

Economic Analysis

Applied | Economic | Strategies, LLC



October 21, 2009

Economic Analysis No. 2009-7

HOW MANY GREEN JOBS ARE THERE IN THE UNITED STATES?

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The U.S. has a growing focus on green jobs with over \$80 billion in American Recovery and Reinvestment Act funding being spent by the federal government on clean and renewable energy industries and to prepare workers for green jobs of the future.¹ Surprisingly, there is no formal definition of a green job, or standardized data on the subject. The purpose of this analysis, conducted in conjunction with PureGreenJobs.com, is to objectively estimate the number of green jobs in the U.S. utilizing the best available data.

Although this analysis undoubtedly underestimates the number of green jobs in the economy because of the constraints in identifying these jobs within the current industry and occupational classification system used by the Bureau of Labor Statistics (BLS), current available data suggest there are at least 3.4 million to 5.5 million green jobs within the U.S. – and likely many more.

Defining What Is A Green Job:

Studies differ on what constitutes a green job. They differ on their definitions of what are existing green jobs and on what new green jobs might be created. Moreover, the varying definitions incorporate important, but often unstated, assumptions about environmental policy, economics, trade, and what should be the appropriate compensation for such jobs.

The United Nations Environmental Programme (UNEP) notes that “not all green jobs are equally green”, and stresses that the “bar needs to be set high” in defining green jobs to prevent the term from becoming meaningless.² The UNEP defines a green job as: Work in agricultural, manufacturing, research and development, administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high-efficiency strategies; decarbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution.

On the other hand, the U.S. Conference of Mayors (Mayors) defined a green job as: Any activity that generates electricity using renewable or nuclear fuels, agriculture jobs supplying corn or soy for transportation fuels, manufacturing jobs producing goods used in

renewable power generation, equipment dealers and wholesalers specializing in renewable energy or energy-efficiency products, construction and installation of energy and pollution management systems, government administration of environmental programs, and supporting jobs in the engineering, legal, research and consulting fields.³

Curiously, the Mayors report counts *current* nuclear power generation jobs as green jobs but not *future* jobs in the nuclear power industry. On the other hand, the UNEP definition of green jobs excludes all nuclear power related jobs and many recycling jobs, including all jobs that “contribute substantially to preserving or restoring environmental quality.”⁴

The White House Task Force on the Middle Class defined green activity quite broadly as anything dealing with some aspect of environmental improvement,⁵ and the Green Jobs title of the Energy Independence and Security Act of 2007, H.R. 6, focuses on a number of energy efficiency and renewable energy industries such as: the energy-efficient building, construction, and retrofits industries; the renewable electric power industry; the energy efficient and advanced drive-train vehicle industry; the biofuels industry; the deconstruction and materials use industries; the energy efficiency assessment industry serving the residential, commercial, or industrial sectors; and manufacturers that produce sustainable products using environmentally sustainable processes and materials.

Given the widely varying definitions of green jobs that have been developed and the hundreds of millions of dollars in federal funding at stake, the biggest challenge will be to come up with a standard definition. Clearly, a wide variety of jobs can be considered “green,” and many other jobs are some shade of green.

In March 2009, the Commissioner of the U.S. Bureau of Labor Statistics (BLS) said that they were developing approaches, including surveying establishments in industries where green activity is expected to occur, to identify the extent specific industries are performing green activities and the occupations of the employees who are doing such work.⁶ The BLS Commissioner also noted that they were going to develop a “useful and measurable definition – or perhaps multiple definitions” of what constitutes a green job.

Perhaps the best working definition, until the BLS weighs in, is any job that directly:

- Involves reducing energy and water consumption, de-carbonizing the economy, recycling materials, and minimizing waste and pollution;
- Involves generating electricity using renewable or nuclear fuels;
- Involves producing goods and services used to reduce energy consumption, minimize waste and pollution, or to produce renewable power generation, including equipment dealers and wholesalers;
- Involves the construction and installation of energy and pollution management systems; and

- Contributes substantially to preserving or restoring environmental quality and protecting ecosystems.

O*Net Research and U.S. Bureau of Labor Statistics Data:

In February 2009, the Occupational Information Network (O*NET) published the *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*.⁷ The report identifies 64 O*NET-SOC occupations that are involved with the green economy. The report also identifies new and emerging occupations in the green economy that are not in the current Standard Occupational Classification (SOC) system used by the Census Bureau and the Bureau of Labor Statistics (BLS). These jobs include: Biomass Plant Engineers, Biofuels Processing Technicians, Carbon Capture and Sequestration Systems Installers, Fuel Cell Engineers and Technicians, Solar Energy Installation Managers, Wind Energy Engineers, and Wind Turbine Service Technicians (See Table 1). Although the number of jobs in these new and emerging green occupations can not be accurately estimated using current BLS data, the substantial investments that are currently being made in green technology and industries will significantly increase the number of green job opportunities in the future.

The BLS produces comprehensive employment data for 670 industries and over 800 occupations following the North American Industrial Classification System (NAICS) and the Standard Occupational Classification (SOC) system. Although the BLS has not yet developed a definition of what a green job is, they have published a few estimates for specific industries and occupations.

According to the BLS, some of the industries within the current classification system can be identified as having green jobs.⁸ For example, recyclable material wholesalers employed 102,300 workers and hydroelectric and nuclear electric power generation industries employed 38,500 and 61,900 workers respectively (See Table 2).⁹

The BLS has also identified some occupations within the current occupational classification system where green jobs can be identified. For example, the business of growing flowers, greenery, trees, and vegetables and planting them in the landscape is traditionally referred to as the green industry (See Table 2).¹⁰

Conservation scientists, environmental scientists, environmental engineers, and hydrologists are among the workers who apply their specialized knowledge to a variety of environmental issues. According to the BLS, in 2008, there were 80,100 environmental scientists and specialists, 52,600 environmental engineers, and 15,800 conservation scientists (See Table 2).¹¹

Although the BLS does not publish employment data on solar photovoltaic installers, it did publish an estimate from industry sources suggesting there are about 7,000 solar photovoltaic installers in the United States.¹² About half of all installers work in California. The BLS also published an estimate from the American Solar Energy Society estimates that

there were 16,000 jobs in wind turbine construction and maintenance in 2006.¹³ Wind farms, a group of wind turbines connected to a central utility, now operate in 34 States across the country.

However, many green activities cut across industries and occupations, or account for a subset of activity within an individual industry and occupational category. For example, botanists, chemists, geoscientists, agricultural engineers, geological engineers, and science and engineering technicians are occupations that may include work with an environmental focus. Environmental jobs include many types of workers in a variety of occupations. For example, interior designers and architects may work on designing green buildings and construction laborers' projects might include retrofitting a building for energy efficiency and working on traditional buildings, too (See Table 3).

Further, many of the jobs in agricultural occupations involve green activities including organic farming, no-till farming, and sustainable farming practices. Certainly, many of the 2.1 million agricultural jobs identified in Table 4 involve some green activity.

Conclusion:

An analysis of BLS data, constrained as it is by the current industry and occupational classification system, suggests there are at least 3.4 million to 5.5 million green jobs in the U.S. – and likely many more. Many companies have created sustainability departments with Chief Sustainability Officers and specialists. Moreover, O*NET has identified a number of new and emerging occupations in the green economy that are not included in current the Standard Occupational Classification (SOC) system that is used by the Census Bureau and the BLS, including carbon capture jobs. Other estimates that use a more expansive definition of what is a green job and include occupations such as cleaning and janitorial services that specialize in green cleaning, ecotourism, environmental legal services, printing and publishing services, and socially responsible investing services generate estimates of the number of green jobs as high as 9 million to 12 million. However, until the BLS develops its definition, or definitions, of what is a green job, and updates the current industry and occupational systems, the actual number will remain a source of constant debate.

Table 1: New And Emerging Green Jobs

Air Quality Control Specialists	Green Marketers
Automotive Engineers and Technicians	Greenhouse Gas Emissions Permitting Consultants
Biochemical Engineers	Greenhouse Gas Emissions Report Verifiers
Biofuels Technology & Product Develop Managers	Hydroelectric Plant Technicians
Biofuels Production Managers	Hydroelectric Production Managers
Biofuels Processing Technicians	Industrial Ecologists
Biomass Plant Engineers	Industrial Engineering Technologists
Biomass Plant Technicians	Methane Capturing System Engineers/Installers/
Brownfield Redevelopment Specialists & Site Managers	Methane/Landfill Gas Collection System Operators
Carbon Capture and Sequestration Systems Installers	Methane/Landfill Gas Generation System Technicians
Carbon Credit Traders	Solar Energy Installation Managers
Carbon Trading Analysts	Solar Photovoltaic Installers
Climate Change Analysts	Solar Power Plant Technicians
Environmental Restoration Planners	Solar Sales Representatives and Assessors
Environmental Certification Specialists	Solar Energy Systems Engineers
Environmental Economists	Solar Thermal Installers and Technicians
Electrical Engineering Technologists	Solar Thermoelectric Plant Operators
Electromechanical Engineering Technologists	Chief Sustainability Officers
Electronics Engineering Technologists	Sustainability Specialists
Energy Auditors	Transportation Engineers
Energy Engineers	Transportation Planners
Energy Brokers	Water Resource Specialists
Fuel Cell Engineers	Water/Wastewater Engineers
Fuel Cell Technicians	Weatherization Installers and Technicians
Geographic Information Systems Technicians	Wind Energy Operations Managers
Geospatial Information Scientists and Technologists	Wind Energy Project Managers
Geothermal Production Managers	Wind Energy Engineers
Geothermal Technicians	Wind Turbine Service Technicians

Source: O*NET, Greening of the World at Work: Implications for O*NET-SOC and New and Emerging Occupations, 2009.

Table 2: Green Jobs Within The Current Industry And Occupational Classification Systems

Industry or Occupation	Total Employment
Green Industries	
Recyclable Material Merchant Wholesalers	102,300
Nuclear Electric Power Generation	61,900
Urban Transit Systems	55,000
Hydroelectric Power Generation	38,500
Air Purification Equipment Manufacturing	16,600
Wind Turbine Construction & Maintenance	16,000
Other Electric Power Generation	15,100
Secondary Processing of Other Nonferrous Metals	11,600
Sewage Treatment Facilities	8,000
Secondary Smelting & Alloying of Aluminum	8,300
Commuter Rail Systems	2,800
Automotive Exhaust System Repair	2,700
Secondary Smelting, Refining, & Alloying of Copper	1,100
Traditional Green Occupations	
Landscaping and groundskeeping workers	921,900
First-line supervisors landscaping, lawn service, & groundskeeping workers	108,900
Tree trimmers and pruners	35,400
Pesticide handlers, sprayers, and applicators, vegetation	25,100
Landscape architects	21,100
Environmental Occupations	
Environmental scientists and specialists, including health	80,100
Environmental engineers	52,600
Environmental engineering technicians	20,700
Environmental science and protection technicians, including health	33,400
Conservation scientists	15,800
Hydrologists	7,600
Other Green Jobs	
Refuse and recyclable material collectors	129,100
Hazardous materials removal workers	42,500
Natural sciences managers	43,100
Urban and regional planners	37,100
Forest and conservation technicians	30,900
Insulation workers, mechanical	30,200
Insulation workers, mechanical	28,400
Grounds maintenance workers, all other	15,800
Soil and plant Scientists	10,800
Bicycle repairers	9,700
Forest and conservation workers	8,300
Fish and game wardens	7,700
Solar photovoltaic installers	7,000
Traffic technicians	7,000
Forest fire inspectors and prevention specialists	1,600
Subtotal of Green Jobs	2,071,700

Source: Bureau of Labor Statistics, 2008.

Table 3: Shades Of Green Jobs Within The Current Industry And Occupational Classification Systems

Industry or Occupation	Total Employment
Architects, except landscape and naval	110,000
Architectural and civil drafters	114,900
Electrical power-line installers and repairers	11,600
Water and liquid waste treatment plant and system operators	110,300
Construction and building inspectors	96,000
Civil engineering technicians	88,100
Chemists	83,100
Biological technicians	72,200
Aerospace engineers	67,800
Chemical technicians	65,800
Pest control workers	63,200
Floral designers	57,500
Interior designers	53,300
Locomotive engineers and operators	42,800
Geoscientists, except hydrologists and geographers	31,300
Chemical engineers	31,000
Biological scientists, all other	28,300
Septic tank servicers and sewer pipe cleaners	24,700
Biochemists and biophysicists	22,200
Zoologists and wildlife biologists	17,800
Nuclear engineers	16,600
Microbiologists	15,800
Animal control workers	15,500
Biomedical engineers	15,200
Foresters	10,200
Atmospheric and space scientists	8,900
Sewers, hand	7,100
Animal scientists	2,800
Geographers	1,100
Subtotal of Shades of Green Jobs	1,316,900

Source: Bureau of Labor Statistics, 2008.

Table 4: Shades of Green Jobs In Agriculture

Industry or Occupation	Total Employment
Farmers and ranchers	1,058,000
Farm workers and laborers, crop, nursery, and greenhouse	603,000
Farm, ranch, and other agricultural managers	258,000
Farm workers, farm and ranch animals	107,000
Farm equipment mechanics	31,000
Agricultural and food science technicians	26,000
Agricultural workers, all other	20,000
Agricultural engineers	3,000
Subtotal of Shades of Green Jobs	2,106,000

Source: Bureau of Labor Statistics, 2008.

¹ The \$80 billion includes, but is not limited to, \$11 billion for improvements to the nation's electrical grid; \$6.3 billion for state and local renewable energy and energy efficiency efforts; \$5 billion for low-income home weatherization projects; \$4.5 billion to green federal buildings; \$2 billion to develop next generation batteries to store energy; and \$600 million in green job training programs.

² United Nations Environmental Programme, *Green Jobs: Towards Decent Work In A Sustainable, Low-Carbon World, 2008*, available at: www.unep.org/labour_environment/PDFs/Greenjobs/UNEP-Green-Jobs-Report.pdf.

³ United States Conference of Mayors, U.S. Metro Economies: Current and Potential Green Jobs In the U.S. Economy, 2008, available at <http://www.usmayors.org/pressreleases/uploads/GreenJobsReport.pdf>.

⁴ United Nations Environmental Programme, *Green Jobs: Towards Decent Work In A Sustainable, Low-Carbon World*, pg. 3.

⁵ Middle Class Task Force, The Vice President of the United States, "*Green Jobs: A Pathway to a Strong Middle Class*," February 28, 2009, page 2.

⁶ Keith Hall, Commissioner, Bureau of Labor Statistics, Statement before the Committee on Appropriations, Subcommittee on Labor, Health and Human Services, Education, and Related Agencies, U.S. House Of Representatives, March 25, 2009, available at: http://www.bls.gov/bls/testimony_march_25_2009_hearing.pdf.

⁷ The Occupational Information Network (O*NET) is being developed under the sponsorship of the U.S. Department of Labor, Employment and Training Administration, and the North Carolina Employment Security Commission. O*NET serves as the nation's primary source of occupational information, providing comprehensive information on key attributes and characteristics of workers and occupations. The report is available at: http://www.onetcenter.org/dl_files/Green.pdf.

⁸ Keith Hall, Commissioner, Bureau of Labor Statistics, Statement before the Committee on Appropriations.

⁹ Bureau of Labor Statistics, Current Employment Statistics database, at: <http://data.bls.gov/PDQ/outside.jsp?survey=ce>.

¹⁰ Bureau of Labor Statistics, *The Editor's Desk*, July 25, 2005, available at: <http://stats.bls.gov/opub/ted/2005/jul/wk4/art02.htm>.

¹¹ Alice Ramey, "*Going "green": Environmental Jobs for Scientists and Engineers*," Bureau of Labor Statistics, Summer 2009, available at: <http://www.bls.gov/opub/ooq/2009/summer/art01.pdf>.

¹² Elka Maria Torpey, *Solar Photovoltaic Installer*, Bureau of Labor Statistics, Occupational Outlook Quarterly, Online, Fall 2009, available at: <http://stats.bls.gov/opub/ooq/2009/fall/yawhat.pdf>.

¹³ Phillip Bastian, *On the grid: Careers in Energy*, Bureau of Labor Statistics, Occupational Outlook Quarterly, Fall 2008, available at: <http://stats.bls.gov/opub/ooq/2008/fall/art02.pdf>.