

# Measuring Green Industry Employment: Issues and Observations in Data Collection

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## Abstract

The Bureau of Labor Statistics (BLS) recently published the second detailed economic statistics on industry employment in the green goods and services sector in the United States. With a sample size of approximately 120,000 units, the Green Goods and Services (GGS) survey estimates the number of green jobs at both the national level and state level for the private sector as well as the public sector. This paper discusses both the definition of green jobs and methodology used by BLS to develop this new survey as well as the first and second published survey results. Insights gained after two years of data collection, including the effects of an 80-percent overlap of respondents, and two response analysis surveys are evaluated.

**Key Words:** Green Jobs, Establishment Survey, Employment, Bureau of Labor Statistics

## 1. Introduction

On March 22, 2013, the U.S. Bureau of Labor Statistics published the second detailed economic statistics on industry employment in the green goods and services sector. For 2011, the BLS reported the U.S. economy had 3.4 million jobs associated with the production of green goods and services, representing 2.6 percent of total employment, showing a growth of 0.1 percent from 2010. This release marked the first opportunity for the BLS to analyze the change in employment within Green Goods and Services (GGS) industries. This paper will focus on the development, methodology, response patterns and results of the first two Green Goods and Services surveys, along with the results of two response analysis surveys.

## 2. Background

In 2010, Congress authorized funding for the BLS to develop and implement the collection of new data on green jobs. To accomplish this task, BLS first had to define "green jobs." While the green economy is of great interest across government, academia, and the business community, various studies and analyses define the term "green jobs" differently. The overarching concept throughout the literature is that green jobs are related to preserving or improving the environment; however, the translation into specific industrial or occupational categories varies across studies.

BLS formed a definitional team to review published studies on green, clean, and environmental jobs. The review included the Green Jobs Act of 2007, studies done by individual states' Labor Market Information (LMI) units, work by Statistics Canada and Eurostat, as well as research conducted by private organizations, such as the Pew Charitable Trusts and Global Insight. From this review, BLS developed a two component

green jobs definition: an output-based approach and a process-based approach. Separate surveys were developed to count each approach.

The BLS output-based green jobs approach includes only employment associated with producing green goods and services. BLS created the GGS Survey to estimate the number of output-based green jobs (GGS jobs).

For the GGS Survey, BLS had to define green goods and services and determine in which industries they are found. After meeting with stakeholders and taking comments from the public, BLS released its official definition of Green Goods and Services jobs: *jobs associated with producing goods or providing services that benefit the environment or conserve natural resources.*

During the GGS definition development, BLS reviewed the 1,193 six-digit industries in the 2007 North American Industry Classification System (NAICS) to identify industries that potentially provide BLS-defined green goods and services. BLS identified 333 NAICS industries that may produce green goods and services within one or more of the GGS definitional categories. The second survey conducted in 2011 switched from using the NAICS 2007 system to the NAICS 2012 system. There was no change in the definition of green goods and services but due to industry classification changes, 325 detailed six-digit NAICS industries were included in the 2011 survey.

According to the Quarterly Census of Employment and Wages (QCEW) program, these 325 in-scope industries included 26.1 million employees for the 2011 GGS survey. The QCEW program includes all employers subject to state Unemployment Insurance laws and federal agencies subject to Unemployment Compensation for Federal Employees.

The other BLS survey that measures green jobs is the Green Technologies and Practices Survey (GTP). GTP collects data using the BLS process-based green jobs definition. This paper will focus solely on the GGS Survey; however the GTP definition and data have been released and are available at [www.bls.gov/gtp/](http://www.bls.gov/gtp/).

### 3. Design

In readying to undertake a full survey on green goods and services jobs, BLS performed several months of field research to understand potential respondents' ability to comprehend the GGS definition. The GGS survey was created to collect establishment data and produce annual estimates of GGS jobs by NAICS industry, state, and ownership. Important issues, such as what questions to ask respondents in order to collect the data needed to count GGS jobs and which collection methodology would yield the highest response rates, were explored to ensure the data collection effort would be successful. BLS began research to develop a form for GGS collection in early 2010 by contacting respondents for feasibility interviews followed by four rounds of forms design and testing.

BLS focused on how to collect the employment associated with the five basic categories covered in the GGS definition. An establishment classified in one of the 325 NAICS industries may produce only green goods, both green and non-green goods, or only non-green goods. The BLS definition of GGS jobs counts only the employment associated

with the production of green goods and services; therefore, the survey needed to distinguish GGS jobs from non-GGS jobs within establishments.

Through the feasibility interviews and test panels, BLS learned it would be difficult for respondents to provide employment associated with a particular product or service. The most common reason behind the difficulty in allocating employment to a particular product was that many employees, especially support and administrative staff, are not dedicated to one particular product. However, respondents indicated that establishments are easily able to provide revenue by product and/or service line. BLS determined that the revenue share for a green product or service could be applied to the establishment's total employment, which BLS collects through the QCEW program, to calculate an establishment's GGS jobs. For example, if a manufacturing plant's QCEW employment was 100 people and 65 percent of its revenue was from scrubbers to reduce a manufacturing plant's emissions and the remaining revenue was from ball point pens, then BLS would count 65 GGS jobs from the plant, since scrubbers are considered a green good and ball point pens are not.

As a result of this research, the forms changed to instruct respondents to provide revenue (or employment for establishments in non-revenue based industries such as government) associated with green goods and services. Respondents indicated they had revenue shares available for the fiscal year. In the next round of testing, the forms were updated to reflect the data available. Test respondents had mixed opinions as to whether revenue was a reasonable proxy for employment. This led the BLS to allow respondents to provide shares of either revenue or employment on the final GGS collection forms. In addition to a green revenue or employment share, BLS constructed the GGS forms to capture the category of the green product or service the establishment provides.

The final GGS forms were printed booklet style with 14 industry-specific versions based on an identical design. Each form provided specific examples for the green categories in that industry. During the test phase, this version resulted in the highest response rate.

#### **4. Sample**

The 2010 and 2011 GGS survey samples used the establishment register created by the QCEW program, which cover about 98% of the business population, as its sampling frame. Only the in-scope NAICS industries were eligible for selection, comprising about 2.1 million establishments. A sample of nearly 120,000 establishments was selected from the 2011 second quarter QCEW data. A few thousand additional establishments were sampled from the 2011 fourth quarter QCEW data to account for business openings and closings in the final two quarters of 2011.

Since green goods and services activity is a relatively rare occurrence at establishments, BLS developed a supplemental environmental frame of "known green" companies. Establishments from these companies were given a higher probability of inclusion in the first and second survey samples. Each year, approximately 6,500 establishments were selected from the supplemental frame.

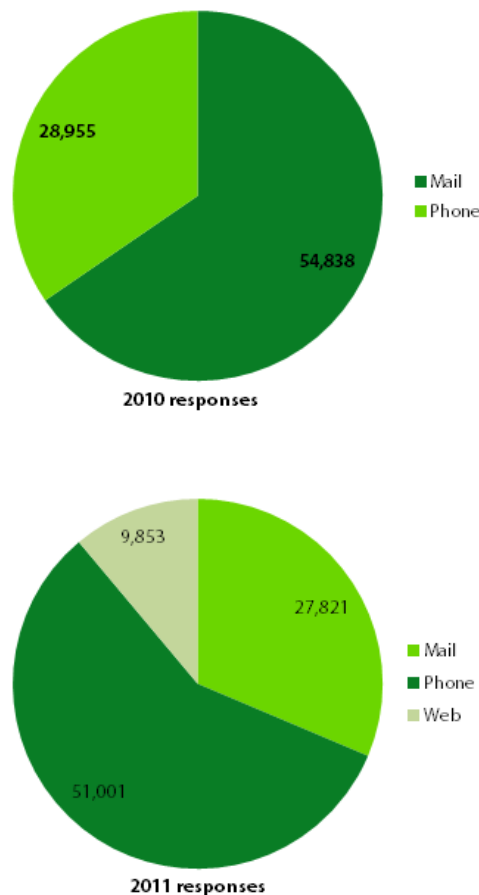
The sample was allocated and stratified to support estimates by national sector and ownership, national detailed NAICS industry, state sector and ownership. The GGS

sample used a panel sample design where the 2010 survey was split into three panels based on QCEW data. The 2011 survey was drawn by reselecting two of the three panels and selecting one new panel, achieving an 80 percent overlap between yearly GGS samples. By overlapping the GGS samples, BLS can monitor the consistency of respondents across surveys and follow up with respondents where necessary. Also, the high percent of overlapping units between the two samples reduces variances on year-to-year change.

## 5. Collection

Data collection for the 2010 GGS survey began in May 2011. Advance notification letters were sent out on May 9<sup>th</sup>, followed two weeks later by the first mailing of GGS survey forms, six weeks later by the second mailing, and another six weeks later by the third mailing. BLS began non-response prompting (NRP) upon the start of the third mailing, a phase which lasted five months. Starting in November, the data collection center performed edit reconciliation for units identified as needing follow-up. This group included respondents with logic failures, unreadable data or respondents who were outliers when compared to the rest of respondents in their industry. All data collection and reconciliation ended at the close of January 2012. The final unit response rate for the 2010 Green Goods and Services survey was 70.6 percent.

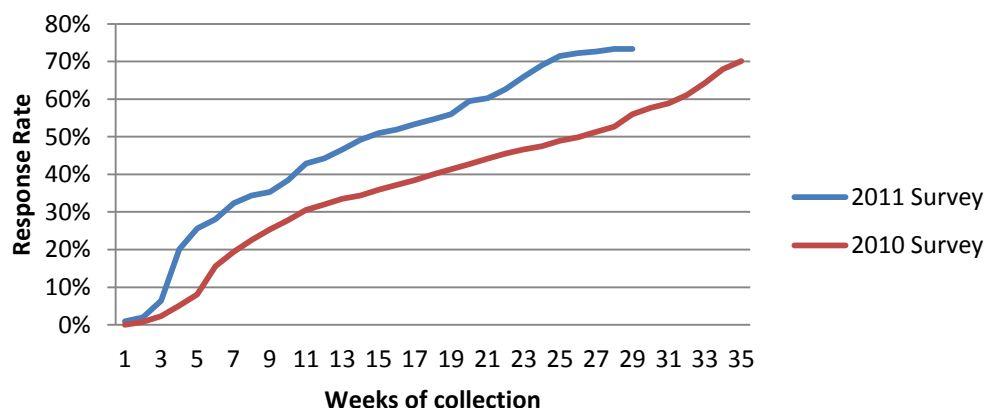
**Figure 1. GGS final responses by submittal method, 2010-11**



Data collection for the 2011 survey began in April 2012. This collection effort included the addition of the Internet Data Collection Facility, a web-based data collection tool, allowing respondents to answer the survey online. The 2011 survey had 5.3 percent of respondents answer online. A complete response breakdown by collection method between 2010 and 2011 can be seen in figure 1.

Advance notification letters for the second survey were sent out on April 25<sup>th</sup>, 2012, followed two weeks later by the first mailing of GGS survey forms and six weeks later by the second mailing. Due to the low response rate of the third mailing during the first data collection, the third mailing was eliminated in the 2011 collection period. Instead NRP was started only one week after the second mailing, targeting units that were difficult to collect in the first survey. All data collection and reconciliation ended at the close of November 2012, achieving a final unit response rate for the survey of 73.3 percent. The second survey collection was finished on a shorter time frame and achieved a higher response rate. (See figure 2.)

**Figure 2. GGS response rates by duration of collection, 2010-11**



Special efforts were made to target multiple establishment units and government units early in the NRP stages in order to increase the response rates of these cells. This concerted effort increased our federal government response rate from 36.4 percent for 2010 to 83.4 percent for 2011; state government also went up from 59.9 percent to 74.7 percent. The 2011 survey also used the change in green activity as a flag for edit reconciliation, flagging the respondents for follow-up if the answers for green revenue or employment differed by ten percent or more. If a unit was determined to have answered incorrectly in the 2010 survey, we were then able to use the corrected 2011 response during our imputation process for 2010.

## 6. Impact of 2012 NAICS Conversion on 2011 GGS Results

The 2010 GGS survey was conducted with NAICS 2007, with the GGS scope containing 333 industries covering 25.3 million jobs. The 2011 GGS release marked the introduction of NAICS 2012. Under this new NAICS structure, there were 325 six-digit NAICS industries that were identified as potential producers of green goods or services. These 325 industries serve as the scope of the GGS survey and cover 26.1 million jobs. The changes in NAICS classification led to instances where industries that were once out-of-scope merged with in-scope industries, resulting in the addition of approximately 600,000 jobs to the overall GGS scope, or the GGS sampling universe.

The most pronounced impact of the NAICS changes can be observed in the manufacturing sector, where NAICS 326199 (all other plastics product manufacturing) moved from out-of-scope to in-scope in 2011 due to its merger with discontinued NAICS 326192 (resilient floor covering manufacturing). Another important change was the identification of the power producing alternative-energy industries: wind, solar, biomass, and geothermal power production. In the first GGS survey results (2010), NAICS 2007 did not uniquely identify these industries, instead classifying them together into the category “other electric power generation.”

The 2011 GGS survey incorporated estimation and methodological updates in addition to the NAICS conversion. The updated procedures were also applied to the 2010 GGS survey results, and the 2010 GGS survey results have been revised to the NAICS 2012 standard, allowing a direct comparison between 2010 GGS survey results and 2011 GGS survey results. For additional information on GGS methodology and data collection, please see our Technical Note at [www.bls.gov/ggs/ggs\\_technote\\_extended.pdf](http://www.bls.gov/ggs/ggs_technote_extended.pdf).

## 7. Results from the 2011 GGS

In 2011, the United States had 3.4 million jobs associated with the production of GGS, accounting for 2.6 percent of total employment. This represented an increase of nearly 160,000 GGS jobs when compared to the revised 2010 GGS estimates. Between 2010 and 2011, GGS employment increased 4.9 percent, compared to a 1.2 percent increase in total employment. Employment in the private sector increased 7.4 percent, compared to 1.9 percent in total employment measured by QCEW. The largest increase was in the construction sector, where GGS employment grew by 26.4 percent, compared to a decrease in total employment of 0.3 percent. Leisure and hospitality experienced the second largest change in GGS employment, 14.8 percent, compared to a 2.2 percent increase in total employment. (See table 1.)

**Table 1. GGS employment level and change by industry, 2010-11 annual averages**

Industry	NAICS	2010 GGS employment	2011 GGS employment	Change in GGS employment, 2010-11	Percent change in total employment <sup>1</sup>
Total, all industries		3,243,533	3,401,279	157,746	1.2%
Total, all private industries		2,342,562	2,515,200	172,638	1.9%
Natural resources and mining	11,21	63,344	64,689	1,345	5.1%
Utilities	22	69,031	71,129	2,098	-0.2%
Construction	23*	385,777	487,709	101,932	-0.3%
Manufacturing	31-33*	492,985	507,168	14,183	1.9%
Trade	42,44-45*	205,567	223,079	17,512	1.3%
Transportation and warehousing	48-49*	242,137	238,755	-3,382	2.8%
Information	51	33,321	29,412	-3,909	-1.1%
Financial activities	52,53	462	475	13	0.2%

Industry	NAICS	2010 GGS employment	2011 GGS employment	Change in GGS employment, 2010-11	Percent change in total employment <sup>1</sup>
Professional, scientific, and technical services	54	355,386	381,981	26,595	2.9%
Management of companies and enterprises	55	62,630	69,310	6,680	3.2%
Administrative and waste services	56	330,650	335,417	4,767	4.2%
Education and health services	61,62	28,789	26,123	-2,666	2.0%
Leisure and hospitality	71,72*	20,642	23,696	3,054	2.2%
Other services, except public administration	81	51,841	56,257	4,416	1.4%
Federal government		208,744	213,340	4,596	-3.9%
State government		256,224	248,539	-7,685	-1.1%
Local government		436,002	424,201	-11,801	-1.6%

NOTE: Data may not add to total due to rounding.

<sup>1</sup>Industries may not add to total because of unclassified employment in the QCEW total employment. The unclassified NAICS sector is not shown separately, but it is included in the total.

\*Changes in these industries are statistically significant at 90 percent level of confidence.

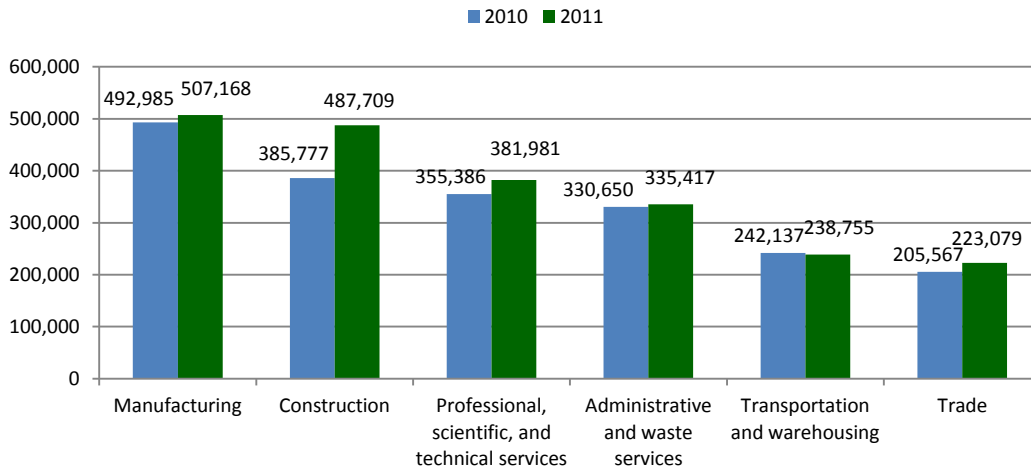
## 7.1 Private Industry

The private sector had 2.5 million GGS jobs in 2011, an increase of 172,638 (7.4 percent) from 2010. Manufacturing had 507,168 GGS jobs in 2011, the most among any private sector industry. Construction had the largest change in GGS employment, increasing by 101,932 (See figure 3).

In 2011, GGS manufacturing jobs accounted for 4.3 percent of all private manufacturing employment in the US. The largest GGS employment within manufacturing in 2011 was found in the “ventilation, heating, AC, and commercial refrigeration equipment manufacturing industry” group (NAICS 3334), with 42,242 GGS jobs. This industry group includes the assembly or production of Energy Star-certified appliances.

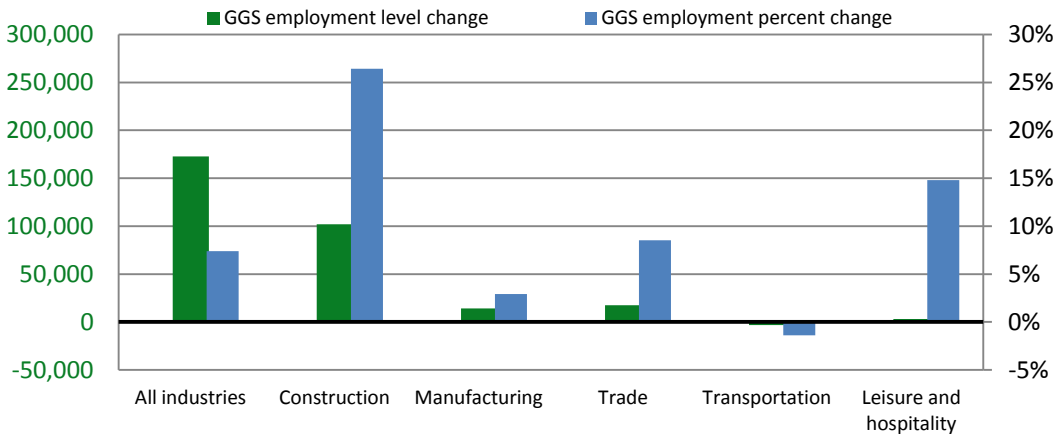
The manufacturing sector experienced a GGS employment growth of 14,183 (2.9 percent). The expansion of GGS jobs within manufacturing jobs was driven by the following industry groups, which experienced significant GGS job increase of over 1,500 jobs: semiconductor and electronic component manufacturing (NAICS 3344) with 4,963 additional GGS jobs, foundries (NAICS 3315) with 1,862 additional GGS jobs, and electric lighting equipment manufacturing (NAICS 3351) with 1,816 additional GGS jobs.

**Figure 3. Green goods and services private sector employment, 2010–11 annual averages**



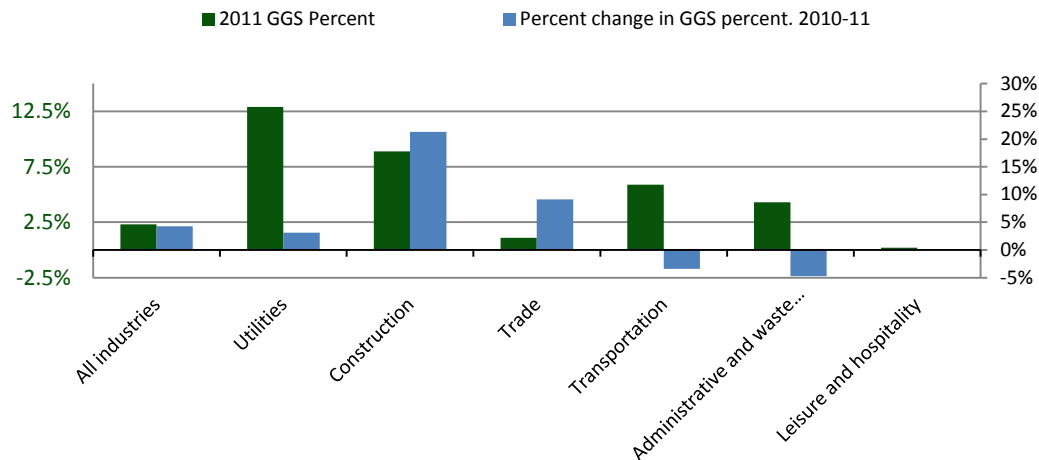
Construction had 487,709 GGS jobs in 2011, comprising 8.9 percent of the sector's employment. The sector underwent the largest increase in GGS employment from 2010 to 2011, with 101,932 additional GGS jobs (26.4 percent). (See table 1 and figure 4). The composition of employment in construction changed in 2011, as the share of jobs associated with green goods and services significantly increased. Over the year, the total private sector construction employment (as measured by the QCEW) decreased from 5,489,499 to 5,473,045 (-16,454), while GGS jobs increased by 101,932, resulting in a GGS percent increase from seven percent in 2010 to 8.9 percent in 2011 (see Figure 5).

**Figure 4. Statistically-significant GGS employment level changes by private industry sector, 2010-11**





**Figure 5. Statistically-significant GGS percent changes by private industry sector, 2010-11**



Within the construction sector, the most significant increase in GGS employment occurred in the “building equipment contractors industry” group (NAICS 2382), which added 29,667 GGS jobs (18 percent) between 2010 and 2011. Establishments in the building equipment contractors industry group provide green services such as the installation of green-certified products or Energy Star-certified heating, ventilation, and air-conditioning (HVAC) systems. Together, building equipment contractors and residential building construction accounted for 54.1 percent of the GGS employment growth in construction. The expansion of GGS jobs in construction can be attributed in part to an increase in requirements that new buildings adhere to industry-certified green standards<sup>1</sup>.

The trade sector had 223,079 GGS jobs in 2011, accounting for 1.1 percent of the industry’s employment. This sector had an increase of 17,512 GGS jobs (8.5 percent) over the year. Within the trade sector, the largest increase in GGS employment occurred in the “miscellaneous durable goods merchant wholesalers industry” group (NAICS 4239), which includes recyclable material merchant wholesalers and used merchandise stores. This industry group experienced an increase in GGS employment of 9,997. The GGS percent of this industry group also experienced the largest increase within the trade sector, growing from 34.4 percent to 36.1 percent.

Administrative and waste services had 335,417 GGS jobs in 2011, accounting for 4.3 percent of the sector’s employment. This sector had an increase of 4,767 GGS jobs (1.4 percent) over the year. The waste collection industry group (NAICS 5621) led the sector’s GGS employment growth with an increase of 6,336 in 2011. Remediation and other waste management services (NAICS 5629) had the second largest increase in this sector, with 4,093 GGS jobs added. Despite the growth in their GGS employment level, neither of these two industries experienced significant growth in the percent of GGS jobs.

#### 7.1.1 Utilities

Utilities had 71,129 GGS jobs in 2011. The utilities sector GGS employment rate grew from 12.5 percent in 2010 to 12.9 percent over the year. The private utilities sector added 2,098 GGS jobs, a three percent increase in 2011. Among the industries involved in

<sup>1</sup> US Green Building Council paper <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1852>

private sector electric power generation, nuclear power had the highest GGS employment with 44,054 jobs in 2011. Hydroelectric power generation had the second largest GGS employment with 3,780 GGS jobs. Wind electric power generation was third with 2,724 GGS jobs, followed by biomass electric power generation (1,166), geothermal electric power generation (1,017), and solar electric power generation (522). Other electric power generation had 525 GGS jobs in 2011.

#### *7.1.2 Government*

The public sector had 886,080 GGS jobs in 2011, or 4.2 percent of public sector employment. Over the year, government GGS employment decreased by 14,890 (-1.7 percent). In 2011, local government had the most GGS employment in the public sector, 424,201, representing 3.1 percent of total local government employment.

Within local government, the transportation and warehousing sector, which encompasses mass transit systems, had the largest GGS employment in local government with 209,063 jobs. The most significant change in GGS employment in local government took place in the utilities sector, which lost 5,346 GGS jobs (-5.4 percent) over the year.

Following an over-the-year loss of 7,685 GGS jobs, state government had 248,539 GGS jobs in 2011, accounting for 5.5 percent of state government employment. Public administration had the largest number of GGS jobs in state government, 164,952 (nine percent). This industry includes the enforcement of environmental regulations and the administration of environmental programs. The most significant change within state government occurred in the professional, scientific, and technical services sector, which includes engineering services. This sector lost 950 GGS jobs between 2010 and 2011.

The federal government had 213,340 GGS jobs representing 7.5 percent of its total employment in 2011. As was the case with state government, most GGS jobs in federal government were in the public administration sector, which had 139,884 GGS jobs in 2011.

#### *7.1.3 Geographic Detail*

Ten states had over 100,000 GGS jobs in 2011: California (360,245), New York (266,308), Texas (227,532), Pennsylvania (167,397), Ohio (137,143), Illinois (136,447), Florida (117,433), North Carolina (108,094), Virginia (107,773), and Washington (101,593). California had the highest GGS employment in the United States, representing 2.5 percent of the state's total employment. Construction had the largest number of private sector GGS jobs in California, 54,070, representing 9.7 percent of total GGS employment in the state.

The District of Columbia had the highest percentage of GGS total employment of any jurisdiction measured, 5.1 percent, in 2011. Oregon had the next highest proportion of its employment in GGS jobs, 4.3 percent. California experienced the largest increase in GGS employment, with an additional 17,366 GGS jobs over the year. Maryland had the second largest increase in GGS employment, with 14,143 GGS jobs added between 2010 and 2011.

## 8. Response Analysis Survey Results

During both years of the collection cycles, GGS conducted a response analysis survey (RAS) to help to better understand the quality of the data and issues of the respondents. The goal of the first RAS was to collect information from approximately 1,000 respondents for the purpose of assessing the understanding of the GGS survey, the quality and reliability of the responses, and any other issues that respondents had during the first collection cycle. For this effort, the targeted number of completed interviews was 950 for the GGS respondents who reported their information by returning the mail survey form (henceforth referred to as mail-respondents) and 50 for the GGS respondents providing their information over the telephone (henceforth referred to as telephone-respondents).

During the 2010 collection cycle, the RAS revealed that data collection was implemented in a straightforward and accurate manner, as the respondents claimed to have very little difficulty receiving or understanding the basic instructions on the forms. Ninety-four percent of the respondents in this RAS claimed that the survey instructions were ‘easy’ or ‘very easy’ to understand. Ninety-three percent of the respondents also felt that the GGS survey took a reasonable amount of time to complete, with over 55 percent of the respondents taking less than fifteen minutes to complete. The following issues were highlighted as areas needing consideration:

- Although most respondents appeared to understand the purpose of the GGS survey, a significant percentage of those who experienced difficulty reported that the relevance of the survey or the questions was an issue for them (they did not see how the survey applied to their particular industry). This issue was seen again when asked about the definitional categories and examples.
- Another area of difficulty was respondents’ understanding of the definition of “green goods and services.” Often goods and services were confused somewhat with technologies and practices. Some clarification on when these practices were applicable to goods and services would be beneficial. The fact that many establishments recycle in their business was particularly problematic as some establishment representatives wanted to include that practice as part of their survey response.
- Respondents who were asked to complete more than one GGS survey for their company (multi-establishment units) sometimes expressed frustration. Many respondents were confused about which survey applied to which location. These respondents stated more clarity on the exact locations was necessary and some suggested a single mailing or phone call for all surveys would be beneficial.

The second RAS was more detailed and collected information from approximately 4,000 respondents reporting green activity. This RAS was also started earlier than the first survey year and addressed two primary concerns:

- Identify and address problems experienced in receiving the survey form, such as the mailing getting to the correct person, and whether the form clearly indicated the correct reporting unit.
- Feedback on the quality of their green revenue or employment estimates and their confidence that the estimate they provided was an accurate representation of their green activity.

Questions seven and eight on the GGS form ask for the percent of GGS revenue or employment, questions asked after we established that the worksite provided a green good or service. The 2011 RAS helped BLS gain a better understanding of how respondents answer questions seven and eight, and how accurate the revenue question is as a proxy for green employment.

The idea for this RAS came from comments elicited from the *Federal Register Notice* on the draft green jobs definition. From a sample of 6,300 green respondents, the RAS was conducted by telephone and achieved a response rate of 50 percent, consisting of mail, NRP, and edit reconciliation responses.

Few RAS survey respondents reported problems receiving or understanding the survey form. Most of those who reported problems were large companies with many departments or locations. The results were consistent across form types. Those who did report problems generally suggested that the survey form be addressed to their accounting or human resources department and that more details regarding the reporting unit would be helpful to have on the survey form.

85.5 percent of respondents to the RAS believed the information they provided was very good or good in reporting green economic activities. For cases that required more effort to collect, the ratings of very good or good fell, and the ratings for fair to poor increased. Fair to poor ratings increased by almost 10 percent in comparing Mail/Web Collection to NRP. Very good to good ratings declined from 90.1 percent for Mail/ Web Collection to 82.2 percent for NRP. See table 2 for forms and responses based on RAS

**Table 2. How good do you believe your estimate is?**

Form Type	Very Good or Good		Fair or Poor	
	N	Percent	N	Percent
<b>A</b>	179	84.0	28	13.1
<b>B</b>	200	72.7	66	24.0
<b>C</b>	29	82.9	4	11.4
<b>D</b>	220	89.8	20	8.5
<b>E</b>	267	93.0	18	6.3
<b>F</b>	133	93.0	4	2.8
<b>G</b>	219	94.4	9	3.9
<b>H</b>	191	79.9	38	15.9
<b>I</b>	162	83.1	27	13.8
<b>J</b>	99	88.4	10	8.9
<b>K</b>	66	78.6	14	16.7
<b>L</b>	24	96.0	1	4.0
<b>M</b>	277	94.5	12	4.1
<b>N</b>	193	72.8	46	17.4
<b>Total</b>	<b>2,259</b>	<b>85.5</b>	<b>297</b>	<b>11.2</b>

Overall, comments provided by respondents about the survey forms were positive. Most found the survey form to be clear and appreciated that it was short and easy to follow. Those who had difficulty filling out the survey form felt that the green examples and definitions were not clear or specific to their business. The RAS results showed the GGS program had been successful in creating non-burdensome forms to produce accurate results.

### 8.1 Imputation Analysis

In order to increase the number of usable responses for estimation, the BLS used respondent information from the survey to help calculate an accurate response for the same unit for a different survey year. Imputations for the 2011 survey refer to one of four changes to a certain year's data based on the information obtained in the other survey year. There were a total of 34,355 imputations--22,695 in 2010 and 11,660 in 2011. (See Table 3.)

**Table 3. Imputations by type, annual averages**

Imputation	2010	2011	Total	Percent of Imputations
Green Change Flag	734		734	2.1
80-90 Status Code Changes	1,589	1,236	2,825	8.2
Comment Code Changes	6,742		6,742	19.6
Non-response Imputations	13,630	10,424	24,054	70.0
<b>Total</b>	<b>22,695</b>	<b>11,660</b>	<b>34,355</b>	

The first imputation was the "Green Change Flag." This change was not as much of an imputation as a data quality check performed after receiving data from our data collector. These flagged units were crossover firms (firms that were sampled and responded in both survey years) that had a change of greater than 10 percent in their green percentage, but no comment code to explain the change. This flag decreased the number of usable units in estimation, but was necessary for data quality and consistency. We changed the 2010 and 2011 data status codes to unusable if they were flagged. There were 734 of these imputations.

The second imputation was the "80-90 Status Code Change." The GGS program uses status codes to identify various problems with respondent data. If a status code is under 90, it is deemed unusable in estimation. For this imputation, if a crossover unit responded in both years, had a usable status code in one year and an unusable status code in the other year, and the change in green percentage was less than 10, the status code in the unusable year was then changed to 91 (usable). There were 1,589 in 2010 and 1,236 in 2011 of these imputations. The majority of these 80-90 status code imputations required verification of a reported green employment figure, failed a logic test, or exceeded expected employment bounds.

In 2011, 1,236 units were moved to usable status codes from the 80-83 codes (see Table 4). This imputation made the usable status codes go from 69.3 percent of all respondents to 70.3 percent of respondents. Overall, after imputation, over 92 percent of status codes were either usable or non-respondents.

**Table 4. Status Code Imputations, annual averages**

Status Code	Imputations			Percent of Imputations
	2010	2011	Total	
80	122	451	573	20.3
81	164	515	679	24.0
82	14	261	275	9.7
83	2	9	11	0.4
84	1,287	-	1287	45.6
Total	1,589	1,236	2,825	-

The change in status codes from 2010 to 2011 was due to the fact that in 2010, status code 84 was a catchall for a failed screening. More information was desired from our data collection agency; therefore, status code 84 (“other failed”) was removed and the interviewer was forced to decide whether the respondent failed due to an employment issue (80), a revenue reporting issue (81), both (82), or a failed logic test (83), such as reporting 100 percent green but listing no green activities. Status codes 94 and 95 were respondents that were deemed usable by BLS in 2010. After the imputation process in 2011, there will be corrected status codes in 2011 from the 80-83 categories along with more corrected status codes in 2010. Overall, there were 4,230 status codes in the 80s in 2010 and 4,606 in 2011. This showed there were similar levels of screening failures for each year, a positive sign that the screenings were consistent despite changes in status code structure. (See table 5).

**Table 5. Status Code by Year**

Status Code	Frequency			Percent
	2010	2011	Total	
70	31,729	27,296	59,025	24.3
71	3,718	1,900	5,618	2.3
72	944	3,799	4,743	2.0
80	271	1,708	1,979	0.8
81	418	1,973	2,391	1.0
82	31	880	911	0.4
83	9	45	54	0.02
84	3,501	-	3,501	1.4
90	78,499	84,664	163,163	67.3
94	892	-	892	0.4
95	157	-	157	0.06
Total	120,169	122,265	242,434	-

The third imputation was the comment code change. These were units in which it was determined during the 2011 collection that the 2010 response was incorrect. This included any change in green percentage greater than 10 percent that was unexplained by the respondent. There were 6,742 of these changes (20 percent of all imputations).

The final imputation rule accounted for 24,054 units or 70 percent of all imputations. This was the “non-response” imputation and it changed 13,630 units in 2010 and 10,424 units in 2011. For this imputation to take a place, a unit had a good response in one year and a nonresponse in the other year. The green percentage for the nonresponse year was imputed based on the other years green percentage using a hot-deck imputation process that is described in greater detail in the technical note. Once the green percentage data was imputed, the status code of each unit was changed to 98 to make it usable and identify which units underwent the hot deck imputation process. Overall the imputation process helped us to improve our usable data for the survey and allowed us to produce more reliable estimates.

### ***Conclusion***

The publication of the first and second Green Goods and Services jobs data provided valuable insight into the size and behavior of the green economy. Once an unknown sector of the economy, we now have detailed information on the distribution and characteristics of green establishments. The definition and industry classification research along with examples used to explain the definition and baseline results will be valuable for any future research on the green goods and services sector.