be more severe than in a traditional gap analysis that considers the entire spectrum of green and traditional jobs because in our analysis the supply fails to meet only a subset of the demand.

Graduates with a bachelor's or higher degree represent the highest over-supply of workers. Although these data indicate a labor market flooded with graduates, it is important to note that the major universities in the

MARC region supply both local and national jobs. Moreover, workers with a bachelor's degree tend to be more mobile in their job search and more likely to relocate after graduation. Because we are unable to model the university graduate leakages, the supply figures overestimate the actual pool of local qualified graduates. To accurately model the supply of workers with higher degrees for the MARC region, we would need to know the leakage rate from the universities to other regions as well as the out-of-region leakage into MARC.

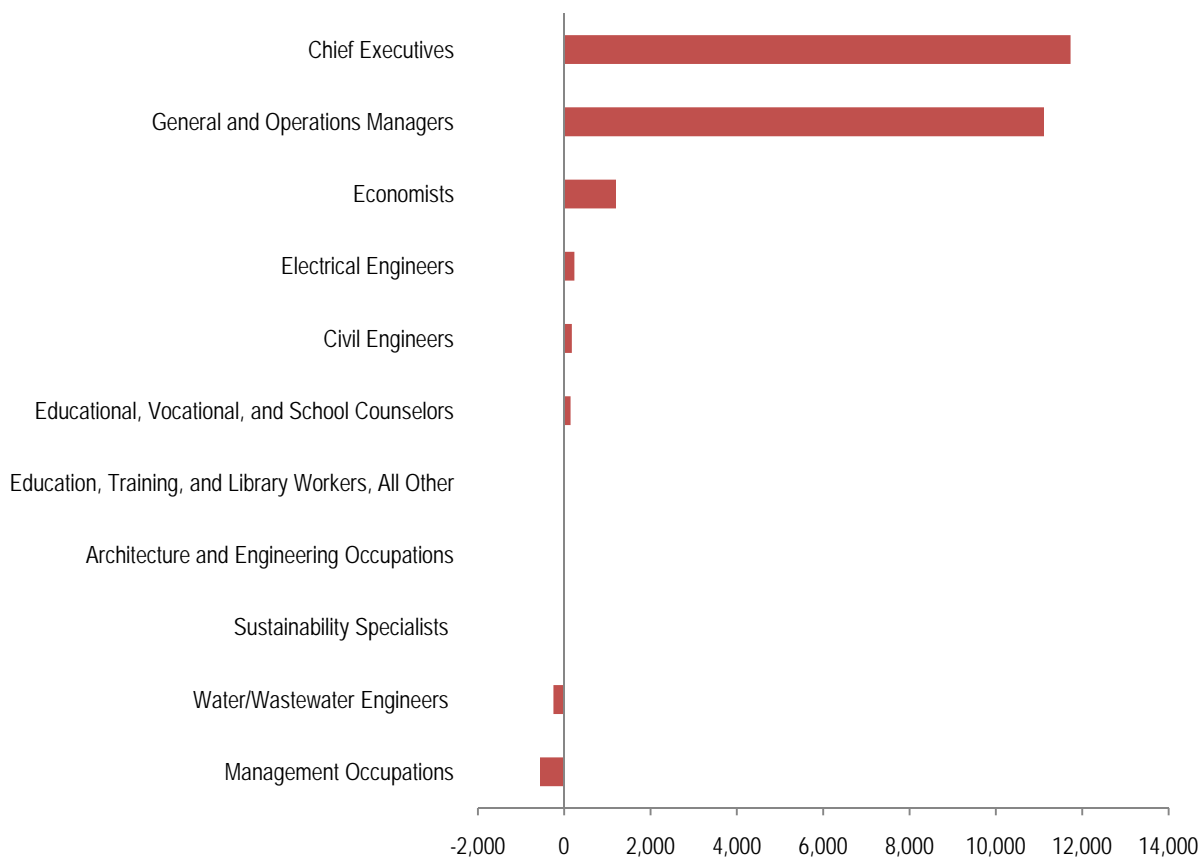
Although this analysis does not capture the true supply of undergraduate and graduate workers, it does highlight the relative job opportunities for these graduates. Consideration should be given to those occupations with a negative gap or an under-supply of workers. A negative gap might signal to universities to encourage graduates to remain in the region, as ample job opportunities exist. It may also indicate that the universities should expand their existing programs or create new programs to fill these green positions.

Graduates with an associate's degree, a vocational degree, and OJT tend to have more ties to the community and can be expected to be more likely stay in the MARC region. Because of these characteristics, the supply estimates for these graduates represents a more accurate estimate. The remainder of this section describes the green labor market gap for all degree levels for DC, Maryland, Virginia, and DC Metro.

District of Columbia

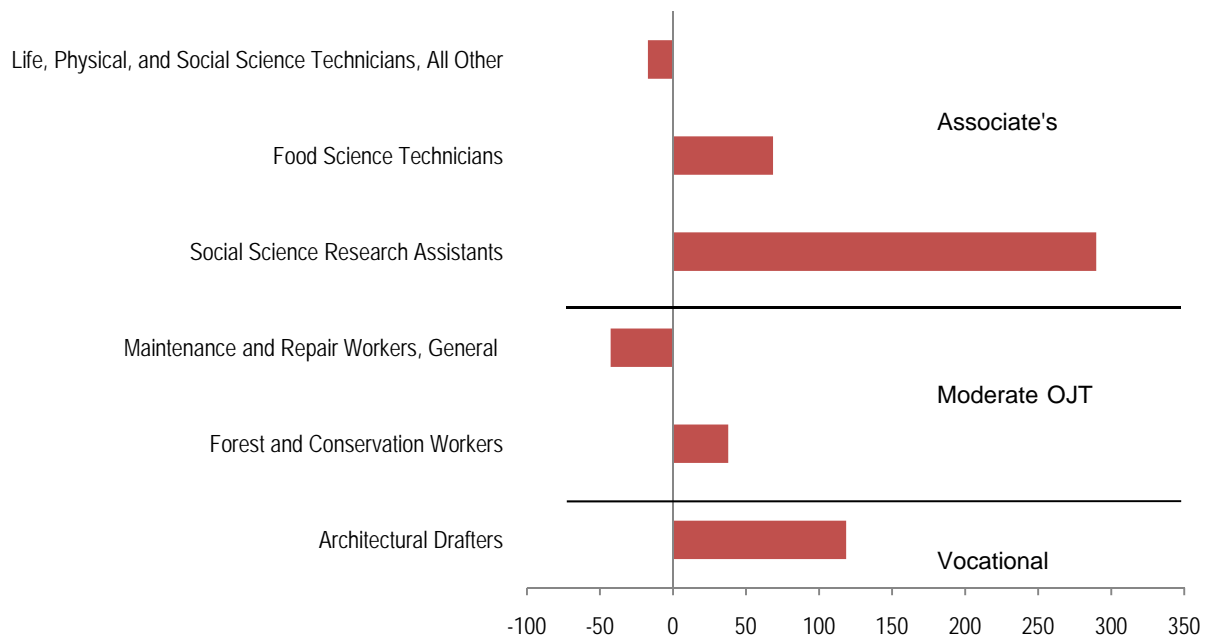
Figure 20 below highlights the over-supply discussed above. Chief executives, general and operations managers, economists, electrical engineers, and civil engineers exhibit an over-supply generated by the universities in DC including, but not limited to American University, Catholic University, Gallaudet University, Georgetown University, George Washington University, Howard University, and the University of the District of Columbia. The region also hosts a number of satellite campuses from universities across the country. DC is known as a national hub of education and these universities grant thousands of bachelor's degrees each year and most have established graduate programs. These graduates tend to search for employment nationwide. However, we observe an under-supply in water/wastewater engineers and management occupations. Because we are only capturing the green demand, the under-supply is understated in the larger picture of the labor demand and may indicate a need for universities to develop programs to support these occupations.

Figure 20. Current Green Labor Market Gap, bachelor's Degree or Higher
(2010, DC)



For jobs not requiring a bachelor's degree, there are both positive and negative green labor market gaps in DC. As shown in Figure 21, social science research assistants and architectural drafters have the largest over-supply in DC, while life science and social science teachers and maintenance and repair workers have the greatest under-supply.

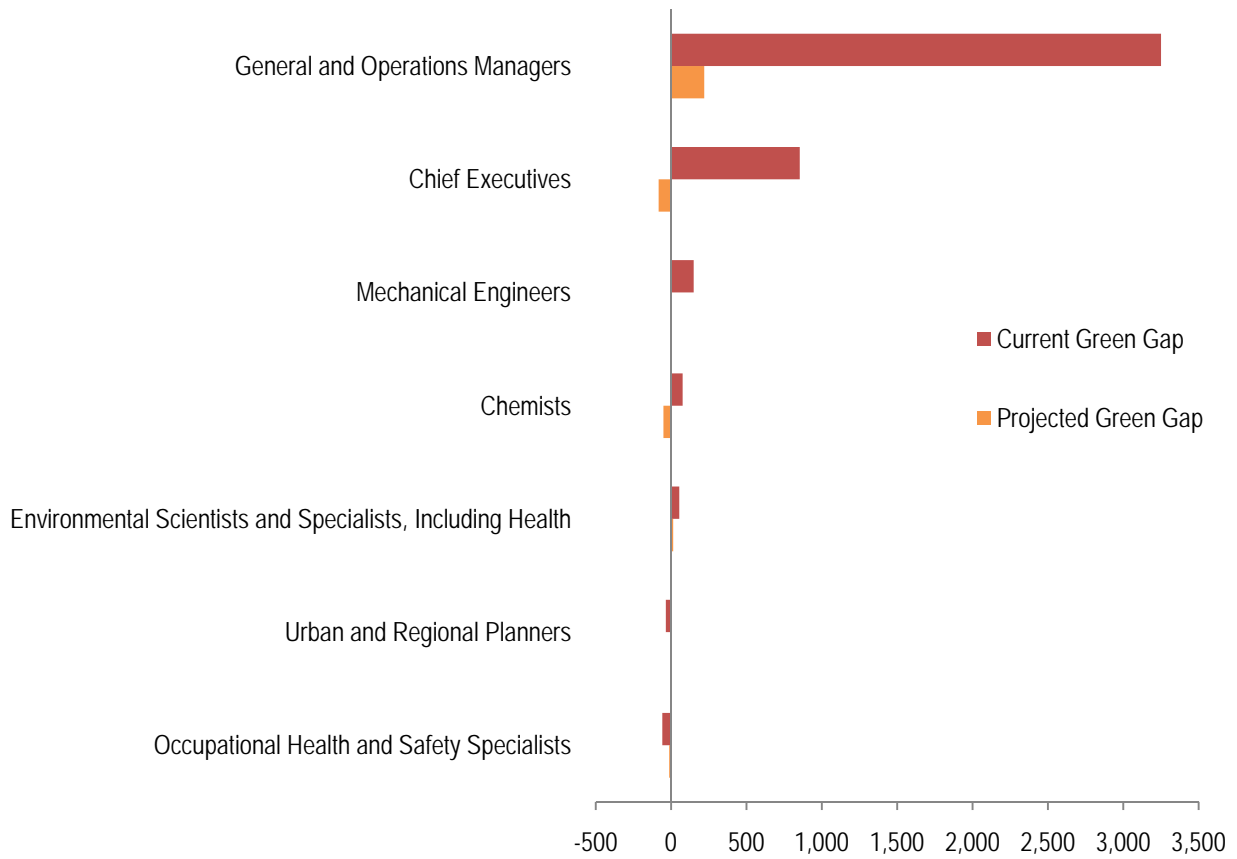
Figure 21. Current Green Labor Market Gap, associate's Degree, Vocational Degree, OJT
(2010, DC)



Maryland

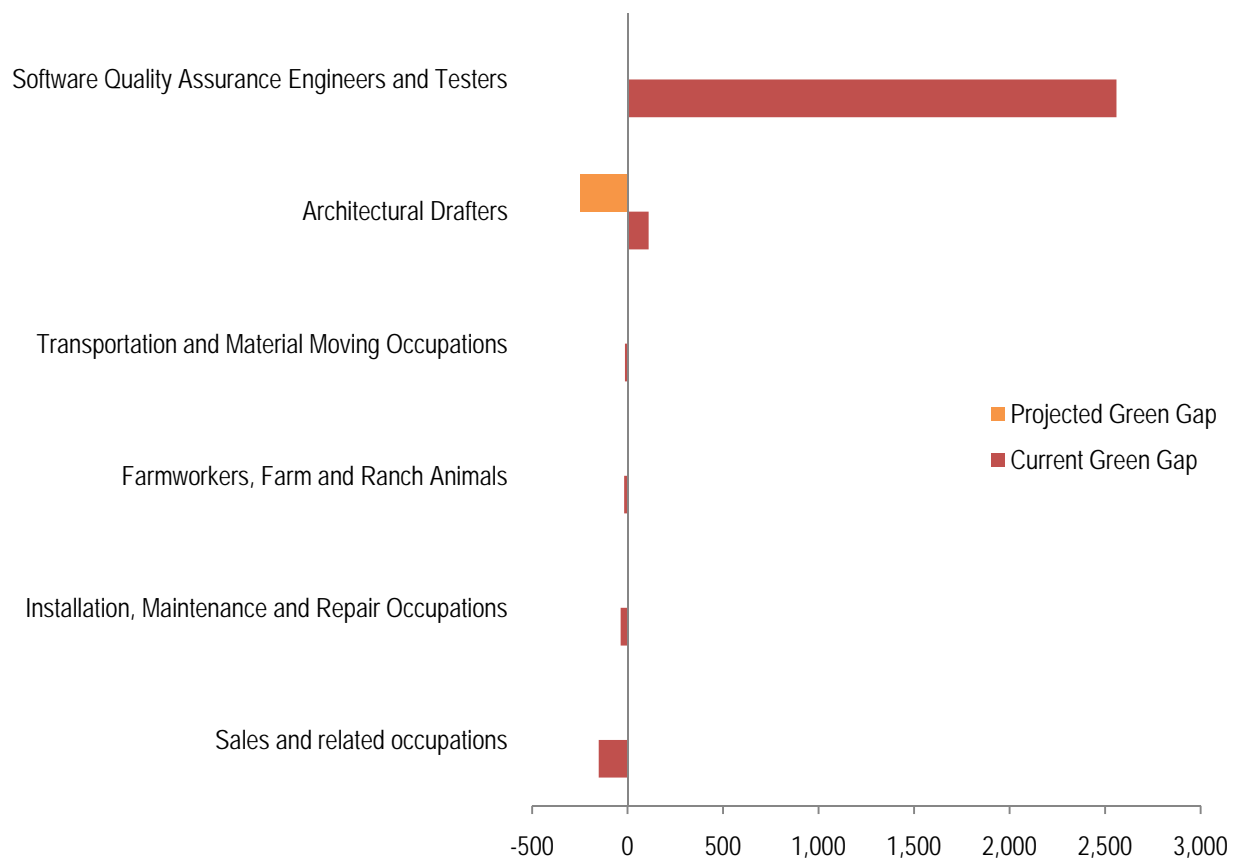
Similar to DC, there is an over-supply of workers in Maryland in many green occupations that require a bachelor's or higher degree, including both general and operations managers and chief executives. Where we were able to make future supply projections, we see an over-supply of chief executives and chemists but a projected under-supply for both in Maryland. Finally, we observe an under-supply for urban and regional planners and occupational health and safety specialists in the state.

Figure 22. Current and Projected Green Labor Market Gap, bachelor's Degree or Higher
(2010 - 2012, MD)



The gap analysis reveals an over-supply of software quality assurance engineers and testers and heating and air conditioning mechanics and installers in Maryland. When the current gap is compared to the projected gap, architectural drafters exhibit a current over-supply but a large projected under-supply.

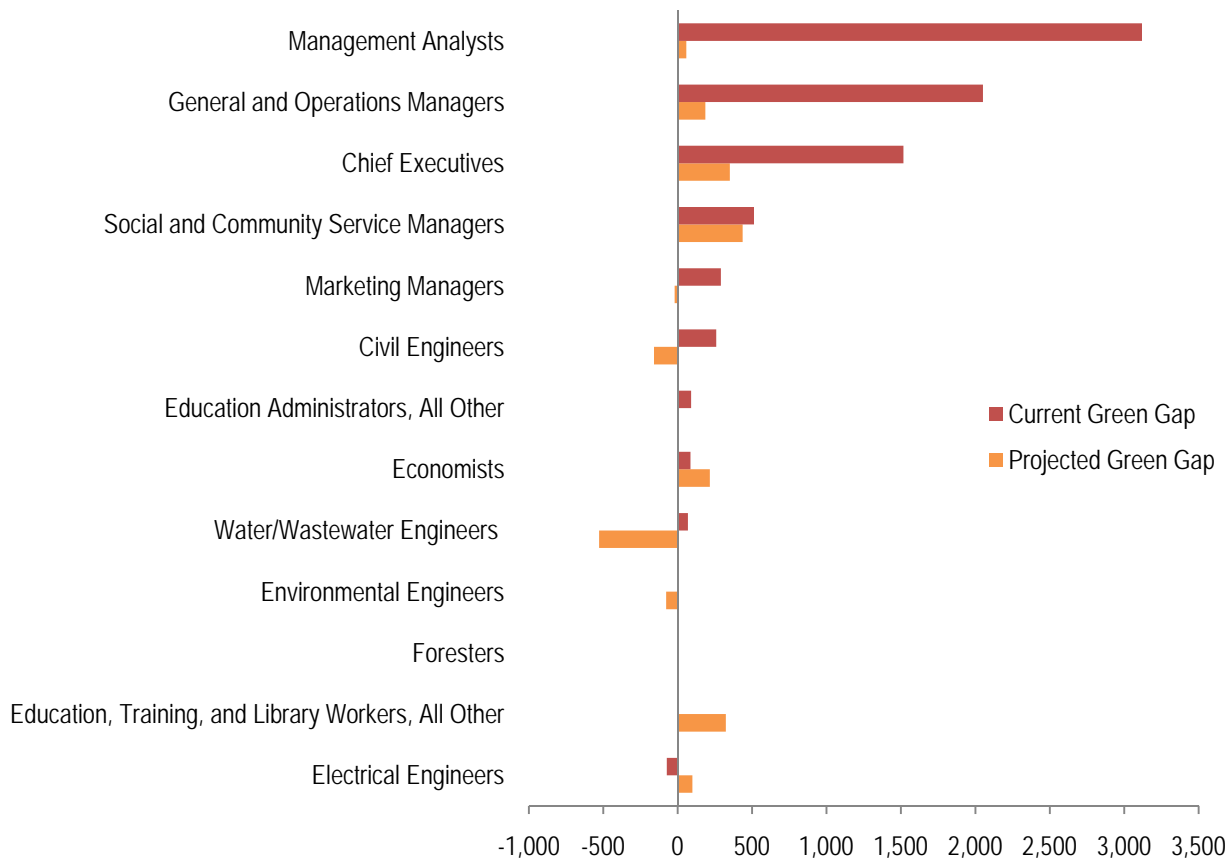
Figure 23. Current Green Labor Market Gap, associate's Degree, Vocational Degree, OJT
(2010 - 2012, MD)



Virginia

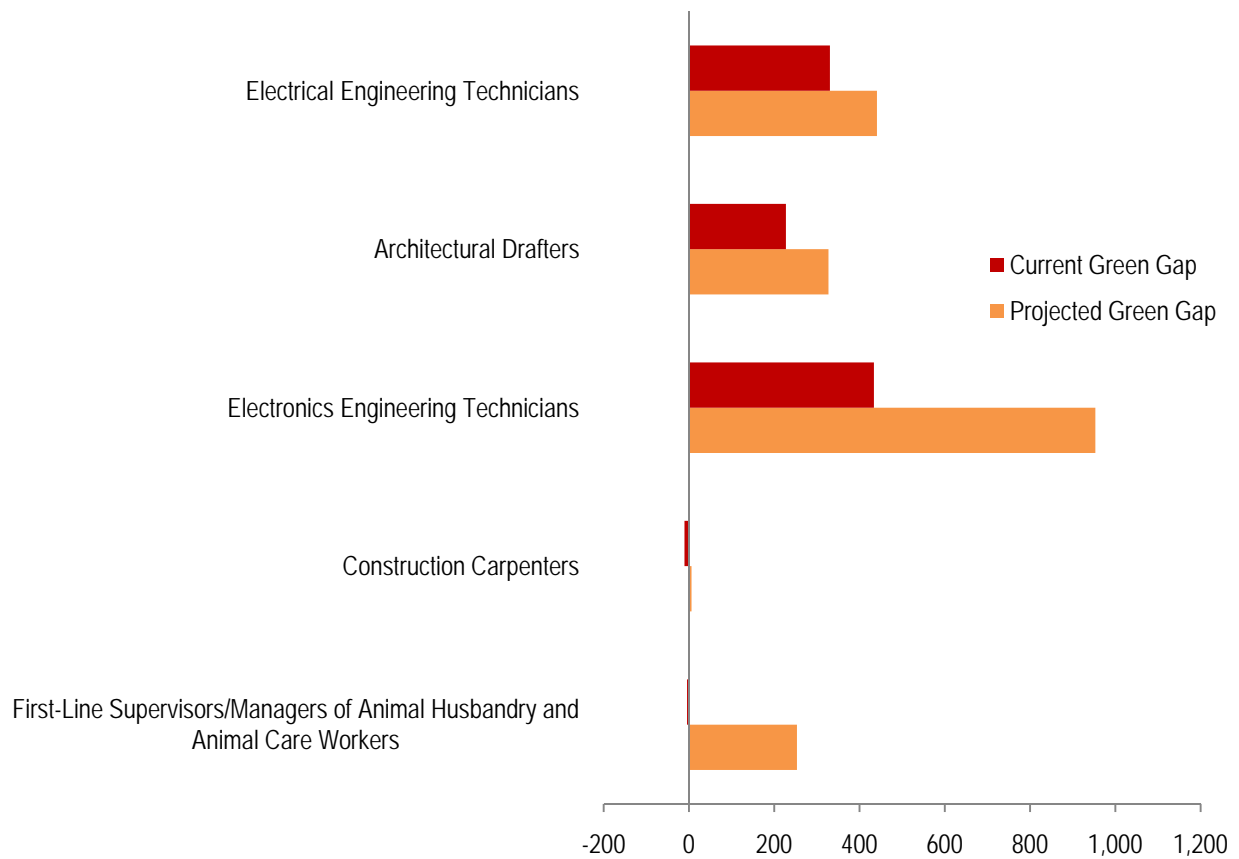
In Virginia, the green gap for graduates holding a bachelor's or higher degree exhibit the same tendencies as in DC and Maryland. There is an over-supply of chief executives, general and operations managers, and economists, among others. Although Virginia has a current over-supply of water/wastewater engineers, the occupation shows an under-supply of water/wastewater engineers projected over the next two years. The same is true for marketing managers and civil engineers. For electrical engineers and education training and library workers, the opposite relationship exists in Virginia—these occupations have a projected over-supply but a current under-supply.

Figure 24. Current and Projected Green Labor Market Gap, bachelor's Degree or Higher
(2010 - 2012, VA)



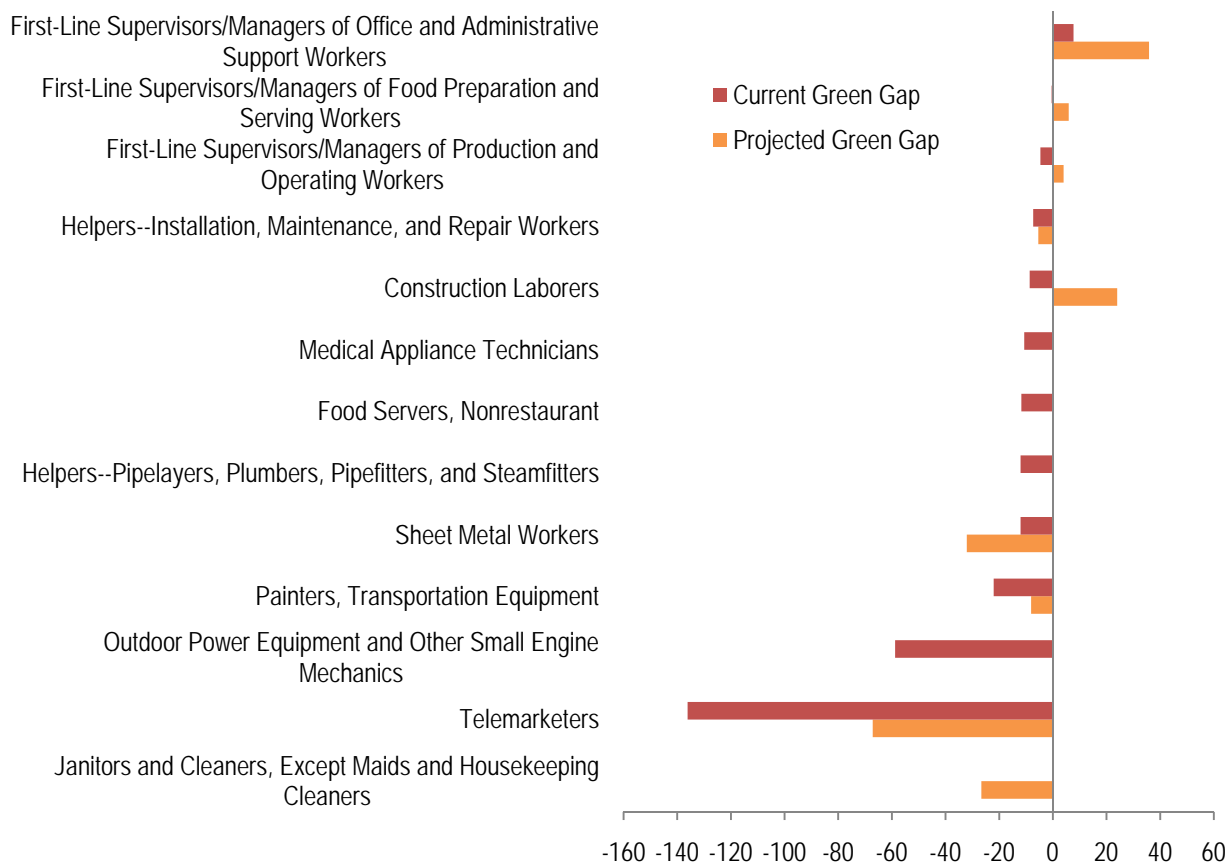
For the selected occupations in Virginia reporting an associate's degree or vocational degree, there is a current and projected over-supply. Two occupations, construction carpenters and first-line supervisors of animal husbandry and animal care workers, show a very small under-supply.

Figure 25. Current Green Labor Market Gap, associate's Degree, Vocational Degree
(2010 - 2012, VA)



Survey respondents in Virginia reported a large number of OJT jobs with positive demand. Figure 26 indicates that all but two of the OJT occupations in Virginia have negative gaps, which means that there is an insufficient supply of labor to fill current and future green job openings. Although the projected gap for construction laborers is positive, the other OJT projected gaps remain negative and the magnitude of the negative gap for sheet metal workers is projected to double.

**Figure 26. Current Green Labor Market Gap, OJT
(2010 - 2012, VA)**



DC Metropolitan Area

Figures 27 through 29 present the current green labor market gaps in DC Metro. Because of data limitations, we were unable to project the supply for DC Metro.

Figure 27 breaks down the gap for green occupations requiring a bachelor's or higher degree in DC Metro. Again, there is an over-supply of general and operations managers, chief executives, economists, and civil engineers, and an under-supply of water/wastewater engineers.

Figure 27. Current Green Labor Market Gap, bachelor's Degree or Higher
(2010, DC Metro)

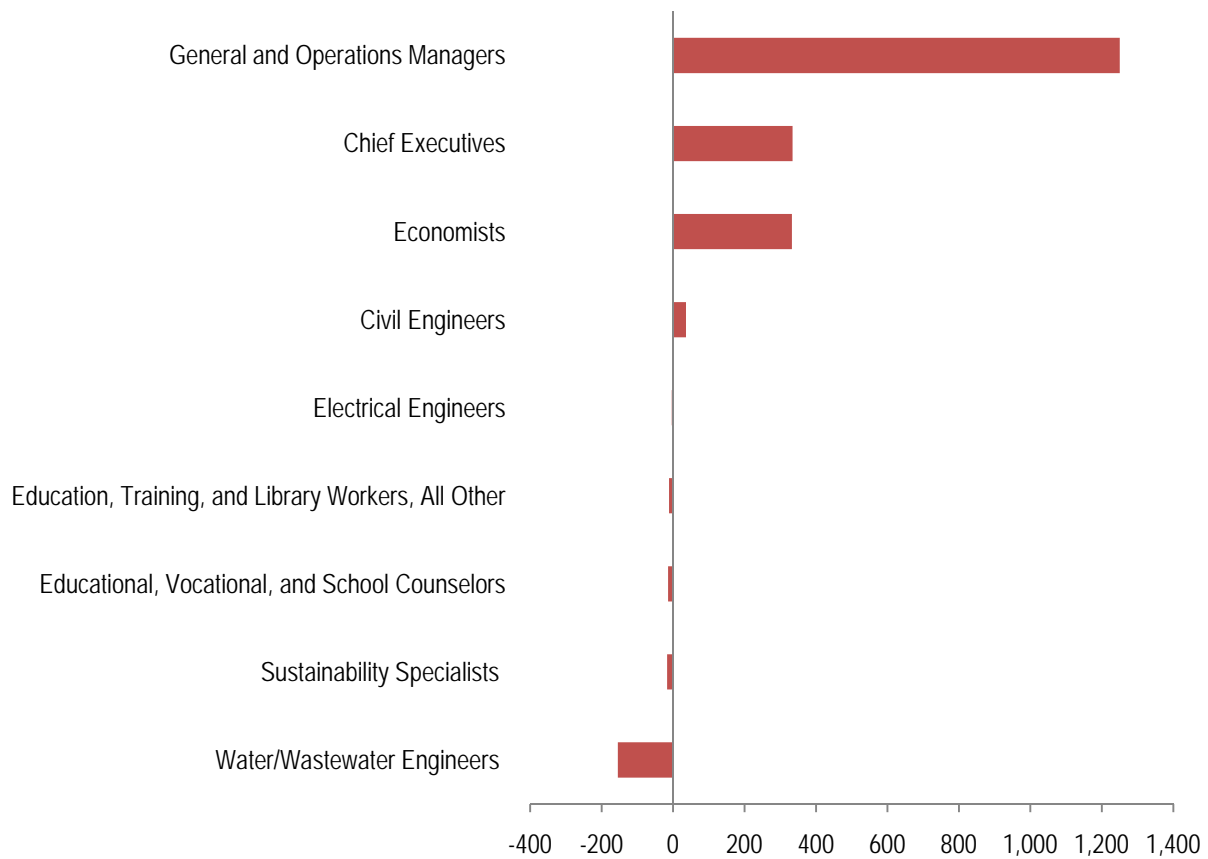


Figure 28 breaks down the green gap for occupations that require an associate's degree, a vocational degree, or other non-bachelor's-related degree. Since DC Metro is a composite of DC, Maryland, and Virginia, many similarities exist. Where there are differences, we can make inferences about the regional location of jobs and jobs migrating towards the city. Software quality assurance engineers and testers and social science researchers exhibit over-supplies in Maryland and DC, respectively, as well as DC Metro. Electrical engineering technicians are over-supplied in Virginia and under-supplied in DC Metro. This difference indicates that individuals in this occupation could be concentrated in areas outside DC Metro, while the job opportunities are concentrated within it, creating a mismatch between supply and demand.

Figure 28. Current Green Labor Market Gap, associate's Degree, Vocational Degree
(2010, DC Metro)

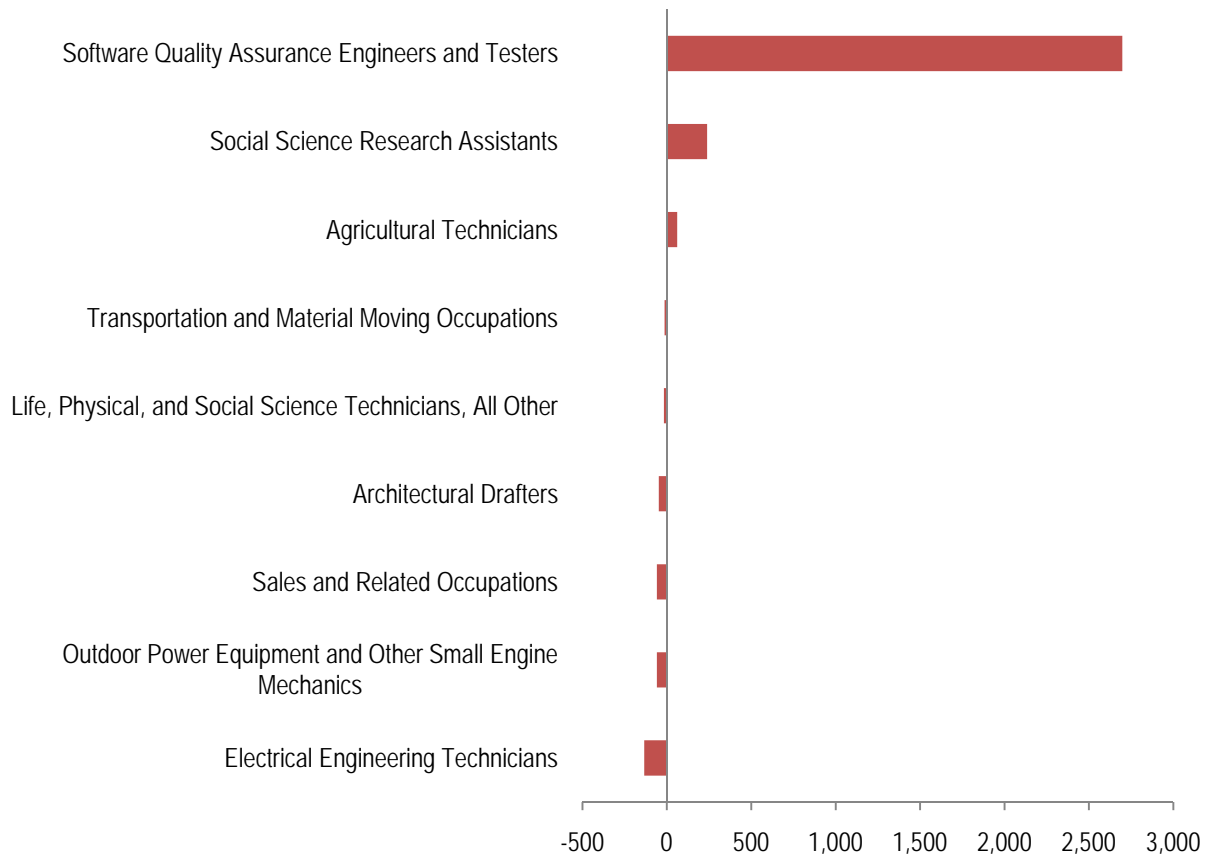
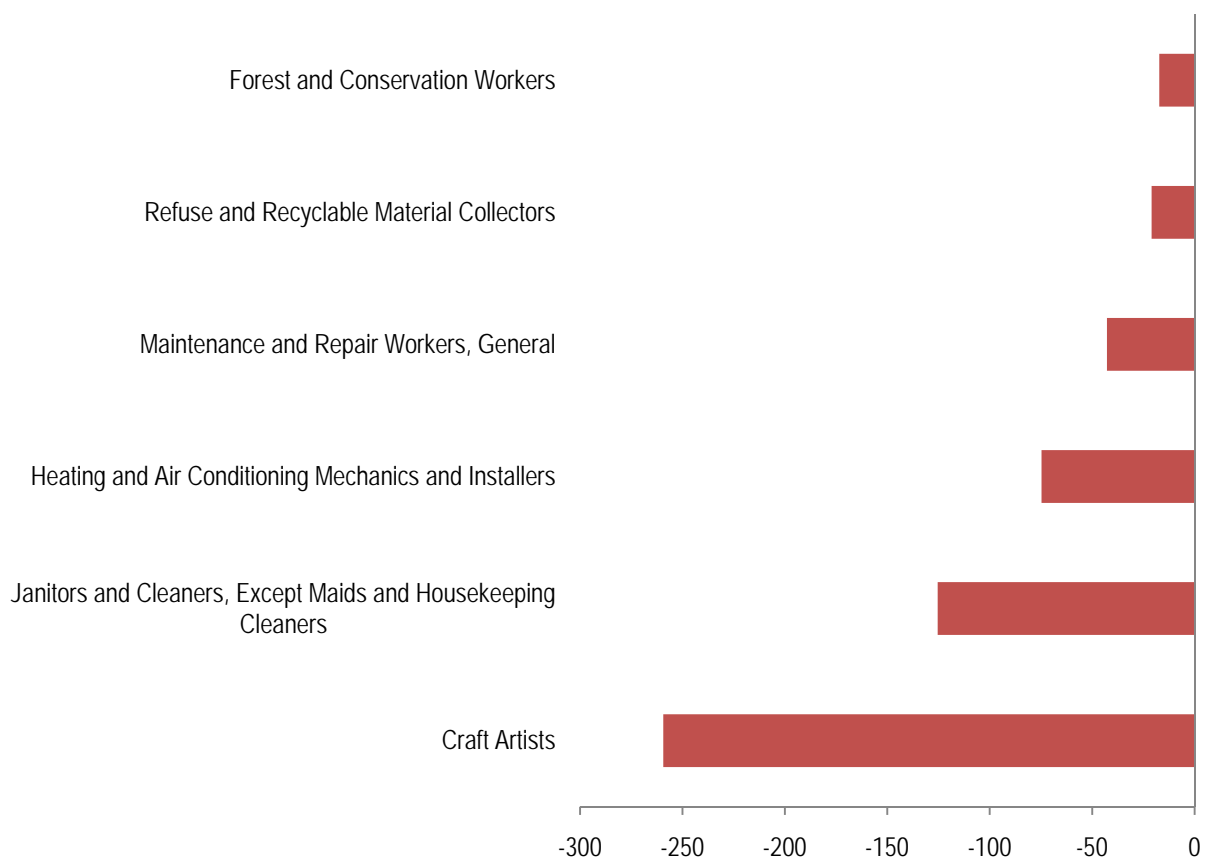


Figure 29 reveals that all green occupations that report OJT experience an under-supply. The most severe under-supply occurs for craft artists, followed by janitors and cleaners (except maids and housekeeping cleaners), and heating and air conditioning mechanics and installers.

Figure 29. Current Green Labor Market Gap, OJT
(2010, DC Metro)



Conclusion

Although the green gap only reflects a segment of the demand, we are able to make general conclusions. There are some occupations that maintain a current over-supply but exhibit a large under-supply over the next two years. There are also distinct differences between the regions with some occupations having an under-supply in one region and an over-supply in another.

In DC, we estimate an over-supply in several of the occupations that typically require a bachelor's degree including chief executives, general managers, and economists. These results reflect the large number of undergraduate and graduate institutions in DC and the qualified workers they produce for both the immediate region and the entire country. We see an under-supply in the typically higher education occupations, including water/wastewater engineers and management occupation. For jobs typically requiring less than bachelor's, we estimate an over-supply in DC in social science research assistants and architectural drafters. We observe an under-supply for life physical and social science technicians and maintenance and repair workers.

In Maryland, we see an over-supply for general and operations managers and chief executives, again reflecting the educational institutions in the region. We see a small under-supply for urban and regional planners and occupational health and safety specialists. Although this may indicate a lack of local programs aimed at these professions, we are not capturing any completers from institutions outside the state. For Maryland jobs not requiring a bachelor's degree, we observe an over-supply of software quality assurance engineers and testers and heating and air condition mechanics and installers and a large under-supply of water and liquid treatment plants and systems operators and craft artists. In Maryland occupations, architectural drafters have a current over-supply of workers but a projected under-supply over the next two years.

In Virginia, we estimate a general over-supply in most occupations reporting a bachelor's or higher degree with the exception of water/wastewater, civil, environmental, and electrical engineers. Since the green occupations in Virginia reporting an under-supply center on engineering programs, educational institutions may be able to take this information to revamp their engineering programs to cater to these green occupations. For occupations reporting less than a bachelor's degree, not including OJT, there is generally an over-supply of workers. In Virginia, for jobs reporting OJT, we estimate several occupations with an under-supply, most notably for telemarketers and outdoor power equipment and other small engine mechanics.

Green Career Pathways

This section presents potential career pathways between traditional occupations and green occupations. Specifically, we examine green occupations that are growing rapidly or have a limited supply and then map traditional occupations into them. Because our gap estimates identified occupations that not only have a limited green supply, but an overall limited supply for traditional occupations, the pipeline of completers would not be able to fulfill these positions. We choose traditional occupations that are currently shedding jobs or showing signs of stagnant growth and map them into growing green occupations.

The process of mapping these occupations involved three steps. First, we identified target occupations, which are green occupations showing large growth in the region that lack sufficient supply to meet the green demand. Next, we ran each target occupation through EMSI's career pathways module to generate the top 20 compatible occupations. EMSI defines a "compatibility index" for each pair of occupations based on similar wages, skill sets, and knowledge requirements. Using the list of top 20 compatible occupations with the target green occupation, we designated source occupations that both achieved a compatibility index of 90 or above (out of 100) and that are expected to either decline or remain stagnant over the next two years. Finally, we looked at the skill profiles of each occupation and identified both skill gaps and wage differentials between the occupations. The remainder of this section presents several examples of these green pathways.

District of Columbia

For DC, we chose agriculture technicians as a target occupation because the current number of green jobs in this occupation is expected to double over the next 2 years. As a source occupation, we chose pesticide

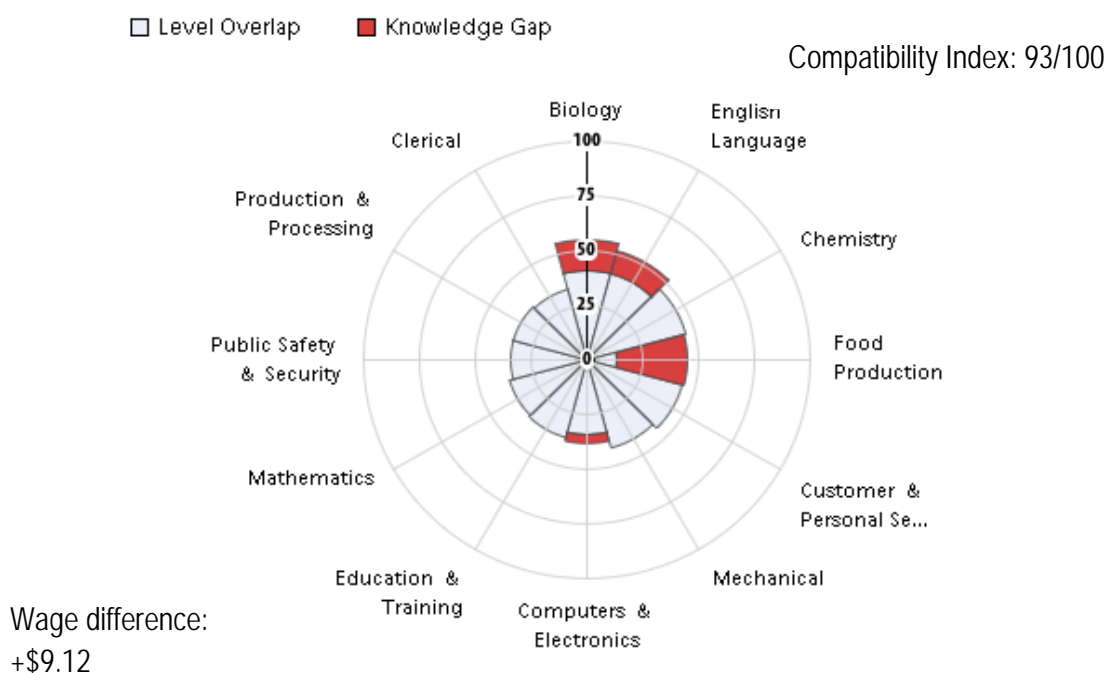
handlers, sprayers, and applicators (vegetation) because the occupation is not expected to grow over the next two years and it maintains a 93/100 compatibility with agricultural technicians.

Because pesticide handlers are not generally shedding jobs, the wage difference factors into workers' willingness to part with their jobs. Agricultural technicians make a median hourly wage that is \$9.12 higher than that of pesticide handlers. Not only would this transition provide higher pay, but it also represents a switch from polluting activities (such as spraying pesticides) to more environmentally sound activities (such as advising farmers on improving water quality).

Finally, the knowledge areas required in these jobs, presented in Figure 30, generally overlap. Admittedly, a worker would need additional training in food production, English language, computers and electronics, and biology to be able to transition into the new occupation.

Figure 30. Target: Agricultural Technicians
Source: Pesticide Handlers, Sprayers, and Applicators, Vegetation
(2010 - 2012, DC)

Most Important Knowledge Levels



Maryland

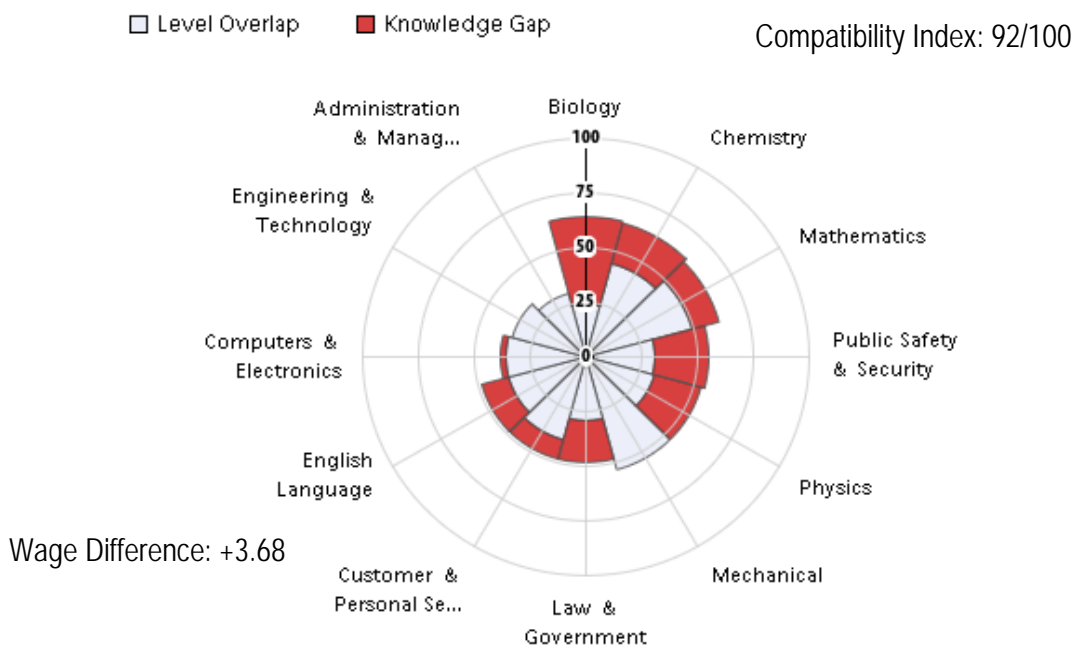
For Maryland, we selected water and liquid waste treatment plant systems operators as a target green occupation because of its 40 current openings and its current gap of -47. For the source occupation, we selected both crushing, grinding, and polishing machine setters (operators and tenders) and farmers and ranchers. In some instances, multiple candidates may feed into one target occupation based both on low

growth and a high compatibility index. In this case, crushing, grinding, and polishing machine setters (operators and tenders) are not projected to grow over the next two years and have a compatibility index of 92/100 with the target occupation. Farmers and ranchers are expected to shed more than 200 positions over the next two years and maintain a 90/100 compatibility index with the target occupation.

Figure 31 presents the knowledge gap between water and liquid waste treatment plant and system operators and the source occupation crushing, grinding, and polishing machine setter operators and tenders. Many of the knowledge gaps occur in the sciences, including biology, chemistry, mathematics, and physics. These types of gaps persist with farmers and ranchers, as indicated in Figure 31. Although these are more significant gaps than in other pathways, they point to a need for a shift in community college offerings and programs and present an opportunity for more targeted green educational programs.

Figure 31. Target: Water & Liquid Waste Treatment Plant and System Operators
Source: Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders
 (2010 - 2012, MD)

Most Important Knowledge Levels



Although the median wage increase for a worker in crushing, grinding, and polishing machine setters is low, the wage difference for farmers and ranchers is much more significant. Farmers and ranchers transitioning into water and liquid waste treatment plant and system operators would need to take classes in the same hard sciences, but the expected payoff of an additional \$12.30 in hourly wages might more than compensate for their investment.

Figure 32. Target: Water and Liquid Waste Treatment Plant and System Operators

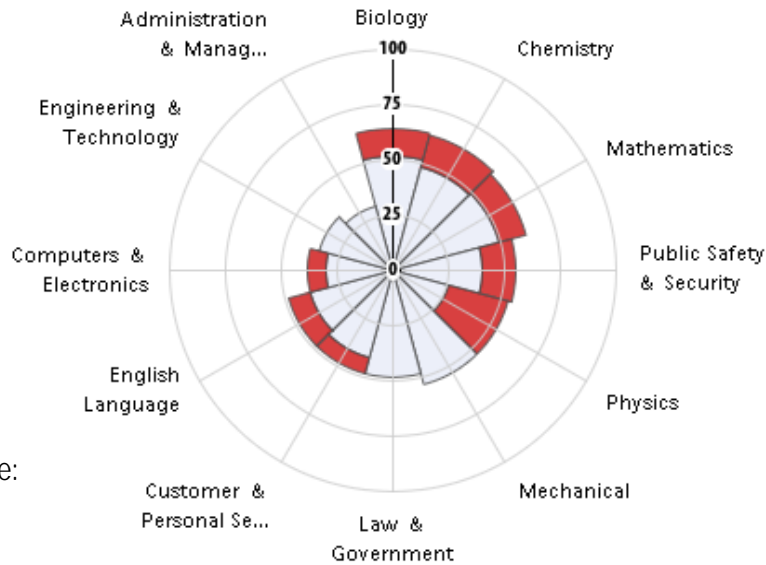
Source: Farmers and Ranchers

(2010 - 2012, MD)

Most Important Knowledge Levels

Compatibility Index: 90/100

□ Level Overlap ■ Knowledge Gap



Wage Difference:
+\$12.30

Virginia

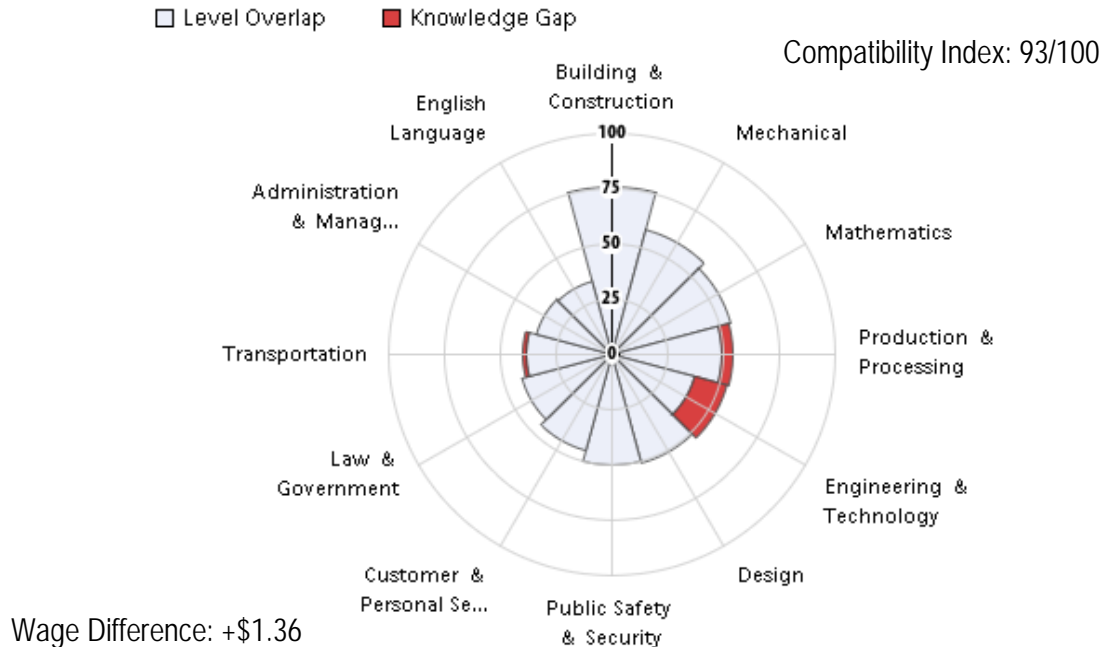
For Virginia, we selected construction carpenters as the target green occupation because it is projected to grow by more than 50 positions over the next two years. The source occupation—drywall and ceiling tile installers—is projected to experience little-to-no growth over the two years. The two occupations have a compatibility index of 93/100 and a wage increase of \$1.36. This example, as shown in Figure 33, presents a high level of overlap between the knowledge areas. The transition involves the construction carpenter needing to acquire knowledge in transportation, production and processing, and engineering and technology.

Figure 33. Target: Drywall and Ceiling Tile Installers

Source: Construction Carpenters

(2010 - 2012, VA)

Most Important Knowledge Levels



DC Metropolitan Area

For DC Metro, we identified the target occupation of heating and air conditioning mechanics and installers. The region reported 125 current green openings and expected green demand of more than 1,000 positions over the next two years. For this target occupation, we identified two source occupations—telecommunications, equipment installers and repair, except line installers; and farmers and ranchers. Both source occupations are expected to lose jobs over the next two years: 24 jobs for telecommunication equipment installers and 381 positions for farmers and ranchers.

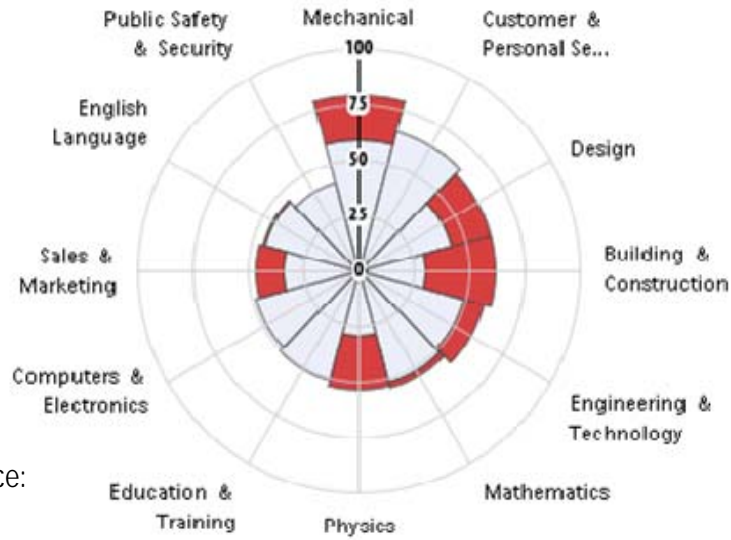
Figures 34 and 35 present the knowledge gaps between the source and target occupations. Telecommunication workers would need to acquire mechanical, design, building and construction, engineering and technology, mathematics, physics, and sales and marketing skills. The hourly wage increase associated with the transition to the target green job would be \$0.51. For farmers and ranchers, there is a similar knowledge gap but a much larger hourly wage increase of \$16.66. Although the skill gaps seem large for these two occupations and the target green occupation, they maintain high compatibility indices. In addition, air conditioning and maintenance installers generally require OJT as the primary form of training.

Figure 34. Target: Heating and Air Conditioning Mechanics & Installers
 Source: Telecommunications Equipment Installers & Repairers (Except Line Installers)
 (2010 - 2012, DC Metro)

Most Important Knowledge Levels

□ Level Overlap ■ Knowledge Gap

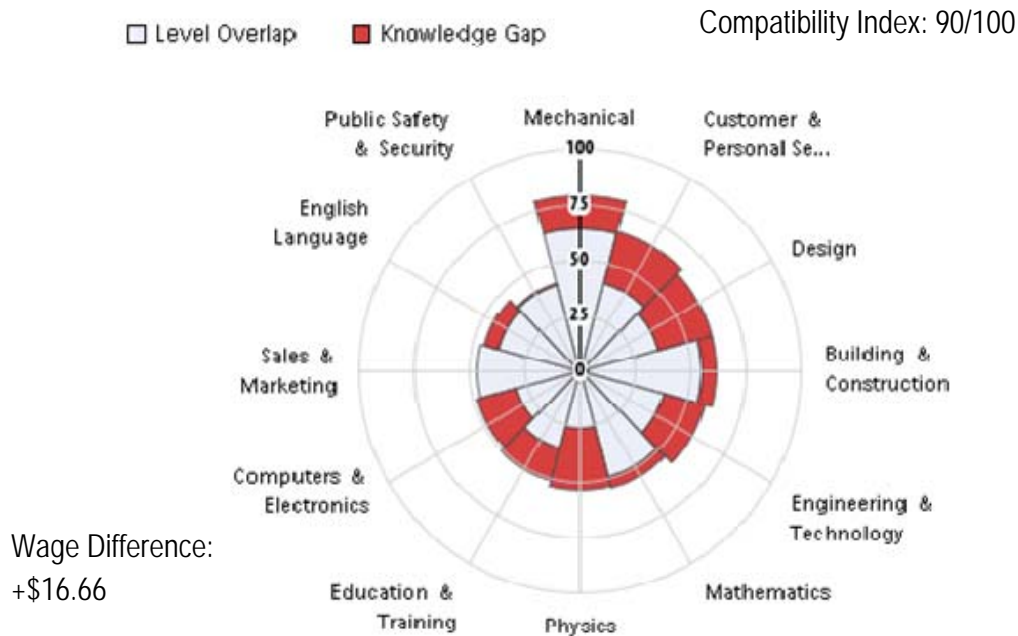
Compatibility Index: 93/100



Wage Difference:
 +\$0.51

Figure 35. Target: Air Conditioning Mechanics and Installers
 Source: Farmers and Ranchers
 (2010 - 2012, DC Metro)

Most Important Knowledge Levels



Conclusion

The green career green pathways illustrate that green jobs represent opportunities for dislocated workers and those in stagnant occupations. In several cases, transitioning to green occupations can lead to higher wages. Through these pathways, we are able to identify source occupations that are compatible with the growing green occupations and that, in some cases, require limited additional training. Identified training gaps include those in hard sciences, such as biology and physics, knowledge that can be acquired through community colleges. Similar exercises could identify areas where community colleges could grow to support the transition from traditional occupations to green occupations.

For DC, we show not only a career pathway based on skill sets and knowledge levels from pesticide handlers, sprayers, and applicators into agricultural technicians, but a pathway that also maps workers from a high-polluting job into a green job. The pesticide handlers would need some training in biology and food preparation, but would also receive, on average, a \$9.12 higher hourly wage.

In Maryland, we map two source occupations into one target green occupation. We see that crushing, grinding, and polishing machine setters, and farmers and ranchers both can feed into the target occupation, water, and liquid waste treatment plant system operators. Workers from both source occupations would be paid higher wages after the transition; however, workers in these two source occupations would require training in biology, chemistry, mathematics, and physics.

In Virginia, we mapped construction carpenters into drywall and ceiling tile installers. This exercise shows that the transition could involve minimal training and still involve higher wages in the green occupation.

These career pathways are just a handful of the many potential ways traditional occupations could be mapped into green occupations. Each green occupation has many sources that could map into them while each traditional occupation could map into several green occupations.

Overall Conclusion

We observed regional patterns in relation to educational attainment in green jobs. In DC, the green occupations generally require a bachelor's or higher degree. This finding supports the notion that the DC green workforce is centered on service and professional occupations that require higher degrees. In Maryland, the majority of the green job openings do not require a bachelor's degree. Virginia and DC Metro have a much more even spread of required education levels for green jobs even though more than 50 percent of green jobs in these regions do not require a bachelor's degree.

We observed expected higher wages for higher degrees and, in general, higher wages in DC Metro. One deviation, ignoring DC Metro wages, occurs in Virginia, which has the highest wages for green occupations requiring OJT. We observed no current openings or expected green demand for low-wage green jobs in DC and little to no openings, expected green demand, or jobs in the highest wage range in Maryland.

Labor market tightness ratios allow us to see how vacancies and unemployed workers are distributed across the region. The five WIAs across the region with the highest ratios of vacancies to unemployed workers are Frederick County, Maryland; Anne Arundel County, Maryland; Montgomery County, Maryland; Western Virginia; and Northern Virginia. Architectural and engineering occupations have the highest ratios, followed by farming, fishing, and forestry occupation or by installation, maintenance, and repair occupations. In DC, Maryland, and Virginia, expected green demand outweighs the current openings, while the number of current openings is high in DC Metro.

Several occupations are over-supplied in one region and under-supplied in another region. Several occupations also present a current over-supply but a projected under-supply. Such information could be useful for training programs to identify where their training lacks the ability to supply the needed green workers for the region.

Finally, we demonstrated various green career pathways for dislocated workers. We mapped traditional occupations that show signs of stagnant growth or shedding jobs over the next two years into growing green occupations. The mapping process identified both the knowledge discrepancies between the source and target occupations and the wages differences. The mappings typically produced occupations with similar knowledge requirements and, when there were differences, they tended to be in hard sciences and other courses offered by community colleges. We also observed wage increases for many of the dislocated workers associated with transitioning into the green occupations.

In DC, we generally found more service and professional green workforce and its associated high wages. We also observed in DC a large over-supply of workers in positions reporting a bachelor's or higher degree.

In Maryland, we observed a large number of production and manufacturing green jobs, and jobs that rely mainly on OJT. A green economy that uses OJT as a primary training tool would be able to readily adapt to changing industry standards and train workers as they move from traditional occupations to green ones, or even as workers transition to "greener" aspects of the occupation where they currently work.

In Virginia, we observed a balanced spread of professional, service, production, and manufacturing jobs, most likely due to the economic diversity of the state, major cities, major production hubs, and rural farmland. We observed a relatively even spread of education attainment, wages, and job openings to support several sectors of the green economy in the state.

Using public data sources and ICF's green jobs survey, we identified various traits of the green labor market in DC, Maryland, Virginia, and DC Metro. This research allows us to identify job locations and expected wages. It identifies various green occupations that currently exhibit, or are expected to exhibit, a shortage of workers. These findings can be used by local workforce agencies, community colleges, and other training institutions to better prepare potential workers and equip them with the knowledge necessary to participate in green activities in the future. Workers could use the findings in this report for guidance on where green jobs are located, their typical training requirements, and prospective wages.

Appendix A: List of Green Industries

NAICS	NAICS Title
111110	Soybean Farming
111120	Oilseed (except Soybean) Farming
111130	Dry Pea and Bean Farming
111140	Wheat Farming
111150	Corn Farming
111160	Rice Farming
111191	Oilseed and Grain Combination Farming
111199	All Other Grain Farming
111211	Potato Farming
111219	Other Vegetable (except Potato) and Melon Farming
111310	Orange Groves
111320	Citrus (except Orange) Groves
111331	Apple Orchards
111332	Grape Vineyards
111333	Strawberry Farming
111334	Berry (except Strawberry) Farming
111335	Tree Nut Farming
111336	Fruit and Tree Nut Combination Farming
111339	Other Noncitrus Fruit Farming
111411	Mushroom Production
111419	Other Food Crops Grown Under Cover
111421	Nursery and Tree Production
111422	Floriculture Production
111910	Tobacco Farming
111920	Cotton Farming
111930	Sugarcane Farming
111940	Hay Farming
111991	Sugar Beet Farming
111992	Peanut Farming
111998	All Other Miscellaneous Crop Farming
112111	Beef Cattle Ranching and Farming
112112	Cattle Feedlots
112120	Dairy Cattle and Milk Production
112210	Hog and Pig Farming
112310	Chicken Egg Production
112320	Broilers and Other Meat Type Chicken Production
112330	Turkey Production
112340	Poultry Hatcheries
112390	Other Poultry Production
112410	Sheep Farming

NAICS	NAICS Title
112420	Goat Farming
112511	Finfish Farming and Fish Hatcheries
112512	Shellfish Farming
112519	Other Aquaculture
112910	Apiculture
112930	Fur-Bearing Animal and Rabbit Production
112990	All Other Animal Production
113110	Timber Tract Operations
113210	Forest Nurseries and Gathering of Forest Products
113310	Logging
115111	Cotton Ginning
115112	Soil Preparation, Planting, and Cultivating
115113	Crop Harvesting, Primarily by Machine
115114	Postharvest Crop Activities (except Cotton Ginning)
115116	Farm Management Services
115210	Support Activities for Animal Production
115310	Support Activities for Forestry
212313	Crushed and Broken Granite Mining and Quarrying
212319	Other Crushed and Broken Stone Mining and Quarrying
212321	Construction Sand and Gravel Mining
213111	Drilling Oil and Gas Wells
221111	Hydroelectric Power Generation
221112	Fossil Fuel Electric Power Generation
221113	Nuclear Electric Power Generation
221119	Other Electric Power Generation
221121	Electric Bulk Power Transmission and Control
221122	Electric Power Distribution
221210	Natural Gas Distribution
221310	Water Supply and Irrigation Systems
221320	Sewage Treatment Facilities
221330	Steam and Air-Conditioning Supply
236115	New Single-Family Housing Construction (except Operative Builders)
236116	New Multifamily Housing Construction (except Operative Builders)
236117	New Housing Operative Builders
236118	Residential Remodelers
236210	Industrial Building Construction
236220	Commercial and Institutional Building Construction
237110	Water and Sewer Line and Related Structures Construction
237120	Oil and Gas Pipeline and Related Structures Construction
237130	Power and Communication Line and Related Structures Construction
237210	Land Subdivision
237310	Highway, Street, and Bridge Construction
237990	Other Heavy and Civil Engineering Construction

NAICS	NAICS Title
238110	Poured Concrete Foundation and Structure Contractors
238120	Structural Steel and Precast Concrete Contractors
238130	Framing Contractors
238140	Masonry Contractors
238160	Roofing Contractors
238170	Siding Contractors
238210	Electrical Contractors and Other Wiring Installation Contractors
238220	Plumbing, Heating, and Air-Conditioning Contractors
238290	Other Building Equipment Contractors
238310	Drywall and Insulation Contractors
238320	Painting and Wall Covering Contractors
238350	Finish Carpentry Contractors
238390	Other Building Finishing Contractors
238910	Site Preparation Contractors
238990	All Other Specialty Trade Contractors
311111	Dog and Cat Food Manufacturing
311119	Other Animal Food Manufacturing
311211	Flour Milling
311212	Rice Milling
311213	Malt Manufacturing
311221	Wet Corn Milling
311222	Soybean Processing
311223	Other Oilseed Processing
311225	Fats and Oils Refining and Blending
311230	Breakfast Cereal Manufacturing
311311	Sugarcane Mills
311312	Cane Sugar Refining
311313	Beet Sugar Manufacturing
311320	Chocolate and Confectionery Manufacturing from Cacao Beans
311330	Confectionery Manufacturing from Purchased Chocolate
311340	Nonchocolate Confectionery Manufacturing
311411	Frozen Fruit, Juice, and Vegetable Manufacturing
311412	Frozen Specialty Food Manufacturing
311421	Fruit and Vegetable Canning
311422	Specialty Canning
311423	Dried and Dehydrated Food Manufacturing
311511	Fluid Milk Manufacturing
311512	Creamery Butter Manufacturing
311513	Cheese Manufacturing
311514	Dry, Condensed, and Evaporated Dairy Product Manufacturing
311520	Ice Cream and Frozen Dessert Manufacturing
311611	Animal (except Poultry) Slaughtering
311612	Meat Processed from Carcasses

NAICS	NAICS Title
311613	Rendering and Meat Byproduct Processing
311615	Poultry Processing
311711	Seafood Canning
311712	Fresh and Frozen Seafood Processing
311811	Retail Bakeries
311812	Commercial Bakeries
311813	Frozen Cakes, Pies, and Other Pastries Manufacturing
311821	Cookie and Cracker Manufacturing
311822	Flour Mixes and Dough Manufacturing from Purchased Flour
311823	Dry Pasta Manufacturing
311830	Tortilla Manufacturing
311911	Roasted Nuts and Peanut Butter Manufacturing
311919	Other Snack Food Manufacturing
311920	Coffee and Tea Manufacturing
311930	Flavoring Syrup and Concentrate Manufacturing
311941	Mayonnaise, Dressing, and Other Prepared Sauce Manufacturing
311942	Spice and Extract Manufacturing
311991	Perishable Prepared Food Manufacturing
311999	All Other Miscellaneous Food Manufacturing
312111	Soft Drink Manufacturing
312120	Breweries
312130	Wineries
312140	Distilleries
312210	Tobacco Stemming and Redrying
312221	Cigarette Manufacturing
312229	Other Tobacco Product Manufacturing
313111	Yarn Spinning Mills
313112	Yarn Texturizing, Throwing, and Twisting Mills
313113	Thread Mills
313210	Broadwoven Fabric Mills
313221	Narrow Fabric Mills
313230	Nonwoven Fabric Mills
313241	Weft Knit Fabric Mills
313249	Other Knit Fabric and Lace Mills
313311	Broadwoven Fabric Finishing Mills
314110	Carpet and Rug Mills
314121	Curtain and Drapery Mills
314999	All Other Miscellaneous Textile Product Mills
315212	Women's, Girls', and Infants' Cut and Sew Apparel Contractors
315239	Women's and Girls' Cut and Sew Other Outerwear Manufacturing
321113	Sawmills
321114	Wood Preservation
321211	Hardwood Veneer and Plywood Manufacturing

NAICS	NAICS Title
321212	Softwood Veneer and Plywood Manufacturing
321213	Engineered Wood Member (except Truss) Manufacturing
321214	Truss Manufacturing
321219	Reconstituted Wood Product Manufacturing
321911	Wood Window and Door Manufacturing
321918	Other Millwork (including Flooring)
321920	Wood Container and Pallet Manufacturing
321991	Manufactured Home (Mobile Home) Manufacturing
321992	Prefabricated Wood Building Manufacturing
321999	All Other Miscellaneous Wood Product Manufacturing
322110	Pulp Mills
322121	Paper (except Newsprint) Mills
322122	Newsprint Mills
322130	Paperboard Mills
322211	Corrugated and Solid Fiber Box Manufacturing
322214	Fiber Can, Tube, Drum, and Similar Products Manufacturing
322299	All Other Converted Paper Product Manufacturing
323110	Commercial Lithographic Printing
323112	Commercial Flexographic Printing
323113	Commercial Screen Printing
323114	Quick Printing
323122	Prepress Services
324110	Petroleum Refineries
324121	Asphalt Paving Mixture and Block Manufacturing
324122	Asphalt Shingle and Coating Materials Manufacturing
324199	All Other Petroleum and Coal Products Manufacturing
325193	Ethyl Alcohol Manufacturing
325199	All Other Basic Organic Chemical Manufacturing
325211	Plastics Material and Resin Manufacturing
325212	Synthetic Rubber Manufacturing
325311	Nitrogenous Fertilizer Manufacturing
325312	Phosphatic Fertilizer Manufacturing
325314	Fertilizer (Mixing Only) Manufacturing
325320	Pesticide and Other Agricultural Chemical Manufacturing
325411	Medicinal and Botanical Manufacturing
325412	Pharmaceutical Preparation Manufacturing
325413	In-Vitro Diagnostic Substance Manufacturing
325510	Paint and Coating Manufacturing
325520	Adhesive Manufacturing
325611	Soap and Other Detergent Manufacturing
325612	Polish and Other Sanitation Good Manufacturing
325620	Toilet Preparation Manufacturing
325910	Printing Ink Manufacturing

NAICS	NAICS Title
325991	Custom Compounding of Purchased Resins
325992	Photographic Film, Paper, Plate, and Chemical Manufacturing
325998	All Other Miscellaneous Chemical Product and Preparation Manufacturing
326111	Plastics Bag and Pouch Manufacturing
326112	Plastics Packaging Film and Sheet (including Laminated) Manufacturing
326113	Unlaminated Plastics Film and Sheet (except Packaging) Manufacturing
326121	Unlaminated Plastics Profile Shape Manufacturing
326122	Plastics Pipe and Pipe Fitting Manufacturing
326130	Laminated Plastics Plate, Sheet (except Packaging), and Shape Manufacturing
326140	Polystyrene Foam Product Manufacturing
326150	Urethane and Other Foam Product (except Polystyrene) Manufacturing
326160	Plastics Bottle Manufacturing
326191	Plastics Plumbing Fixture Manufacturing
326192	Resilient Floor Covering Manufacturing
326199	All Other Plastics Product Manufacturing
326212	Tire Retreading
326299	All Other Rubber Product Manufacturing
327111	Vitreous China Plumbing Fixture and China and Earthenware Bathroom Accessories
327112	Vitreous China, Fine Earthenware, and Other Pottery Product Manufacturing
327121	Brick and Structural Clay Tile Manufacturing
327122	Ceramic Wall and Floor Tile Manufacturing
327123	Other Structural Clay Product Manufacturing
327124	Clay Refractory Manufacturing
327125	Nonclay Refractory Manufacturing
327211	Flat Glass Manufacturing
327212	Other Pressed and Blown Glass and Glassware Manufacturing
327213	Glass Container Manufacturing
327215	Glass Product Manufacturing Made of Purchased Glass
327310	Cement Manufacturing
327320	Ready-Mix Concrete Manufacturing
327331	Concrete Block and Brick Manufacturing
327332	Concrete Pipe Manufacturing
327390	Other Concrete Product Manufacturing
327410	Lime Manufacturing
327420	Gypsum Product Manufacturing
327991	Cut Stone and Stone Product Manufacturing
327993	Mineral Wool Manufacturing
327999	All Other Miscellaneous Nonmetallic Mineral Product Manufacturing
331111	Iron and Steel Mills
331210	Iron and Steel Pipe and Tube Manufacturing from Purchased Steel
331221	Rolled Steel Shape Manufacturing
331222	Steel Wire Drawing
331311	Alumina Refining

NAICS	NAICS Title
331312	Primary Aluminum Production
331314	Secondary Smelting and Alloying of Aluminum
331315	Aluminum Sheet, Plate, and Foil Manufacturing
331316	Aluminum Extruded Product Manufacturing
331319	Other Aluminum Rolling and Drawing
331421	Copper Rolling, Drawing, and Extruding
331422	Copper Wire (except Mechanical) Drawing
331423	Secondary Smelting, Refining, and Alloying of Copper
331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing, and Extruding
331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and
331511	Iron Foundries
331512	Steel Investment Foundries
331513	Steel Foundries (except Investment)
331521	Aluminum Die-Casting Foundries
331522	Nonferrous (except Aluminum) Die-Casting Foundries
331524	Aluminum Foundries (except Die-Casting)
331525	Copper Foundries (except Die-Casting)
331528	Other Nonferrous Foundries (except Die-Casting)
332111	Iron and Steel Forging
332112	Nonferrous Forging
332311	Prefabricated Metal Building and Component Manufacturing
332312	Fabricated Structural Metal Manufacturing
332321	Metal Window and Door Manufacturing
332322	Sheet Metal Work Manufacturing
332323	Ornamental and Architectural Metal Work Manufacturing
332431	Metal Can Manufacturing
332710	Machine Shops
332722	Bolt, Nut, Screw, Rivet, and Washer Manufacturing
332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to
332813	Electroplating, Plating, Polishing, Anodizing, and Coloring
332911	Industrial Valve Manufacturing
332913	Plumbing Fixture Fitting and Trim Manufacturing
332919	Other Metal Valve and Pipe Fitting Manufacturing
332992	Small Arms Ammunition Manufacturing
332996	Fabricated Pipe and Pipe Fitting Manufacturing
332999	All Other Miscellaneous Fabricated Metal Product Manufacturing
333111	Farm Machinery and Equipment Manufacturing
333112	Lawn and Garden Tractor and Home Lawn and Garden Equipment Manufacturing
333132	Oil and Gas Field Machinery and Equipment Manufacturing
333220	Plastics and Rubber Industry Machinery Manufacturing
333298	All Other Industrial Machinery Manufacturing
333311	Automatic Vending Machine Manufacturing
333312	Commercial Laundry, Drycleaning, and Pressing Machine Manufacturing

NAICS	NAICS Title
333315	Photographic and Photocopying Equipment Manufacturing
333319	Other Commercial and Service Industry Machinery Manufacturing
333411	Air Purification Equipment Manufacturing
333412	Industrial and Commercial Fan and Blower Manufacturing
333414	Heating Equipment (except Warm Air Furnaces) Manufacturing
333415	Air-Conditioning and Warm Air Heating Equipment and Commercial and Industrial
333511	Industrial Mold Manufacturing
333514	Special Die and Tool, Die Set, Jig, and Fixture Manufacturing
333611	Turbine and Turbine Generator Set Units Manufacturing
333612	Speed Changer, Industrial High-Speed Drive, and Gear Manufacturing
333613	Mechanical Power Transmission Equipment Manufacturing
333618	Other Engine Equipment Manufacturing
333911	Pump and Pumping Equipment Manufacturing
333994	Industrial Process Furnace and Oven Manufacturing
333996	Fluid Power Pump and Motor Manufacturing
334111	Electronic Computer Manufacturing
334113	Computer Terminal Manufacturing
334119	Other Computer Peripheral Equipment Manufacturing
334210	Telephone Apparatus Manufacturing
334220	Radio and Television Broadcasting and Wireless Communications Equipment
334290	Other Communications Equipment Manufacturing
334310	Audio and Video Equipment Manufacturing
334413	Semiconductor and Related Device Manufacturing
334418	Printed Circuit Assembly (Electronic Assembly) Manufacturing
334419	Other Electronic Component Manufacturing
334510	Electromedical and Electrotherapeutic Apparatus Manufacturing
334512	Automatic Environmental Control Manufacturing for Residential, Commercial, and
334513	Instruments and Related Products Manufacturing for Measuring, Displaying, and
334514	Totalizing Fluid Meter and Counting Device Manufacturing
334515	Instrument Manufacturing for Measuring and Testing Electricity and Electrical Signals
334516	Analytical Laboratory Instrument Manufacturing
334519	Other Measuring and Controlling Device Manufacturing
335110	Electric Lamp Bulb and Part Manufacturing
335121	Residential Electric Lighting Fixture Manufacturing
335122	Commercial, Industrial, and Institutional Electric Lighting Fixture Manufacturing
335129	Other Lighting Equipment Manufacturing
335211	Electric Housewares and Household Fan Manufacturing
335221	Household Cooking Appliance Manufacturing
335222	Household Refrigerator and Home Freezer Manufacturing
335224	Household Laundry Equipment Manufacturing
335228	Other Major Household Appliance Manufacturing
335311	Power, Distribution, and Specialty Transformer Manufacturing
335312	Motor and Generator Manufacturing

NAICS	NAICS Title
335313	Switchgear and Switchboard Apparatus Manufacturing
335314	Relay and Industrial Control Manufacturing
335911	Storage Battery Manufacturing
335912	Primary Battery Manufacturing
335931	Current-Carrying Wiring Device Manufacturing
335999	All Other Miscellaneous Electrical Equipment and Component Manufacturing
336111	Automobile Manufacturing
336112	Light Truck and Utility Vehicle Manufacturing
336120	Heavy Duty Truck Manufacturing
336213	Motor Home Manufacturing
336214	Travel Trailer and Camper Manufacturing
336311	Carburetor, Piston, Piston Ring, and Valve Manufacturing
336312	Gasoline Engine and Engine Parts Manufacturing
336322	Other Motor Vehicle Electrical and Electronic Equipment Manufacturing
336340	Motor Vehicle Brake System Manufacturing
336350	Motor Vehicle Transmission and Power Train Parts Manufacturing
336360	Motor Vehicle Seating and Interior Trim Manufacturing
336370	Motor Vehicle Metal Stamping
336391	Motor Vehicle Air-Conditioning Manufacturing
336399	All Other Motor Vehicle Parts Manufacturing
336411	Aircraft Manufacturing
336412	Aircraft Engine and Engine Parts Manufacturing
336413	Other Aircraft Parts and Auxiliary Equipment Manufacturing
336510	Railroad Rolling Stock Manufacturing
336611	Ship Building and Repairing
336612	Boat Building
336991	Motorcycle, Bicycle, and Parts Manufacturing
337110	Wood Kitchen Cabinet and Countertop Manufacturing
337121	Upholstered Household Furniture Manufacturing
337122	Nonupholstered Wood Household Furniture Manufacturing
337212	Custom Architectural Woodwork and Millwork Manufacturing
337214	Office Furniture (except Wood) Manufacturing
337920	Blind and Shade Manufacturing
339112	Surgical and Medical Instrument Manufacturing
339113	Surgical Appliance and Supplies Manufacturing
339116	Dental Laboratories
339920	Sporting and Athletic Goods Manufacturing
339931	Doll and Stuffed Toy Manufacturing
339932	Game, Toy, and Children's Vehicle Manufacturing
339950	Sign Manufacturing
339992	Musical Instrument Manufacturing
339999	All Other Miscellaneous Manufacturing
423110	Automobile and Other Motor Vehicle Merchant Wholesalers

NAICS	NAICS Title
423120	Motor Vehicle Supplies and New Parts Merchant Wholesalers
423130	Tire and Tube Merchant Wholesalers
423140	Motor Vehicle Parts (Used) Merchant Wholesalers
423210	Furniture Merchant Wholesalers
423220	Home Furnishing Merchant Wholesalers
423310	Lumber, Plywood, Millwork, and Wood Panel Merchant Wholesalers
423320	Brick, Stone, and Related Construction Material Merchant Wholesalers
423330	Roofing, Siding, and Insulation Material Merchant Wholesalers
423390	Other Construction Material Merchant Wholesalers
423420	Office Equipment Merchant Wholesalers
423430	Computer and Computer Peripheral Equipment and Software Merchant Wholesalers
423440	Other Commercial Equipment Merchant Wholesalers
423450	Medical, Dental, and Hospital Equipment and Supplies Merchant Wholesalers
423460	Ophthalmic Goods Merchant Wholesalers
423490	Other Professional Equipment and Supplies Merchant Wholesalers
423510	Metal Service Centers and Other Metal Merchant Wholesalers
423610	Electrical Apparatus and Equipment, Wiring Supplies, and Related Equipment Merchant
423620	Electrical and Electronic Appliance, Television, and Radio Set Merchant Wholesalers
423690	Other Electronic Parts and Equipment Merchant Wholesalers
423720	Plumbing and Heating Equipment and Supplies (Hydronics) Merchant Wholesalers
423730	Warm Air Heating and Air-Conditioning Equipment and Supplies Merchant Wholesalers
423740	Refrigeration Equipment and Supplies Merchant Wholesalers
423810	Construction and Mining (except Oil Well) Machinery and Equipment Merchant
423820	Farm and Garden Machinery and Equipment Merchant Wholesalers
423830	Industrial Machinery and Equipment Merchant Wholesalers
423840	Industrial Supplies Merchant Wholesalers
423850	Service Establishment Equipment and Supplies Merchant Wholesalers
423860	Transportation Equipment and Supplies (except Motor Vehicle) Merchant Wholesalers
423920	Toy and Hobby Goods and Supplies Merchant Wholesalers
423930	Recyclable Material Merchant Wholesalers
423990	Other Miscellaneous Durable Goods Merchant Wholesalers
424110	Printing and Writing Paper Merchant Wholesalers
424120	Stationery and Office Supplies Merchant Wholesalers
424130	Industrial and Personal Service Paper Merchant Wholesalers
424210	Drugs and Druggists' Sundries Merchant Wholesalers
424310	Piece Goods, Notions, and Other Dry Goods Merchant Wholesalers
424330	Women's, Children's, and Infants' Clothing and Accessories Merchant Wholesalers
424410	General Line Grocery Merchant Wholesalers
424420	Packaged Frozen Food Merchant Wholesalers
424430	Dairy Product (except Dried or Canned) Merchant Wholesalers
424440	Poultry and Poultry Product Merchant Wholesalers
424450	Confectionery Merchant Wholesalers
424460	Fish and Seafood Merchant Wholesalers

NAICS	NAICS Title
424470	Meat and Meat Product Merchant Wholesalers
424480	Fresh Fruit and Vegetable Merchant Wholesalers
424490	Other Grocery and Related Products Merchant Wholesalers
424510	Grain and Field Bean Merchant Wholesalers
424520	Livestock Merchant Wholesalers
424590	Other Farm Product Raw Material Merchant Wholesalers
424610	Plastics Materials and Basic Forms and Shapes Merchant Wholesalers
424690	Other Chemical and Allied Products Merchant Wholesalers
424710	Petroleum Bulk Stations and Terminals
424720	Petroleum and Petroleum Products Merchant Wholesalers (except Bulk Stations and
424810	Beer and Ale Merchant Wholesalers
424820	Wine and Distilled Alcoholic Beverage Merchant Wholesalers
424910	Farm Supplies Merchant Wholesalers
424920	Book, Periodical, and Newspaper Merchant Wholesalers
424930	Flower, Nursery Stock, and Florists' Supplies Merchant Wholesalers
424940	Tobacco and Tobacco Product Merchant Wholesalers
424950	Paint, Varnish, and Supplies Merchant Wholesalers
424990	Other Miscellaneous Nondurable Goods Merchant Wholesalers
425110	Business to Business Electronic Markets
425120	Wholesale Trade Agents and Brokers
441110	New Car Dealers
441120	Used Car Dealers
441210	Recreational Vehicle Dealers
441310	Automotive Parts and Accessories Stores
441320	Tire Dealers
442110	Furniture Stores
442210	Floor Covering Stores
442291	Window Treatment Stores
443111	Household Appliance Stores
443112	Radio, Television, and Other Electronics Stores
443120	Computer and Software Stores
444110	Home Centers
444120	Paint and Wallpaper Stores
444130	Hardware Stores
444190	Other Building Material Dealers
444210	Outdoor Power Equipment Stores
444220	Nursery, Garden Center, and Farm Supply Stores
445110	Supermarkets and Other Grocery (except Convenience) Stores
445120	Convenience Stores
445210	Meat Markets
445220	Fish and Seafood Markets
445230	Fruit and Vegetable Markets
445291	Baked Goods Stores

NAICS	NAICS Title
445292	Confectionery and Nut Stores
445299	All Other Specialty Food Stores
445310	Beer, Wine, and Liquor Stores
446110	Pharmacies and Drug Stores
446120	Cosmetics, Beauty Supplies, and Perfume Stores
446191	Food (Health) Supplement Stores
446199	All Other Health and Personal Care Stores
447110	Gasoline Stations with Convenience Stores
447190	Other Gasoline Stations
451110	Sporting Goods Stores
451120	Hobby, Toy, and Game Stores
451130	Sewing, Needlework, and Piece Goods Stores
451211	Book Stores
451212	News Dealers and Newsstands
451220	Prerecorded Tape, Compact Disc, and Record Stores
452111	Department Stores (except Discount Department Stores)
452112	Discount Department Stores
452910	Warehouse Clubs and Supercenters
452990	All Other General Merchandise Stores
453110	Florists
453210	Office Supplies and Stationery Stores
453310	Used Merchandise Stores
453910	Pet and Pet Supplies Stores
453930	Manufactured (Mobile) Home Dealers
453991	Tobacco Stores
453998	All Other Miscellaneous Store Retailers (except Tobacco Stores)
454111	Electronic Shopping
454112	Electronic Auctions
454113	Mail-Order Houses
454210	Vending Machine Operators
454311	Heating Oil Dealers
454319	Other Fuel Dealers
454390	Other Direct Selling Establishments
482111	Line-Haul Railroads
483114	Coastal and Great Lakes Passenger Transportation
483212	Inland Water Passenger Transportation
484110	General Freight Trucking, Local
484121	General Freight Trucking, Long-Distance, Truckload
484122	General Freight Trucking, Long-Distance, Less Than Truckload
484210	Used Household and Office Goods Moving
484220	Specialized Freight (except Used Goods) Trucking, Local
484230	Specialized Freight (except Used Goods) Trucking, Long-Distance
485111	Mixed Mode Transit Systems

NAICS	NAICS Title
485112	Commuter Rail Systems
485113	Bus and Other Motor Vehicle Transit Systems
485119	Other Urban Transit Systems
485210	Interurban and Rural Bus Transportation
485310	Taxi Service
485320	Limousine Service
485410	School and Employee Bus Transportation
485510	Charter Bus Industry
485991	Special Needs Transportation
485999	All Other Transit and Ground Passenger Transportation
486210	Pipeline Transportation of Natural Gas
487110	Scenic and Sightseeing Transportation, Land
487210	Scenic and Sightseeing Transportation, Water
488119	Other Airport Operations
488190	Other Support Activities for Air Transportation
488330	Navigational Services to Shipping
488410	Motor Vehicle Towing
488510	Freight Transportation Arrangement
491110	Postal Service
492110	Couriers and Express Delivery Services
492210	Local Messengers and Local Delivery
493110	General Warehousing and Storage
493120	Refrigerated Warehousing and Storage
493130	Farm Product Warehousing and Storage
493190	Other Warehousing and Storage
511110	Newspaper Publishers
511120	Periodical Publishers
511130	Book Publishers
511140	Directory and Mailing List Publishers
511199	All Other Publishers
511210	Software Publishers
512110	Motion Picture and Video Production
512120	Motion Picture and Video Distribution
515111	Radio Networks
515112	Radio Stations
515120	Television Broadcasting
515210	Cable and Other Subscription Programming
518210	Data Processing, Hosting, and Related Services
519110	News Syndicates
519120	Libraries and Archives
519130	Internet Publishing and Broadcasting and Web Search Portals
522110	Commercial Banking
522120	Savings Institutions

NAICS	NAICS Title
522130	Credit Unions
522190	Other Depository Credit Intermediation
522220	Sales Financing
523130	Commodity Contracts Dealing
523140	Commodity Contracts Brokerage
523210	Securities and Commodity Exchanges
523910	Miscellaneous Intermediation
523920	Portfolio Management
523930	Investment Advice
531110	Lessors of Residential Buildings and Dwellings
531120	Lessors of Nonresidential Buildings (except Miniwarehouses)
531130	Lessors of Miniwarehouses and Self-Storage Units
531210	Offices of Real Estate Agents and Brokers
531312	Nonresidential Property Managers
532111	Passenger Car Rental
532112	Passenger Car Leasing
532210	Consumer Electronics and Appliances Rental
532292	Recreational Goods Rental
532411	Commercial Air, Rail, and Water Transportation Equipment Rental and Leasing
532412	Construction, Mining, and Forestry Machinery and Equipment Rental and Leasing
532420	Office Machinery and Equipment Rental and Leasing
533110	Lessors of Nonfinancial Intangible Assets (except Copyrighted Works)
541110	Offices of Lawyers
541199	All Other Legal Services
541211	Offices of Certified Public Accountants
541214	Payroll Services
541219	Other Accounting Services
541310	Architectural Services
541320	Landscape Architectural Services
541330	Engineering Services
541350	Building Inspection Services
541360	Geophysical Surveying and Mapping Services
541370	Surveying and Mapping (except Geophysical) Services
541380	Testing Laboratories
541410	Interior Design Services
541420	Industrial Design Services
541430	Graphic Design Services
541490	Other Specialized Design Services
541511	Custom Computer Programming Services
541512	Computer Systems Design Services
541513	Computer Facilities Management Services
541519	Other Computer Related Services
541611	Administrative Management and General Management Consulting Services

NAICS	NAICS Title
541612	Human Resources Consulting Services
541613	Marketing Consulting Services
541614	Process, Physical Distribution, and Logistics Consulting Services
541618	Other Management Consulting Services
541620	Environmental Consulting Services
541690	Other Scientific and Technical Consulting Services
541711	Research and Development in Biotechnology
541712	Research and Development in the Physical, Engineering, and Life Sciences (except
541720	Research and Development in the Social Sciences and Humanities
541810	Advertising Agencies
541820	Public Relations Agencies
541850	Display Advertising
541922	Commercial Photography
541940	Veterinary Services
541990	All Other Professional, Scientific, and Technical Services
551112	Offices of Other Holding Companies
551114	Corporate, Subsidiary, and Regional Managing Offices
561110	Office Administrative Services
561210	Facilities Support Services
561311	Employment Placement Agencies
561320	Temporary Help Services
561330	Professional Employer Organizations
561439	Other Business Service Centers (including Copy Shops)
561499	All Other Business Support Services
561510	Travel Agencies
561520	Tour Operators
561612	Security Guards and Patrol Services
561710	Exterminating and Pest Control Services
561720	Janitorial Services
561730	Landscaping Services
561910	Packaging and Labeling Services
561920	Convention and Trade Show Organizers
562111	Solid Waste Collection
562112	Hazardous Waste Collection
562119	Other Waste Collection
562211	Hazardous Waste Treatment and Disposal
562212	Solid Waste Landfill
562213	Solid Waste Combustors and Incinerators
562219	Other Nonhazardous Waste Treatment and Disposal
562910	Remediation Services
562920	Materials Recovery Facilities
562991	Septic Tank and Related Services
562998	All Other Miscellaneous Waste Management Services

NAICS	NAICS Title
611110	Elementary and Secondary Schools
611210	Junior Colleges
611310	Colleges, Universities, and Professional Schools
611430	Professional and Management Development Training
611513	Apprenticeship Training
611519	Other Technical and Trade Schools
621111	Offices of Physicians (except Mental Health Specialists)
621210	Offices of Dentists
621340	Offices of Physical, Occupational and Speech Therapists, and Audiologists
621399	Offices of All Other Miscellaneous Health Practitioners
621492	Kidney Dialysis Centers
621511	Medical Laboratories
622110	General Medical and Surgical Hospitals
622310	Specialty (except Psychiatric and Substance Abuse) Hospitals
623110	Nursing Care Facilities
623312	Homes for the Elderly
624120	Services for the Elderly and Persons with Disabilities
624210	Community Food Services
624229	Other Community Housing Services
624310	Vocational Rehabilitation Services
711211	Sports Teams and Clubs
711212	Racetracks
711310	Promoters of Performing Arts, Sports, and Similar Events with Facilities
711510	Independent Artists, Writers, and Performers
712110	Museums
712130	Zoos and Botanical Gardens
712190	Nature Parks and Other Similar Institutions
713110	Amusement and Theme Parks
713210	Casinos (except Casino Hotels)
713920	Skiing Facilities
713940	Fitness and Recreational Sports Centers
713990	All Other Amusement and Recreation Industries
721110	Hotels (except Casino Hotels) and Motels
721214	Recreational and Vacation Camps (except Campgrounds)
722110	Full-Service Restaurants
722211	Limited-Service Restaurants
722212	Cafeterias, Grill Buffets, and Buffets
722213	Snack and Nonalcoholic Beverage Bars
722310	Food Service Contractors
722320	Caterers
722330	Mobile Food Services
722410	Drinking Places (Alcoholic Beverages)
811111	General Automotive Repair

NAICS	NAICS Title
811112	Automotive Exhaust System Repair
811113	Automotive Transmission Repair
811118	Other Automotive Mechanical and Electrical Repair and Maintenance
811121	Automotive Body, Paint, and Interior Repair and Maintenance
811191	Automotive Oil Change and Lubrication Shops
811192	Car Washes
811198	All Other Automotive Repair and Maintenance
811211	Consumer Electronics Repair and Maintenance
811212	Computer and Office Machine Repair and Maintenance
811213	Communication Equipment Repair and Maintenance
811219	Other Electronic and Precision Equipment Repair and Maintenance
811310	Commercial and Industrial Machinery and Equipment (except Automotive and Electronic)
811412	Appliance Repair and Maintenance
811490	Other Personal and Household Goods Repair and Maintenance
812112	Beauty Salons
812220	Cemeteries and Crematories
812320	Drycleaning and Laundry Services (except Coin-Operated)
812331	Linen Supply
812930	Parking Lots and Garages
813110	Religious Organizations
813211	Grantmaking Foundations
813219	Other Grantmaking and Giving Services
813311	Human Rights Organizations
813312	Environment, Conservation and Wildlife Organizations
813319	Other Social Advocacy Organizations
813410	Civic and Social Organizations
813910	Business Associations
813920	Professional Organizations
813940	Political Organizations
813990	Other Similar Organizations (except Business, Professional, Labor, and Political)
921120	Legislative Bodies
921140	Executive and Legislative Offices, Combined
921190	Other General Government Support
922140	Correctional Institutions
922190	Other Justice, Public Order, and Safety Activities
923110	Administration of Education Programs
923130	Administration of Human Resource Programs (except Education, Public Health, and
924110	Administration of Air and Water Resource and Solid Waste Management Programs
924120	Administration of Conservation Programs
925110	Administration of Housing Programs
925120	Administration of Urban Planning and Community and Rural Development
926110	Administration of General Economic Programs
926120	Regulation and Administration of Transportation Programs

NAICS	NAICS Title
926130	Regulation and Administration of Communications, Electric, Gas, and Other Utilities
926140	Regulation of Agricultural Marketing and Commodities
926150	Regulation, Licensing, and Inspection of Miscellaneous Commercial Sectors
928110	National Security

Appendix B: List of Green Occupations

SOC Code	SOC Description
11000000	Management Occupations
11101100	Chief Executives
11101103	Chief Sustainability Officers
11102100	General and Operations Managers
11201100	Advertising and Promotions Managers
11201101	Green Marketers
11202100	Marketing Managers
11202200	Sales Managers
11203100	Public Relations Managers
11301100	Administrative Services Managers
11302100	Computer and Information Systems Managers
11303101	Treasurers and Controllers
11303102	Financial Managers, Branch or Department
11304000	Human Resources Managers
11304200	Training and Development Managers
11305100	Industrial Production Managers
11305101	Quality Control Systems Managers
11305105	Methane/Landfill Gas Collection System Operators
11306100	Purchasing Managers
11307101	Transportation Managers
11307102	Storage and Distribution Managers
11901101	Nursery and Greenhouse Managers
11901200	Farmers and Ranchers
11902100	Construction Managers
11903100	Education Administrators, Preschool and Child Care Center/Program
11903200	Education Administrators, Elementary and Secondary School
11903300	Education Administrators, Postsecondary
11903900	Education Administrators, All Other
11904100	Engineering Managers
11907100	Gaming Managers
11911100	Medical and Health Services Managers
11912100	Natural Sciences Managers
11912102	Water Resource Specialists
11914100	Property, Real Estate, and Community Association Managers
11915100	Social and Community Service Managers
11919900	Managers, All Other
11919901	Regulatory Affairs Managers
11919902	Compliance Managers
13000000	Business and Financial Operations Occupations
13101100	Agents and Business Managers of Artists, Performers, and Athletes

SOC Code	SOC Description
13102100	Purchasing Agents and Buyers, Farm Products
13102200	Wholesale and Retail Buyers, Except Farm Products
13102300	Purchasing Agents, Except Wholesale, Retail, and Farm Products
13103102	Insurance Adjusters, Examiners, and Investigators
13104101	Environmental Compliance Inspectors
13104102	Licensing Examiners and Inspectors
13104104	Government Property Inspectors and Investigators
13104107	Regulatory Affairs Specialists
13105100	Cost Estimators
13106100	Emergency Management Specialists
13107300	Training and Development Specialists
13108100	Logisticians
13108102	Logistics Analysts
13111100	Management Analysts
13112100	Meeting and Convention Planners
13119900	Business Operations Specialists, All Other
13119901	Energy Auditors
13119905	Sustainability Specialists
13201101	Accountants
13201102	Auditors
13204100	Credit Analysts
13205100	Financial Analysts
13205200	Personal Financial Advisors
13208100	Tax Examiners, Collectors, and Revenue Agents
15102100	Computer Programmers
15103100	Computer Software Engineers, Applications
15103200	Computer Software Engineers, Systems Software
15104100	Computer Support Specialists
15105100	Computer Systems Analysts
15107100	Network and Computer Systems Administrators
15109901	Software Quality Assurance Engineers and Testers
15109911	Information Technology Project Managers
15203100	Operations Research Analysts
17000000	Architecture and Engineering Occupations
17101100	Architects, Except Landscape and Naval
17101200	Landscape Architects
17102200	Surveyors
17203100	Biomedical Engineers
17204100	Chemical Engineers
17205100	Civil Engineers
17205101	Transportation Engineers
17205102	Water/Wastewater Engineers
17207100	Electrical Engineers

SOC Code	SOC Description
17207200	Electronics Engineers, Except Computer
17208100	Environmental Engineers
17211101	Industrial Safety and Health Engineers
17211200	Industrial Engineers
17214100	Mechanical Engineers
17217100	Petroleum Engineers
17219903	Energy Engineers
17219910	Wind Energy Engineers
17301101	Architectural Drafters
17301201	Electronic Drafters
17301202	Electrical Drafters
17301300	Mechanical Drafters
17302301	Electronics Engineering Technicians
17302303	Electrical Engineering Technicians
17302500	Environmental Engineering Technicians
17302600	Industrial Engineering Technicians
17302900	Engineering Technicians, Except Drafters, All Other
17302909	Manufacturing Production Technicians
17303101	Surveying Technicians
17303102	Mapping Technicians
19000000	Life, Physical, and Social Science Occupations
19101300	Soil and Plant Scientists
19102001	Biologists
19102300	Zoologists and Wildlife Biologists
19103101	Soil and Water Conservationists
19103103	Park Naturalists
19103200	Foresters
19203100	Chemists
19204100	Environmental Scientists and Specialists, Including Health
19204101	Climate Change Analysts
19204102	Environmental Restoration Planners
19301100	Economists
19302100	Market Research Analysts
19305100	Urban and Regional Planners
19309200	Geographers
19309900	Social Scientists and Related Workers, All Other
19401101	Agricultural Technicians
19401102	Food Science Technicians
19406100	Social Science Research Assistants
19409100	Environmental Science and Protection Technicians, Including Health
19409900	Life, Physical, and Social Science Technicians, All Other
21101100	Substance Abuse and Behavioral Disorder Counselors
21101200	Educational, Vocational, and School Counselors

SOC Code	SOC Description
21101500	Rehabilitation Counselors
21109300	Social and Human Service Assistants
23101100	Lawyers
23201100	Paralegals and Legal Assistants
25000000	Education, Training, and Library Occupations
25102200	Mathematical Science Teachers, Postsecondary
25103100	Architecture Teachers, Postsecondary
25105300	Environmental Science Teachers, Postsecondary
25106300	Economics Teachers, Postsecondary
25112200	Communications Teachers, Postsecondary
25119300	Recreation and Fitness Studies Teachers, Postsecondary
25119400	Vocational Education Teachers, Postsecondary
25119900	Postsecondary Teachers, All Other
25401300	Museum Technicians and Conservators
25402100	Librarians
25904100	Teacher Assistants
25909900	Education, Training, and Library Workers, All Other
27000000	Arts, Design, Entertainment, Sports, and Media Occupations
27101100	Art Directors
27101200	Craft Artists
27101400	Multi-Media Artists and Animators
27102300	Floral Designers
27102400	Graphic Designers
27102500	Interior Designers
27102600	Merchandise Displayers and Window Trimmers
27201203	Program Directors
27202100	Athletes and Sports Competitors
27303100	Public Relations Specialists
27304300	Writers and Authors
27309100	Interpreters and Translators
27309900	Media and Communication Workers, All Other
27401100	Audio and Video Equipment Technicians
27401200	Broadcast Technicians
27401400	Sound Engineering Technicians
29000000	Healthcare Practitioners and Technical Occupations
29105100	Pharmacists
29106900	Physicians and Surgeons, All Other
29111100	Registered Nurses
29112300	Physical Therapists
29112900	Therapists, All Other
29201200	Medical and Clinical Laboratory Technicians
29901100	Occupational Health and Safety Specialists
29909900	Healthcare Practitioners and Technical Workers, All Other

SOC Code	SOC Description
31909200	Medical Assistants
33101100	First-Line Supervisors/Managers of Correctional Officers
33102101	Municipal Fire Fighting and Prevention Supervisors
33201101	Municipal Fire Fighters
33301200	Correctional Officers and Jailers
35000000	Food Preparation and Serving Related Occupations
35101200	First-Line Supervisors/Managers of Food Preparation and Serving Workers
35202100	Food Preparation Workers
35301100	Bartenders
35302100	Combined Food Preparation and Serving Workers, Including Fast Food
35303100	Waiters and Waitresses
35304100	Food Servers, Nonrestaurant
35902100	Dishwashers
37101100	First-Line Supervisors/Managers of Housekeeping and Janitorial Workers
37101200	First-Line Supervisors/Managers of Landscaping, Lawn Service, and
37201100	Janitors and Cleaners, Except Maids and Housekeeping Cleaners
37201200	Maids and Housekeeping Cleaners
37201900	Building Cleaning Workers, All Other
37301100	Landscaping and Groundskeeping Workers
37301200	Pesticide Handlers, Sprayers, and Applicators, Vegetation
37301300	Tree Trimmers and Pruners
37301900	Grounds Maintenance Workers, All Other
39101200	Slot Key Persons
39102100	First-Line Supervisors/Managers of Personal Service Workers
39202100	Nonfarm Animal Caretakers
39303100	Ushers, Lobby Attendants, and Ticket Takers
39309100	Amusement and Recreation Attendants
39602100	Tour Guides and Escorts
39603200	Transportation Attendants, Except Flight Attendants and Baggage Porters
39901100	Child Care Workers
39902100	Personal and Home Care Aides
41000000	Sales and Related Occupations
41101100	First-Line Supervisors/Managers of Retail Sales Workers
41201100	Cashiers
41202100	Counter and Rental Clerks
41202200	Parts Salespersons
41203100	Retail Salespersons
41401200	Sales Representatives, Wholesale and Manufacturing, Except Technical and
41902100	Real Estate Brokers
41904100	Telemarketers
41909100	Door-To-Door Sales Workers, News and Street Vendors, and Related Workers
43101100	First-Line Supervisors/Managers of Office and Administrative Support Workers
43201100	Switchboard Operators, Including Answering Service

SOC Code	SOC Description
43302102	Billing, Cost, and Rate Clerks
43303100	Bookkeeping, Accounting, and Auditing Clerks
43306100	Procurement Clerks
43405100	Customer Service Representatives
43415100	Order Clerks
43416100	Human Resources Assistants, Except Payroll and Timekeeping
43419900	Information and Record Clerks, All Other
43502100	Couriers and Messengers
43503200	Dispatchers, Except Police, Fire, and Ambulance
43505100	Postal Service Clerks
43505300	Postal Service Mail Sorters, Processors, and Processing Machine Operators
43506100	Production, Planning, and Expediting Clerks
43507100	Shipping, Receiving, and Traffic Clerks
43508100	Stock Clerks and Order Fillers
43508101	Stock Clerks, Sales Floor
43508103	Stock Clerks- Stockroom, Warehouse, or Storage Yard
43508104	Order Fillers, Wholesale and Retail Sales
43511100	Weighers, Measurers, Checkers, and Samplers, Recordkeeping
43601100	Executive Secretaries and Administrative Assistants
43601400	Secretaries, Except Legal, Medical, and Executive
43902100	Data Entry Keyers
43906100	Office Clerks, General
43907100	Office Machine Operators, Except Computer
43919900	Office and Administrative Support Workers, All Other
45101105	First-Line Supervisors/Managers of Logging Workers
45101107	First-Line Supervisors/Managers of Agricultural Crop and Horticultural Workers
45101108	First-Line Supervisors/Managers of Animal Husbandry and Animal Care Workers
45209100	Agricultural Equipment Operators
45209201	Nursery Workers
45209202	Farmworkers and Laborers, Crop
45209300	Farmworkers, Farm and Ranch Animals
45209900	Agricultural Workers, All Other
45301100	Fishers and Related Fishing Workers
45302100	Hunters and Trappers
45401100	Forest and Conservation Workers
45402100	Fallers
45402200	Logging Equipment Operators
45402900	Logging Workers, All Other
47000000	Construction and Extraction Occupations
47101100	First-Line Supervisors/Managers of Construction Trades and Extraction Workers
47203100	Carpenters
47203101	Construction Carpenters
47204200	Floor Layers, Except Carpet, Wood, and Hard Tiles

SOC Code	SOC Description
47204300	Floor Sanders and Finishers
47206100	Construction Laborers
47207300	Operating Engineers and Other Construction Equipment Operators
47211100	Electricians
47213100	Insulation Workers, Floor, Ceiling, and Wall
47214100	Painters, Construction and Maintenance
47215201	Pipe Fitters and Steamfitters
47215202	Plumbers
47217100	Reinforcing Iron and Rebar Workers
47218100	Roofers
47221100	Sheet Metal Workers
47222100	Structural Iron and Steel Workers
47301100	Helpers--Brickmasons, Blockmasons, Stonemasons, and Tile and Marble Setters
47301300	Helpers--Electricians
47301500	Helpers--Pipelayers, Plumbers, Pipefitters, and Steamfitters
47401100	Construction and Building Inspectors
47402100	Elevator Installers and Repairers
47403100	Fence Erectors
47404100	Hazardous Materials Removal Workers
47405100	Highway Maintenance Workers
47407100	Septic Tank Servicers and Sewer Pipe Cleaners
47409900	Construction and Related Workers, All Other
47409903	Weatherization Installers and Technicians
47501100	Derrick Operators, Oil and Gas
47502100	Earth Drillers, Except Oil and Gas
47503100	Explosives Workers, Ordnance Handling Experts, and Blasters
47509900	Extraction Workers, All Other
49000000	Installation, Maintenance, and Repair Occupations
49101100	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers
49202100	Radio Mechanics
49202200	Telecommunications Equipment Installers and Repairers, Except Line Installers
49302100	Automotive Body and Related Repairers
49302300	Automotive Service Technicians and Mechanics
49302301	Automotive Master Mechanics
49302302	Automotive Specialty Technicians
49304100	Farm Equipment Mechanics
49305200	Motorcycle Mechanics
49309300	Tire Repairers and Changers
49901100	Mechanical Door Repairers
49902101	Heating and Air Conditioning Mechanics and Installers
49903100	Home Appliance Repairers
49904100	Industrial Machinery Mechanics
49904200	Maintenance and Repair Workers, General

SOC Code	SOC Description
49904300	Maintenance Workers, Machinery
49905200	Telecommunications Line Installers and Repairers
49909800	Helpers--Installation, Maintenance, and Repair Workers
49909900	Installation, Maintenance, and Repair Workers, All Other
51000000	Production Occupations
51101100	First-Line Supervisors/Managers of Production and Operating Workers
51204100	Structural Metal Fabricators and Fitters
51209100	Fiberglass Laminators and Fabricators
51209900	Assemblers and Fabricators, All Other
51302300	Slaughterers and Meat Packers
51309300	Food Cooking Machine Operators and Tenders
51404100	Machinists
51407200	Molding, Coremaking, and Casting Machine Setters, Operators, and Tenders, Metal
51411100	Tool and Die Makers
51419400	Tool Grinders, Filers, and Sharpeners
51501200	Bookbinders
51502100	Job Printers
51502200	Prepress Technicians and Workers
51502300	Printing Machine Operators
51601100	Laundry and Dry-Cleaning Workers
51609900	Textile, Apparel, and Furnishings Workers, All Other
51701100	Cabinetmakers and Bench Carpenters
51702100	Furniture Finishers
51704100	Sawing Machine Setters, Operators, and Tenders, Wood
51704200	Woodworking Machine Setters, Operators, and Tenders, Except Sawing
51801200	Power Distributors and Dispatchers
51801300	Power Plant Operators
51802100	Stationary Engineers and Boiler Operators
51803100	Water and Liquid Waste Treatment Plant and System Operators
51809900	Plant and System Operators, All Other
51809903	Biomass Plant Technicians
51901100	Chemical Equipment Operators and Tenders
51902300	Mixing and Blending Machine Setters, Operators, and Tenders
51908200	Medical Appliance Technicians
51912100	Coating, Painting, and Spraying Machine Setters, Operators, and Tenders
51912200	Painters, Transportation Equipment
51912300	Painting, Coating, and Decorating Workers
51919500	Molders, Shapers, and Casters, Except Metal and Plastic
51919504	Glass Blowers, Molders, Benders, and Finishers
51919507	Molding and Casting Workers
51919800	Helpers--Production Workers
51919900	Production Workers, All Other
51919901	Recycling and Reclamation Workers

SOC Code	SOC Description
53000000	Transportation and Material Moving Occupations
53102100	First-Line Supervisors/Managers of Helpers, Laborers, and Material Movers, Hand
53102101	Recycling Coordinators
53103100	First-Line Supervisors/Managers of Transportation and Material-Moving Machine
53202200	Airfield Operations Specialists
53302200	Bus Drivers, School
53303200	Truck Drivers, Heavy and Tractor-Trailer
53309900	Motor Vehicle Operators, All Other
53603100	Service Station Attendants
53701100	Conveyor Operators and Tenders
53702100	Crane and Tower Operators
53703200	Excavating and Loading Machine and Dragline Operators
53706100	Cleaners of Vehicles and Equipment
53706200	Laborers and Freight, Stock, and Material Movers, Hand
53706300	Machine Feeders and Offbearers
53706400	Packers and Packagers, Hand
53708100	Refuse and Recyclable Material Collectors
53712100	Tank Car, Truck, and Ship Loaders
99999999	#N/A

Appendix C: Detailed Methodology for Labor Demand Analysis

MARC Geography in EMSI

DC Metro was defined within EMSI as including DC, particular counties of Maryland, and particular counties and independent cities of Virginia.¹⁴ We did not include Jefferson County, the one County of West Virginia that is historically considered a part of the DC Metro area. West Virginia lay beyond the MARC region and scope of this analysis.

O*NET Code Alignment

Primary analysis of the MARC Regional Employer Survey produced O*NET-SOC codes that were 8 digits in length, providing more specificity than the 6 digit O*NET limit found within the EMSI program. This is primarily because other economic data sources, such as the Economic Census, utilize only 6 digit SOC codes. Thus when we created the regional queries, we reduced the code length of each occupation from 8 to 6 digits. For example, if the Survey provided 11-1011.03, Chief Sustainability Officer, we would enter 11-1011.00, Chief Executive, into EMSI. When EMSI was unable to provide data on the 6 digit SOC code, we would go to the 5 digit, then the 4 digit, etc., until we could generate the desired data. We seldom had to go below the 6 digit SOC code to obtain the data. EMSI produces unemployment data at the top 2 digit SOC codes, such as 11-0000.00. In order to match this format, we aggregated SOC codes generated from the survey at the 2 digit SOC code level as well. We aggregated these SOC codes for use in the labor tightness analysis, and the aggregated SOC codes were not necessary for the analysis of the labor-demand gap. EMSI based its unemployment dataset off the December 2010 editions of the Bureau of Labor Statistics' *Local Area Unemployment Statistics* and the Employment & Training Administration's *Characteristics of the Insured Unemployed*.

EMSI was also limited in its ability to specify SOC code levels in several categories for economic data, the first of which was the "farming, fishing, and forestry" occupations. EMSI aggregated supervisory roles within this industry under SOC code 45-1099 "Supervisors, farming, fishing, and forestry workers." When the Survey produced a SOC code numerically below 45-1099, we found that it was necessary to select this EMSI-generated SOC code 45-1099 to represent these specific Survey results.¹⁵ EMSI also aggregated farm workers under the code 45-209A "miscellaneous agricultural workers." Here too we utilized an EMSI

¹⁴ The Maryland zones that fell within the Washington Metropolitan Area included Calvert County, Charles County, Frederick County, Montgomery County, and Prince George's County. The Virginia zones that fell within the Washington Metropolitan Area included Arlington County, Clarke County, Fairfax County, Fauquier County, Frederick County, Loudoun County, Prince William County, Spotsylvania County, Stafford County, Warren County, the City of Alexandria, the City of Fairfax, the City of Falls Church, the City of Fredericksburg, the City of Manassas, and the City of Manassas Park.

¹⁵ All SOC codes that fall under 45-1099 includes 45-1011.00 "First-Line Supervisors/Managers of Farming, Fishing, and Forestry Workers," 45-1011.05 "First-Line Supervisors/Managers of Logging Workers," 45-1011.06 "First-Line Supervisors/Managers of Agricultural Workers," 45-1011.07 "First-Line Supervisors/Managers of Agricultural Crop and Horticultural Workers," 45-1011.08 First-Line Supervisors/Managers of Animal Husbandry and Animal Care Workers," and 45-1012.00 "Farm Labor Contractors."

code to represent the various types of agricultural workers counted in the Survey.¹⁶ The “education, training, and library occupations” SOC code within EMSI also had its own exception. All forms of “postsecondary teachers” were aggregated within the system as 25-1099 “Postsecondary teachers.” We categorized every postsecondary teacher occupation within the Survey under this EMSI code.¹⁷ It is important to note that these limitations only applied to the economic data within EMSI and not the education data.

¹⁶ All SOC codes that fall under 45-209A includes 45-2091.00 “Agricultural Equipment Operators,” 45-2092.00 “Farmworkers and Laborers, Crop, Nursery, and Greenhouse,” 45-2092.01 “Nursery Workers,” 45-2092.02 “Farmworkers and Laborers, Crops,” 45-2093.00 “Farmworkers, Farm and Ranch Animals,” and 45-2099.00 “Agricultural Workers, All Other.”

¹⁷ All SOC codes that fall under 25-1099 includes 25-1011.00 “Business Teachers, Postsecondary,” 25-1021.00 “Computer Science Teachers, Postsecondary,” 25-1022.00 “Mathematical Science Teachers, Postsecondary,” 25-1031.00 “Architecture Teachers, Postsecondary,” 25-1032.00 “Engineering Teachers, Postsecondary,” 25-1041.00 “Agricultural Sciences Teachers, Postsecondary,” 25-1042.00 “Biological Science Teachers, Postsecondary,” 25-1043.00 “Forestry and Conservation Science Teachers, Postsecondary,” 25-1051.00 “Atmospheric, Earth, Marine, and Space Sciences Teachers, Postsecondary,” 25-1052.00 “Chemistry Teachers, Postsecondary,” 25-1053.00 “Environmental Science Teachers, Postsecondary,” 25-1054.00 “Physics Teachers, Postsecondary,” 25-1061.00 “Anthropology and Archeology Teachers, Postsecondary,” 25-1062.00 “Area, Ethnic, and Cultural Studies Teachers, Postsecondary,” 25-1063.00 “Economics Teachers, Postsecondary,” 25-1064.00 “Geography Teachers, Postsecondary,” 25-1065.00 “Political Science Teachers, Postsecondary,” 25-1066.00 “Psychology Teachers, Postsecondary,” 25-1067.00 “Sociology Teachers, Postsecondary,” 25-1069.00 “Social Sciences Teachers, Postsecondary, All Other,” 25-1071.00 “Health Specialties Teachers, Postsecondary,” 25-1072.00 “Nursing Instructors and Teachers, Postsecondary,” 25-1081.00 “Education Teachers, Postsecondary,” and 25-1082.00 “Library Science Teachers, Postsecondary.”