

Note 2 and corresponding text (page 26) were updated on February 6, 2013.

## The Green Goods and Services Occupational survey: initial results

*A new BLS survey provides data on occupations and wages in green establishments; a wage gap between green and nongreen establishments is traced to the occupational mix*

Zack Warren

In 2012, the Bureau of Labor Statistics (BLS, the Bureau) published data on the green economy from three new data collection efforts. The results that follow come from one of these efforts: the Green Goods and Services Occupational survey (also known as the GGS-OCC survey), whose data were first released in September 2012. Integrating green revenue data from one BLS survey—the Green Goods and Services (GGS) survey—with occupational staffing patterns from another BLS survey—the Occupational Employment Statistics (OES) survey—the GGS-OCC survey provides information on occupational employment and earnings in GGS industries. After giving some background on the GGS-OCC methodology, this article presents a number of high-level findings on occupational employment and wages in establishments providing green goods or services. The article concludes by demonstrating how wages in green establishments are largely a result of the industrial and occupational composition of those establishments.

### The GGS-OCC survey

As noted in the previous section, GGS-OCC data do not come from a dedicated survey; rather, the estimates are calculated from the aforementioned GGS and OES surveys. To facilitate the calculation, the

GGS survey was designed from the ground up to allow for the creation of the GGS-OCC estimates, while the OES survey was modified by altering sampling procedures and supplementing data collection with additional units.<sup>1</sup>

The GGS survey is comprised of 120,000 units selected from 333 of the roughly 1,200 detailed industries listed in the 2007 North American Industrial Classification System (NAICS).<sup>2</sup> The Bureau identified these 333 industries as industries that could produce green goods and services. This subset of industries collectively represents approximately 23 percent of all establishments, and 20 percent of all employment, in the U.S. economy. The number of industries included within the scope of the survey varies by industry sector; for example, nearly all the industries in the construction sector are in scope, whereas none of the healthcare and social assistance industries are.<sup>3</sup> An important fact to recall is that NAICS industries are assigned a code only by the “primary activity” of the establishment; thus, it is likely that some establishments which produce green goods and services as a secondary activity, and hence the employees from those establishments, are *not* included in the GGS survey. Because the GGS-OCC and GGS surveys share the same scope, all GGS-OCC data are restricted to this “potentially green” sector of the economy based on the primary activity of the establishment.

The GGS survey form asks each establishment sampled for the percentage of its revenue generated by the sale of goods and services “that

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benefit the environment or conserve natural resources,” according to the BLS definition of a green job.<sup>4</sup> Alternatively, and in the case of establishments that do not generate revenue, such as government or nonprofit establishments, respondents are asked for the percentage of employment associated with green goods and services. The revenue or employment percentage reported is then referred to as the establishment’s *green percentage*.

The other source of data for the GGS-OCC estimates, the OES survey, is a longtime BLS program that surveys establishments for their staffing patterns: lists of employees classified by their occupations,<sup>5</sup> along with the wages of those employees. The OES sample of 1.2 million establishments is drawn from a list of U.S. establishments maintained by the BLS Quarterly Census of Employment and Wages (QCEW) and is the same frame used to select the 120,000-unit GGS sample. The OES sample is collected in six semiannual panels, rather than in single annual panels as is the GGS sample. To facilitate the GGS-OCC estimates, the GGS and OES samples are drawn simultaneously in a manner that maximizes the number of OES units that are also sampled by the GGS survey. Whenever possible, in addition to the units that naturally overlap the two surveys, GGS units are replaced with similar units already sampled by the OES survey. A 25,000-unit sample supplement also is added to the OES sample in order to collect data from industries that are not within the scope of the OES survey, as well as to improve the GGS-OCC’s coverage of existing industries. All these modifications serve to maximize the number of available units for the GGS-OCC estimates.

Finally, to create the GGS-OCC estimates, the OES staffing patterns are matched to the GGS green percentages for each of the establishments that responded to the GGS survey. For units that did not respond to the OES survey, staffing patterns are imputed according to a nearest neighbor method. A nonresponse adjustment factor is used to adjust for nonresponding GGS units, and the employment estimate is benchmarked to the QCEW employment levels. The last step of estimation leads to the most important distinction between the GGS and GGS-OCC surveys: the manner in which the green percentage is used to derive green employment. To get the GGS estimate of green employment, the Bureau multiplies the green percentage by the establishment’s employment figure to estimate the establishment’s “GGS employment.” By contrast, the GGS-OCC estimates of green employment are based on *grouping* establishments by their green percentage rather than prorating employment by it.

The Bureau found prorating to be a good proxy for

determining *total* green employment by industry, but the method would not provide as useful an estimate of green *occupational* employment. The employment estimates from the GGS survey, which use prorating, rely on the assumption that the ratio of green revenue to total revenue is directly proportional to the ratio of green employment to total employment. However, in establishments with revenue from the sale of green goods and services, one would expect certain occupations to be more closely related to producing those green goods and services than others. Under that expectation, prorating all employment by the green percentage would result in *part* of every occupation in such an establishment becoming a green job, rather than the entirety of a subset of occupations.

Consequently, to preclude such a possibility, establishments were categorized into three groups, based on their reported percentages of greenness and named for their degree of greenness: those which derive *all* of their revenue from green sources; those which derive *some*, but not all, of their revenue from green sources; and those with *no* green revenue. The three groups are defined strictly; that is, the all-green category comprises all establishments that reported a green revenue or employment of 100 percent; the some-green category comprises those which reported greater than zero percent but less than 100 percent; and the no-green category comprises those reporting exactly zero percent. Because of the different estimation methods, even though the GGS and GGS-OCC surveys share a common data source, there is no single green employment estimate that is directly comparable between the two surveys. GGS data offer more detailed industry estimates—down to the six-digit NAICS level for some industries—as well as estimates by state, but lack occupational detail, making GGS estimates generally most useful for analyses in which occupational detail is not required. By contrast, although the GGS-OCC estimates are national only and provide industry data just to the sector NAICS level, they include occupational detail.

Three key factors to bear in mind in reviewing the GGS-OCC data in the rest of this article are (1) that the estimates are created from the green percentages collected by the GGS survey and staffing patterns collected by the OES survey; (2) that the green categories are based on establishments’ reported green percentages, so that all employment in an establishment contributes to the same green category, regardless of whether those occupations are or are not related to the green activity at the establishment; and (3) that the GGS-OCC survey is restricted to a subset of the entire economy: the 333 industries that could produce green goods and services.

## Overall GGS-OCC estimates

At their highest level of aggregation, the GGS-OCC estimates show that employment is overwhelmingly concentrated in no-green establishments. In all, more than 1.9 million jobs are in all-green establishments, 6.1 million are in some-green establishments, and almost 18.3 million—nearly 70 percent of all in-scope employment—are in no-green establishments, as shown in the following tabulation:

<i>Green revenue category</i>	<i>Total employment</i>	<i>Average annual wage</i>
Total, all in-scope establishments.....	26,326,990	\$56,540
All-green establishments .....	1,949,520	48,210
Some-green establishments .....	6,110,380	54,440
No-green establishments .....	18,267,090	58,130

Table 1 shows how employment, even when classified into occupational groups, is nearly always greatest in no-green establishments, compared with the other two green categories: in only 4 of the 22 major occupational groups—life, physical, and social science; education, training, and library; food preparation and serving related occupations; and transportation and material moving—is the majority of employment found in all-green or some-green establishments (or both combined).

The largest occupations in all-green establishments, shown in table 2, include school bus drivers (174,450 employees), transit bus drivers (111,760), collectors of refuse and recyclable materials (56,930), and forest and conservation technicians (56,620). The largest occupations in no-green establishments are general office clerks (530,180 employees), secretaries and administrative assistants (417,780), general and operations managers (408,080), and construction laborers (405,880). All of these no-green occupations are among the largest in the economy overall.<sup>6</sup>

Another interesting way to look at the occupational composition of GGS employment is to examine the distribution of occupations across the three categories of revenue—in particular, the occupations that are most heavily concentrated in each category. The occupations that are almost entirely found in all-green establishments include subway and street car operators, school bus drivers, nuclear reactor operators, forest and conservation technicians, and transportation attendants. In all of these occupations, more than 75 percent of in-scope employment is found in the all-green category. A far greater number of occupations are found exclusively in no-green establishments, an unsurprising fact given the much greater employment in

that category. Some of the largest occupations that are at least 99 percent concentrated in the no-green category are air traffic controllers, insurance underwriters, transportation security screeners, insurance sales agents, actuaries, actors, and law clerks.

The bulk of this article treats the all-green and no-green categories, because the two extremes provide the most interesting comparisons. Still, the some-green category is not without interesting results. The category tends to be dominated by large, nonspecialized institutions that might have a particular department or subunit which focuses on green products and services. This structure is noticeable in the occupations most heavily concentrated in the some-green category: sociologists, locker room attendants, psychiatrists, musical instrument repairers, and family and general practitioners. These occupations are the five most concentrated, and all five have the majority of their in-scope GGS-OCC employment in universities and colleges.<sup>7</sup>

The other noteworthy finding from the some-green category is that the establishments in the construction industry that conduct any green activity are almost entirely in that category. In other words, very few construction establishments provide green construction services exclusively. Rather, such services are provided mostly by traditional construction establishments, either specializing temporarily in green construction or dedicating only a small part of their activities to it while continuing with traditional activities. This finding is apparent in GGS-OCC estimates in several ways. First, the some-green category comprises roughly 25 percent of employment within the construction occupational group, while the all-green category comprises only 4 percent. Second, 7 of the 10 largest occupations in the some-green category are specific to construction: carpenters, electricians, plumbers, general managers, construction laborers, civil engineers, and construction supervisors. (The other 3 occupations are office clerks, the catchall grouping “all other postsecondary teachers,” and secretaries.) Finally, as shown later, employment in the construction industry as a whole is 24 percent in the some-green category and only 2 percent in the all-green category.<sup>8</sup>

In the development of the green surveys at the Bureau, an early research avenue was to examine the occupations collected by the OES survey to see if analysts could consider any of them as green by definition; for example, the definition of “environmental engineers” says that they “research, design, plan, or perform engineering duties in the prevention, control, and remediation of environmental hazards using various engineering disciplines.”<sup>9</sup> Because

**Table 1. Employment and wages, by occupational group and green category, November 2011**

Occupational group	All green		Some green		No green	
	Employment	Mean annual wage	Employment	Mean annual wage	Employment	Mean annual wage
Total, all occupations	1,949,520	\$48,210	6,110,380	\$54,440	18,267,090	\$58,130
Management	95,360	110,220	428,390	108,450	1,428,280	124,230
Business and financial operations	83,740	71,250	279,960	64,750	1,216,160	69,530
Computer and mathematical	25,540	77,270	196,340	68,280	1,422,100	78,940
Architecture and engineering	105,670	77,130	404,910	70,900	822,600	75,920
Life, physical, and social science	174,930	57,660	185,160	57,510	324,850	68,670
Community and social service	3,030	47,170	44,870	45,780	75,790	44,500
Legal	6,670	115,150	39,350	144,720	562,080	116,020
Education, training, and library	13,090	53,440	941,770	66,810	918,970	58,650
Arts, design, entertainment, sports, and media	22,200	50,750	155,910	52,520	647,880	73,260
Healthcare practitioners and technical	7,900	66,640	57,830	57,740	113,510	67,310
Healthcare support	70	35,260	9,270	31,760	26,400	34,350
Protective service	26,320	44,090	54,190	40,350	106,880	39,930
Food preparation and serving related	2,160	27,190	26,790	27,620	27,550	25,040
Building and grounds cleaning and maintenance	35,620	29,080	186,050	28,900	627,090	27,520
Personal care and service	18,780	24,320	45,730	27,130	71,440	31,210
Sales and related	84,560	38,020	180,010	46,920	629,940	61,200
Office and administrative support	194,440	37,260	877,470	35,970	2,918,530	37,850
Farming, fishing, and forestry	29,260	25,670	86,420	25,150	625,000	23,690
Construction and extraction	137,060	44,910	895,310	47,000	2,539,890	45,270
Installation, maintenance, and repair	135,470	49,140	278,480	44,580	1,000,620	42,210
Production	208,180	39,240	462,710	36,780	1,520,970	36,150
Transportation and material moving	539,470	35,390	273,450	34,570	640,560	36,720

SOURCE: U.S. Bureau of Labor Statistics.

**Table 2. Employment and wages in the largest occupations in the all-green and no-green categories, November 2011**

Occupation	Employment	Mean annual wage
<b>All green</b>		
Bus drivers, school or special client	174,450	\$30,460
Bus drivers, transit and intercity	111,760	41,580
Refuse and recyclable materials collectors	56,930	34,670
Forest and conservation technicians	56,620	40,110
Laborers and freight, stock, and material movers, hand	54,890	26,270
<b>No green</b>		
Office clerks, general	530,180	29,730
Secretaries and administrative assistants, except legal, medical, and executive	417,780	33,770
General and operations managers	408,080	133,890
Construction laborers	405,880	35,340
Landscaping and groundskeeping workers	403,440	25,350

SOURCE: U.S. Bureau of Labor Statistics.

one of the conditions listed in the BLS definition of a green job is that the job “reduce or eliminate the creation or release of pollutants or toxic compounds, or remove pollutants or hazardous waste from the environment,” the job of any worker who performed, for example, the duties that meet the definition of “environmental engineers” would also meet the definition of a green job.<sup>10</sup> Eight occupations whose duties were found to be directly linked to green activities were examined in an OES publication while the GGS survey was first being collected;<sup>11</sup> chart 1 shows the GGS-OCC data for those eight occupations.

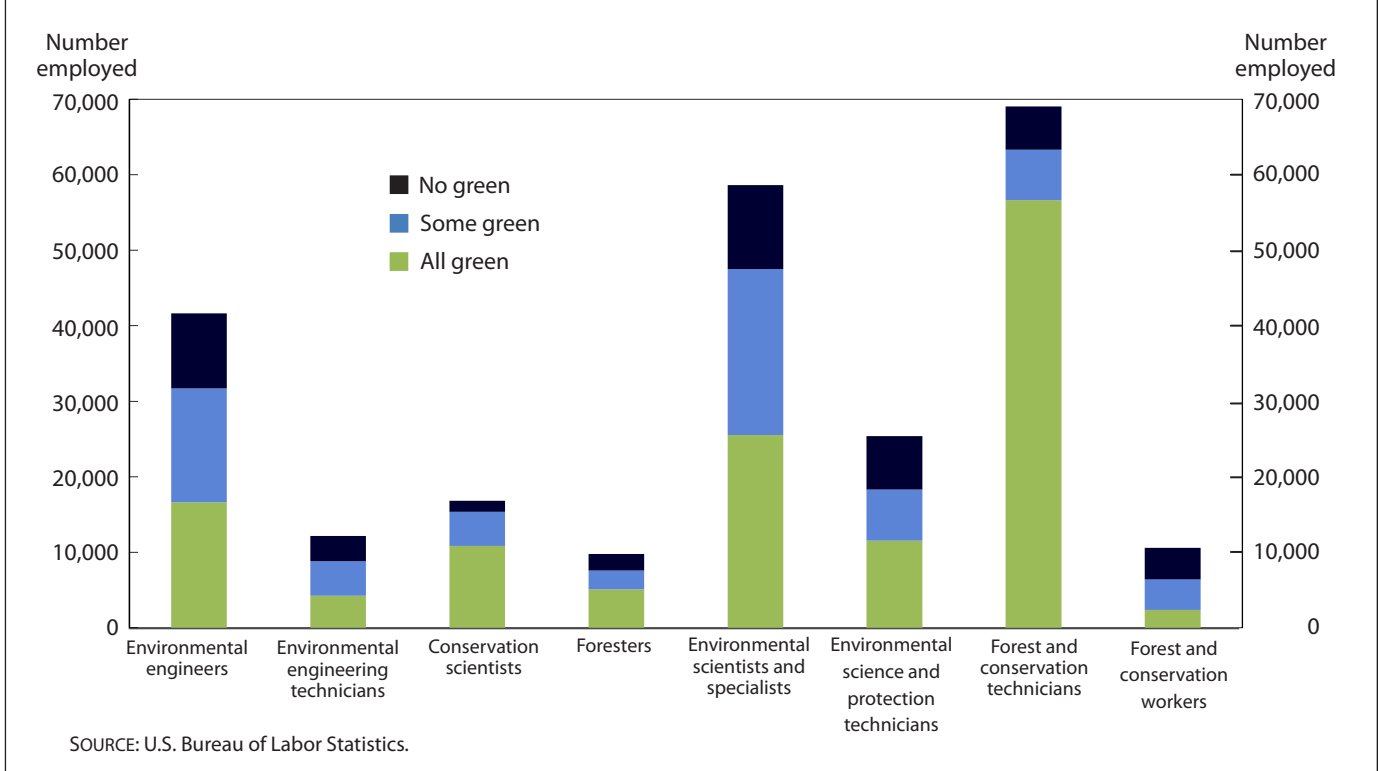
Because the eight occupations in the chart seem “inherently green,” one might expect the no-green employment in those occupations to be vanishingly small. Yet it isn’t: the eight occupations have from 8 percent to 40 percent of their employment in the no-green category. Such a range illustrates how the different BLS approaches to measuring green jobs capture different workers: the “inherently green” workers may still be found in establishments with no green revenue, because those workers are developing green products or services that are not yet generating revenue or they could be performing activities to make the establishment’s production processes greener, rather than producing a green product or service. Activities that make

the establishment’s production processes greener would be captured by the BLS Green Technologies and Practices survey.<sup>12</sup>

The GGS-OCC data include mean (or average) and median (or 50th-percentile) wage estimates in addition to the employment figures. The wage estimates are available both as hourly wage rates and as annual wages based on a 2,080-hour standard work year.<sup>13</sup> The latter is used in this article. Across all occupations, the average wage of the three categories decreases from the no-green to the all-green category. As shown in the text tabulation on page 28, the no-green category has an average annual wage of \$58,130. The some-green category is lower, at \$54,440, while the all-green category is still lower, at \$48,210. Although this appears to be a stark result, the analysis will subsequently demonstrate that these differences reflect mainly the occupational composition of the three categories of revenue.

The employment and wage figures cited in the previous several paragraphs highlight the broadest estimates in the first publication of the GGS-OCC survey, as well as some of the more noteworthy occupational estimates. The remainder of the article will continue to clarify the significance of these high-level GGS-OCC estimates by

**Chart 1. Employment in eight occupations with duties expected to be directly linked to green activities, by green category, November 2011**





illustrating what the detailed GGS-OCC estimates can reveal about them.

## Industry effects and employment

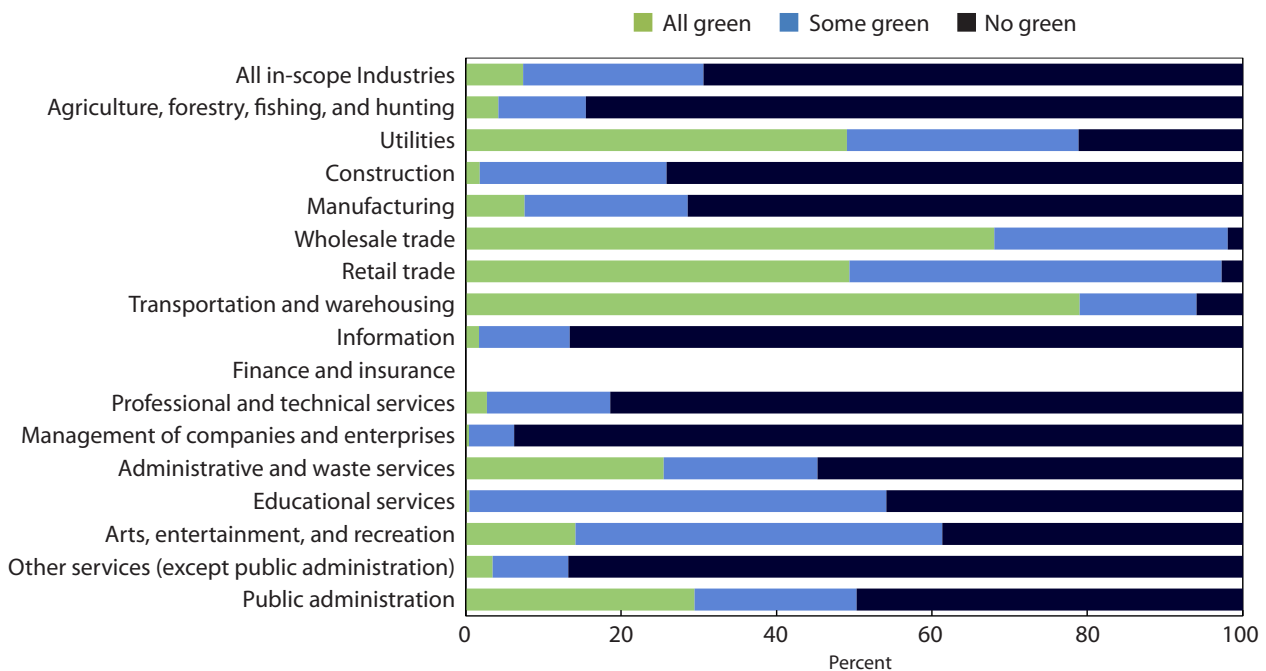
Chart 2 introduces a new level of detail in the GGS-OCC estimates. The chart shows how the total in-scope employment in each of the 16 NAICS industry sectors (as well as the cross-industry total) is divided among the three green revenue categories. Across all industries, 69 percent of employment is found in establishments with no green revenue (or employment), 23 percent is found in those with some, and just 7 percent is found in establishments in which all the revenue comes from green revenue streams. That pattern does not hold in many individual industries, however: all-green employment ranges from 79 percent in transportation and warehousing to less than 1 percent in management of companies and enterprises and in educational services.

The distribution of green employment in each sector is useful for any overall or cross-industry analysis that uses GGS-OCC data because it lays bare some of the industrial effects behind the estimates. Any employment estimates involving multiple industries will be heavily influenced

by industry differences, but the GGS-OCC estimates are especially so because they are based on a limited industry scope. Chart 2 helps to illustrate how the largest occupations in each green category appear there, given that the occupations naturally follow from the industrial mix of the category. The reason is that industry is by far the most important determinant of which occupations an establishment will employ. It is clear from this fact why bus drivers and refuse and recyclable material collectors are among the largest all-green occupations. Aside from the wholesale and retail trade industries, which are very small in the scope of the GGS survey, the transportation and warehousing industry and the utilities industry are the greenest of all the industries in the chart. Thus, it comes as no surprise that many of the largest all-green occupations are found primarily in those industries.

Although there is a considerable amount of shading indicating all-green and some-green employment in industries shown in the chart, those industries tend to be the smaller ones within the scope of the GGS survey. The industries with the most all-green employment—transportation and warehousing, wholesale trade, utilities, and retail trade—are 4 of the 6 smallest industry sectors within the scope of the survey. Of course, the retail trade sector is very large in the

**Chart 2. Percentage of industry sector employed, by green category, November 2011**



NOTE: Complete data for finance and insurance are not available.  
SOURCE: U.S. Bureau of Labor Statistics.

overall economy, while the wholesale trade and transportation sectors are midsized; but in each of those three sectors, only a small portion of the total industry is within the scope of the GGS survey. The utilities sector, by contrast, is mostly within the survey's scope, but it is small overall.

In addition to estimates at the levels of aggregation already mentioned, detailed occupational estimates for each of the 16 industry sectors are included in the GGS-OCC data. Thus, industry-specific comparisons between the green categories can help isolate industry effects. As noted before, an establishment's industry is the major determinant of the occupations that establishment will employ. The GGS-OCC data show that, within an industry, an establishment's greenness is also a determinant of the occupations that establishment employs. For example, in the construction sector, while both all-green and no-green establishments employ many basic construction occupations, such as construction supervisors, carpenters, electricians, and construction laborers, establishments in the

two categories also have specialized occupations that are heavily favored by one category over the other. One way to show these differences, given the large employment size difference between the all-green and no-green categories, is to compare the relative concentrations of all the occupations in those categories. Table 3 lists selected occupations in construction that are more prevalent in all-green establishments, those which appear in both categories in nearly equal proportions, and those which are more prevalent in no-green establishments.

Table 3 shows that there are more insulation workers working in no-green establishments than in all-green establishments. The reason, however, is primarily because there are more than 30 no-green establishments for every all-green establishment in the construction sector. In order to control for that size discrepancy, table 3 also shows the relative concentration of each occupation in the all-green and no-green categories. The relative concentration of an occupation in all-green establishments is calculated

**Table 3. Relative concentrations of selected occupations in the construction industry, November 2011**

Occupation	All-green employment	No-green employment	Concentration in all green relative to no green
<b>Concentrated in all-green establishments</b>			
Insulation workers, floor, ceiling, and wall	8,210	13,210	25.7
Electrical engineers	460	1,300	14.7
Helpers, construction trades, all other	1,420	9,310	6.3
Electrical power-line installers and repairers	1,690	21,440	3.3
Heating, air conditioning, and refrigeration mechanics and installers	5,190	93,760	2.3
Heavy and tractor-trailer truck drivers	2,430	52,590	1.9
Welders, cutters, solderers, and brazers	1,020	24,870	1.7
<b>Similarly concentrated</b>			
Construction managers	2,610	103,530	1.0
First-line supervisors of construction trades and extraction workers	5,830	232,610	1.0
Carpenters	7,860	319,090	1.0
Electricians	5,390	256,320	.9
Construction laborers	7,680	390,060	.8
<b>Concentrated in no-green establishments</b>			
Sheet metal workers	–	51,750	.3
Cement masons and concrete finishers	–	92,540	.3
Roofers	–	70,180	.2
Painters, construction and maintenance	–	105,800	.0
Telecommunications equipment installers and repairers, except line installers	0	21,190	.0
Telecommunications line installers and repairers	0	23,140	.0
Brickmasons and blockmasons	0	61,500	.0

NOTE: Dash indicates data do not meet BLS publication standards.

SOURCE: U.S. Bureau of Labor Statistics.

by dividing the share of all-green construction employment in all-green establishments by the share of no-green construction employment in no-green establishments. That is, the relative concentration is

$$RC_{cj} = \frac{(a_{cj}/A_c)}{(n_{cj}/N_c)}$$

where  $N_c$  = no-green total employment in industry  $c$ ,

$n_{cj}$  = no-green employment in industry  $c$  and occupation  $j$ ,

$A_c$  = all-green total employment in industry  $c$ , and

$a_{cj}$  = all-green employment in industry  $c$  and occupation  $j$ .

Thus, although there are 5,000 more insulation workers in no-green establishments than in all-green establishments, insulation workers are relatively more important in the latter establishments. In fact, a worker in an all-green construction establishment is 25 times more likely than a worker in a no-green establishment to be an insulation worker. In contrast, no-green establishments use painters heavily, whereas all-green establishments do not. Both types of establishments employ carpenters, electricians, and construction laborers in approximately similar proportions. From these data, an analyst can identify the occupations that are relatively more important to green employers and, in some cases, such as the appearance of insulation workers and heating, air conditioning, and refrigeration mechanics and installers in the all-green category, get an indication of the type of green activities the green establishments engage in.

## Occupational composition and wages

In the same manner that occupational differences between the green categories shown in the overall numbers are largely a result of the specific industries that make up those categories, the rather large wage differences between categories can be illuminated with the use of the more detailed occupational estimates. For example, a data user may be immediately struck by the relatively large wage gap of nearly \$10,000 in annual mean wages between the all-green and no-green categories. However, the overall wage of \$48,210 in the all-green category, compared with the \$58,130 mean for the no-green category, does not necessarily indicate that all workers in green establishments are paid significantly less than those producing nongreen products and services. In fact, as of November 2011, wages

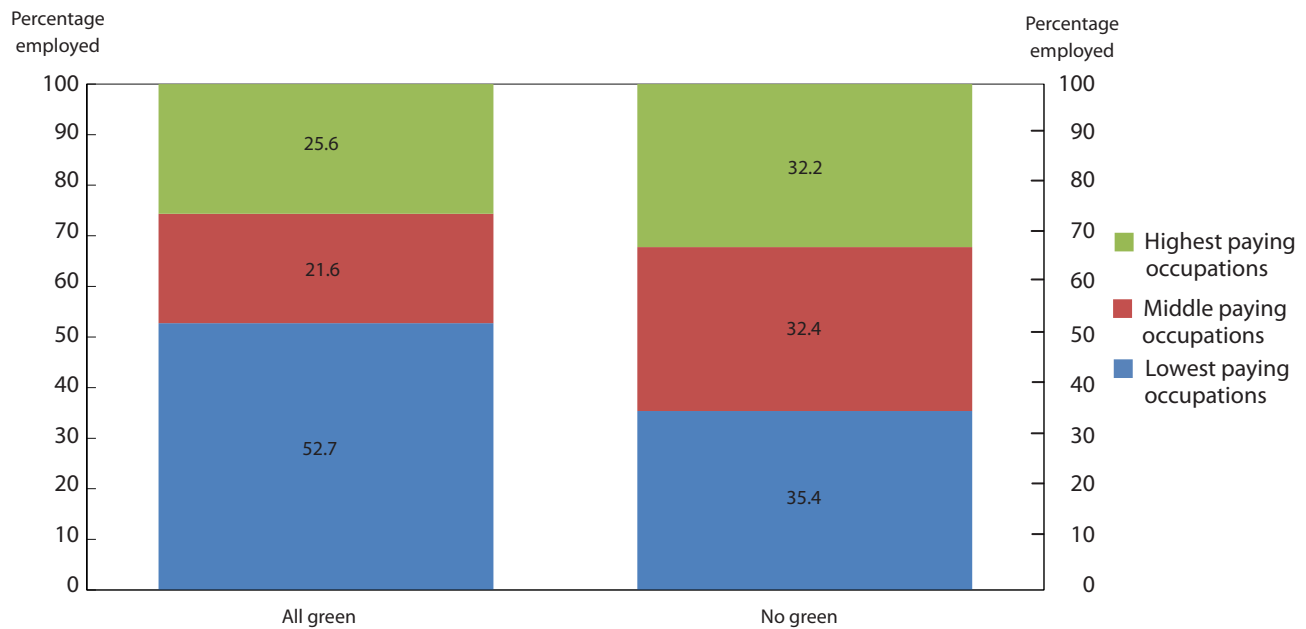
in all-green establishments and in some-green establishments were still higher than the U.S. average of \$45,230 measured 6 months earlier.

A worker's wage rates can be influenced by many factors, including the worker's experience, education, or union participation; the industry, size, or location of the worker's employer; and, most importantly when groups with many occupations are compared, the worker's occupation. A simple analysis shows how the wage difference between the all-green and no-green categories can be attributed largely to the occupational composition of employment in those categories. To illustrate, the 22 major occupational groups are divided into 3 categories according to the mean wage of the occupational group in the May 2011 OES estimates. The 8 occupational groups with an average below the 33rd percentile of the wage distribution are considered lowest paying, the 7 occupational groups between the 33rd and 66th percentiles are considered middle paying, and the 7 with an average wage above the 66th percentile are considered highest paying.<sup>14</sup> Chart 3 shows the resulting share of employment in the lowest, middle, and highest paying occupational groups in the all-green and no-green categories when those wage classifications are applied to the major groups in the GGS-OCC data. The chart shows that the no-green category has roughly equal employment among the lowest, middle, and highest paying occupational groups while the all-green category has relatively more employment in the lowest paying occupational groups.

A more sophisticated technique called *shift-share analysis* can be used to isolate one source of the wage difference. In the June 2009 issue of the *Review*, BLS economist Rebecca Keller used the technique to break down changes in the U.S. real wage, and in the May 2003 issue of *Occupational Employment and Wages*, BLS economist Patrick Kilcoyne used it to compare the average wages of the 50 States and the District of Columbia.<sup>15</sup> The technique is useful in the analysis presented here because occupation is one of the largest determinants of wages for an individual worker. The mix of occupations that make up an entity such as a State, an industry, a snapshot in time of the economy, or, in this case, a green category, plays a large part in determining the average wage of that entity. If the large wage difference between all-green and no-green workers is real, then it should persist across occupations; if it is misleading, then it is most likely because all-green workers are found more in the lowest paying occupations than are no-green workers. The shift-share technique is used to separate the \$9,920 wage difference between the two groups of workers into a portion due to differences in pay, a portion due to the occupations in



**Chart 3. Distribution of employment in lowest, middle, and highest paying occupations, by green category, November 2011**



SOURCE: U.S. Bureau of Labor Statistics.

which those workers are employed, and a portion due to all other reasons.

The shift-share technique works in this instance by swapping data between the two green categories and recording the effect on the estimates in order to estimate the size of each portion. This is done, in simple terms, by multiplying the all-green employment by the no-green wage, and vice versa, for each occupation. The sum of all occupations for the former is used to estimate the portion of the wage gap due to real differences in pay. The sum of all occupations for the latter is used to estimate the portion of the wage gap due to occupational composition. The formula used to compare wages in the all-green and no-green categories is

$$\bar{w}_a - \bar{w}_n = \left. \frac{\sum_{j=1}^J \left[ \left( \frac{n_j}{N} \right) \times A \times w_{aj} \right]}{A} - W_N \right\} \text{Wage portion}$$

$$\left. \frac{\sum_{j=1}^J (a_j \times w_{nj})}{A} - W_N \right\} \text{Occupational portion}$$

$$\sum_{j=1}^J \left\{ \left[ \left( \frac{n_j}{N} \right) - \left( \frac{a_j}{A} \right) \right] \times [w_{nj} - w_{aj}] \right\} \left. \right\} \text{Residual}$$

where  $N$  = no-green total employment,  
 $n_j$  = no-green employment in occupation  $j$ ,

$A$  = all-green total employment,  
 $a_j$  = all-green employment in occupation  $j$ ,  
 $W_N$  = no-green total wage,  
 $w_{nj}$  = no-green wage in occupation  $j$ ,  
 $w_{aj}$  = all-green wage in occupation  $j$ , and  
 $\bar{w}_a - \bar{w}_n$  = difference of all-green and no-green average annual wages.

When shift-share analysis is used on the GGS-OCC estimates to compare the all-green average wage with the no-green average wage, the hypothesis that the nearly \$10,000 wage gap is due more to the variety of occupations employed in each category than to the various wages is confirmed, as the following tabulation shows:

Category	Dollar amount or percentage
Annual wage, no-green establishments.....	\$58,130
Annual wage, all-green establishments.....	\$48,210
Difference (all green minus no green).....	-\$9,920
Wage-rate component.....	-\$3,080
Occupational component.....	-\$10,310
Residual.....	\$3,470
Percentage due to wages.....	31
Percentage due to occupational composition..	104
Percentage due to other factors.....	-35

The idea to take away from this tabulation is not so much the specific dollar values for each component as the fact that the occupational composition has roughly 3 times the explanatory power as the wage values. Similar to the earlier analysis, this one shows that the wage gap between green categories is due mostly to the types of jobs the establishment employs and not because no-green establishments always pay better. Still, there is a \$3,000 wage-rate-based component in the analysis, suggesting that there is some difference in pay between the categories even when isolated from the occupational mix. This wage-rate component is matched and canceled by a component attributable to unknown factors. In addition to the much more sizable oc-

cupational component, the fact that the residual is as large as the wage-rate component suggests that the wage-rate component is a minor factor in the wage gap. Even though the full \$10,000 wage gap is misleading, the analysis is not meant to suggest that the wage estimates are not informative: it is still worthwhile to know that, in the aggregate, the all-green jobs tend to be lower paying. The all-green workers may be close to equally compensated for their jobs relative to the other categories, but the fact remains that those jobs tend to be lower paying. The intent of the analysis is simply to illustrate the meaning behind the estimates and to show how the detailed estimates can clarify the higher level aggregates.<sup>16</sup> □

## Notes

<sup>1</sup> For a thorough discussion of the survey methodology, see “Green Goods and Services Occupations: Survey Methods and Reliability Statement for Occupational Employment and Wages in Green Goods and Services” (U.S. Bureau of Labor Statistics, Oct. 3, 2012), [http://www.bls.gov/ggsocc/survey\\_methods.htm](http://www.bls.gov/ggsocc/survey_methods.htm).

<sup>2</sup> An article on the Green Goods and Services survey will be published in a forthcoming issue of the *Monthly Labor Review*.

<sup>3</sup> For the full list of included and excluded industries, see “Green Goods and Services Occupations: Green Goods and Services Occupations (GGS-OCC) FAQs,” question 7, “What industries are within scope for the GGS-OCC estimates?” (U.S. Bureau of Labor Statistics, Oct. 3, 2012), <http://www.bls.gov/ggsocc/faq.htm#7>.

<sup>4</sup> For the full BLS definition of a green job, see “The BLS Green Jobs Definition,” in *Green Jobs: Measuring Green Jobs* (U.S. Bureau of Labor Statistics), <http://www.bls.gov/green/#definition>.

<sup>5</sup> The GGS-OCC classifies occupations in accordance with the Standard Occupational Classification system; see “Standard Occupational Classification” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/soc>.

<sup>6</sup> According to May 2011 OES data, general office clerks, secretaries and administrative assistants, and general and operations managers are among the 15 largest occupations in the U.S. economy while construction laborers are among the 40 largest. The OES estimates, unlike those of the GGS-OCC, include data from all nonfarm establishments.

<sup>7</sup> Other than sociologists, these occupations are not normally concentrated in universities, but because the GGS-OCC survey excludes many industries, colleges and universities make up the largest remaining industry to employ these workers.

<sup>8</sup> In the case of construction, it can be easy to confuse occupations and industries because the construction occupations make up the bulk of the construction industry. However, construction occupations can be found in many industries, while the construction industry also employs many nonconstruction workers, such as secretaries and accountants.

<sup>9</sup> See *Standard Occupational Classification* (U.S. Bureau of Labor Statis-

tics, Mar. 11, 2010) p. 27, <http://www.bls.gov/soc/2010/soc172081.htm>.

<sup>10</sup> See “The BLS Green Jobs Definition.”

<sup>11</sup> See “Occupational Employment Statistics: Occupational Employment Statistics (OES) Highlights: Jobs for the Environment” (U.S. Bureau of Labor Statistics, June 2009), [http://www.bls.gov/oes/high\\_light\\_environment.htm](http://www.bls.gov/oes/high_light_environment.htm).

<sup>12</sup> See “Green Technologies and Practices” (U.S. Bureau of Labor Statistics), <http://www.bls.gov/gtp>.

<sup>13</sup> In the GGS-OCC survey, a standard work year is 40 hours of work a week for 52 weeks.

<sup>14</sup> The lowest paying occupational groups are healthcare support; food preparation and serving; building and grounds cleaning; personal care and service; office and administrative support; farming, fishing, and forestry; production; and transportation and material moving. The middle-paying groups are community and social service; education, training, and library; arts, design, entertainment, sports, and media; protective service; sales; construction; and installation, maintenance, and repair. The highest paying occupational groups are management; business and financial occupations; computer and mathematical occupations; architecture and engineering; life, physical, and social science; legal occupations; and healthcare practitioners and technical occupations.

<sup>15</sup> See Rebecca Keller, “How shifting occupational composition has affected the real average wage,” *Monthly Labor Review*, June 2009, pp. 26–38, <http://www.bls.gov/opub/mlr/2009/06/art2full.pdf>; and Patrick Kilcoyne, “The role of occupational composition in state wage differentials,” *Occupational Employment and Wages*, September 2004, pp. 8–13, <http://www.bls.gov/oes/2003/may/composition.pdf>.

<sup>16</sup> The entirety of the November 2011 GGS-OCC data, which consists of more than 10,000 distinct green category–industry–occupation cells, is available on the BLS GGS-OCC program page; see “Green Goods and Services Occupations: Green Goods and Services Occupations (GGS-OCC),” [www.bls.gov/ggsocc](http://www.bls.gov/ggsocc).