



## Green-Collar Jobs

*The promise of an economy that creates good jobs while protecting and restoring the natural world is an alluring one. Depending on society's commitment to sustainability, between 8 and 40 million green-collar jobs—loosely defined as employment that contributes to environmental quality—could be created in the U.S. alone by the year 2030.*

As more people recognize the need to address the multitude of threats to our environment, businesses are rethinking their core business models to reflect the shift in consumer preferences toward products that are less harmful to the environment. Likewise, entrepreneurs are rushing to develop new green products and services. Besides climate change, critical environmental issues facing business today include energy, water, biodiversity and land use, chemicals, toxics, heavy metals, air pollution, waste management, ozone layer depletion, oceans and fisheries, and deforestation (Esty and Winston 2009). The demand for innovative solutions to address these challenges has led many commentators to conclude that we are on the cusp of a “green wave” in terms of job growth and economic opportunity. Millions of new green jobs will be created, so the theory goes, ranging from renewable energy installers to mass transit employees, from sustainability analysts to water resource technicians. Because many of the jobs are blue-collar in nature, they may provide pathways out of poverty for low-skilled, low-income earners (Jones 2008).

Beyond job creation, the green economy promises to provide additional economic benefits. For example, households, businesses, and governments save money as they become more energy efficient. These savings are recycled into the local economy, creating opportunities for local businesses to grow. New markets for greener products and services also support new industries, potentially expanding

the local tax base. A greener economy, with its emphasis on green buildings, also promises to improve worker productivity by creating healthier work environments where employees have greater access to fresh air, sunlight, and less exposure to toxins.

In addition to the economic benefits, the green economy will improve environmental quality as greener products and services are brought to market. Electric cars have lower carbon emissions. Green buildings use less water. Mass transit promotes denser development patterns lessening pressure to convert productive farm and forestlands.

Green-collar jobs provide communities with the opportunity to both strengthen the local economy and improve the health of the environment. As green-collar jobs become as commonplace as white- and blue-collar ones, we will be forced to rethink our current approach to economic development with its focus on unbridled growth and lack of concern for the environment. In a green economy, economic development and environmental quality go hand in hand. Businesses become much more efficient and waste as we know it is practically eliminated. Decision making is driven by the recognition that only a healthy environment can support a long-term, sustainable economy (Hawken, Lovins, and Lovins 1999).

### Defining Green-Collar Jobs

There is no consensus in the literature on how to define green-collar jobs. A broad interpretation of green jobs includes all existing and new jobs that contribute to environmental quality. Probably the most concise, general definition is “well-paid, career track jobs that contribute directly to preserving or enhancing environmental quality” (Apollo Alliance 2008, 3). This definition suggests that green-collar jobs directly contribute to improving environmental

quality, but would not include low-wage jobs that provide little job mobility. Most discussions of green-collar jobs do not refer to positions that require a college degree but to positions that typically involve training beyond high school. Many positions are similar to those held by skilled, blue-collar workers such as electricians, welders, and carpenters. Examples of green industries employing worker with such skills include smart-grid construction; expansion of freight and passenger rail; wind, solar, and biofuel production; and energy efficiency industries.

Estimating the number of existing and potential green-collar jobs is equally as difficult as defining exactly what a green job is. Thus far, research documenting the number of green-collar jobs has been quite varied. Conservative estimates that include only renewable-energy and energy-efficiency industries suggest about 8.5 million jobs in the United States. These estimates focus on specific activities rather than traditional job or industry characteristics (Pinderhughes 2007). According to the American Solar Energy Society, this figure could grow by as many as 40 million by 2030.

Differences in estimates of the number of green-collar jobs can be attributed to several issues. First, a few analyses include all jobs related to promote a green economy. Thus, they would include workers in the plastics and steel industry, for example, because these materials are used to construct products like wind turbines and solar panels. These reports tend to overestimate the number of green-collar jobs because most of these jobs would not be considered green. Second, even if these related jobs are considered, they probably should not be considered as full-time equivalents because much of their output, in most cases, may not go to green activities. A more accurate accounting method might try to take into consideration the proportion of their product that is used to promote environmental quality. Third, some analyses attempt to consider the multiplier effect of the green economy. These analyses assess the direct and indirect impacts on a regional economy by estimating the number of jobs and income that are created through investments in green-collar jobs (Pollin and Wicks-Lim 2008). These estimates typically include service-sector jobs that most people would not consider career-track jobs. Finally, data collected through the Census Bureau and other official sources do not collect information in a manner that would allow researchers to identify green-collar jobs.

## Strategies for Promoting Green-Collar Jobs

Communities seeking to promote green-collar jobs first need to identify their goals. This does not have to be an extensive process, but it is essential to build on local strengths and opportunities (Green and Haines 2007). Next, localities need to identify appropriate public policies

that will allow them to achieve their goals. Concurrently, it is essential to prepare the workforce for green-collar jobs. Programs should be linked to local opportunities and provide workers with skills that will allow them to move up the career-track (Apollo Alliance 2008). Finally, communities should monitor and evaluate their progress toward growing green jobs. Given the current economy and evolving technologies, it is likely that significant course corrections will be necessary as the green economy continues to take shape. By linking green job policies with environmental goals, communities may find broad-based support for the types of strategies discussed below.

Many of the green job strategies outlined are demand-driven. These types of strategies are seen as crucial to the successful development of the green economy because they provide a stable, secure funding environment in which companies can take root and grow. There are probably many more strategies than are discussed here, but these are the core considerations for most communities.

## Energy Efficiency and Green Buildings

A report by The American Council for an Energy Efficient Economy (ACEEE) found that significant energy efficiency potential remains available in the United States. For example, across all sectors, studies show a median technical potential of 33 percent for electricity (Nadel, Shipley, and Elliot 2004). In addition, approximately 40 percent of our energy use is associated with buildings. Energy efficiency is seen as a powerful strategy to grow green-collar jobs because of the potential demand for energy audits and retrofits that exists in neighborhoods, schools, and businesses across the entire United States. Communities can drive green-collar job creation that is tied to efficiency and green building by crafting policies to improve their own facilities. The jobs related to energy efficiency are often concentrated in traditional building trades and construction industries. The jobs related to green buildings not only include green construction jobs but sustainability analysts, urban planners specializing in brownfield redevelopment, and other development professionals with experience in green design. Estimates suggest that about ten jobs are created per \$1 million investments in high-performance buildings (Center on Wisconsin Strategy 2007). Jobs are created through the economic activity associated with retrofitting buildings and green construction, and also through the energy savings that result from these activities (Goldstein 2007).

## Renewable Energy

Renewable energy is growing rapidly as an alternative to fossil fuel usage. It is seen as a significant generator of green-collar jobs both in terms of manufacturing and in

terms of design, installation, and servicing of the systems themselves. Communities can promote renewable energy development through conventional means such as offering tax incentives, credits, and other mechanisms to encourage renewable energy manufacturing in their own backyards. They can also develop creative financing mechanisms that incentivize homeowners and businesses to deploy renewable energy on site. Many countries, states, and even some cities are effectively mandating renewable energy development by passing renewable energy portfolio standards (RPS) requiring that a certain percent of energy purchased be derived from renewable sources. Worldwide, the largest number of jobs in this sector is in biomass. Three countries (Brazil, the United States, and China) account for the vast majority of jobs in biomass. Jobs in solar industries are the second highest, with most of those jobs located in China. Overall, renewable energy sources are growing rapidly, especially in developed countries (Renner, Sweeney, and Kubit 2008). Varied job opportunities appear throughout the renewable energy industry including biomass, solar thermal, wind, solar panels, hydropower, and geothermal. A few of the renewable-energy job types include electrical and mechanical engineers to design solar components, solar installers, and geothermal and heat pump system engineers, installers, and operators.

## Transportation

Transportation accounts for about one-fourth of the world's energy use. Green-collar jobs in this sector are most often associated with fuel efficiency and public transportation. There are few reliable estimates of the number of jobs in the transportation sector. The discussion tends to focus on improvements made through green vehicle manufacturing and through public transportation. Green vehicles include electric hybrids, compressed natural gas, low sulfur diesel vehicles, and vehicles capable of running on various bio-fuel blends. As of 2009 the number of jobs in manufacturing green vehicles is relatively small, with most of the jobs concentrated in Europe. Public transportation, however, is a significant employer in many developed countries. Many of these counts, however, include employment with traditional petroleum-based bus systems.

## Smart Grid

The current electrical grid is widely seen as a barrier to achieving significant improvements in both energy efficiency and renewable energy growth. The system prevents the full deployment of wind, for example, because the transmission lines simply do not exist to connect our nation's largely rural high-plains wind resource to our

urban population centers. The grid is also highly localized and disjointed, which prevents the effective movement of power throughout the country when demand exceeds supply in a given region. A newer, more modern smart grid can take advantage of recent improvements in information technologies to better manage electrical loads. An industry estimate of jobs associated with investments in a smart-grid system for the United States claim that 280,000 jobs potentially could be created (The Gridwise Alliance 2009). These jobs would likely encompass a broad range of occupations including system designers, project developers, marketers, public relations, supply chain managers, and several types of field technicians.

## Environmental Management

This strategy is often not equated with green-collar jobs but it is so broad that it has tremendous potential to grow them. Included in this category would be many technologies that directly benefit the natural environment, including water, solid and hazardous waste, and air quality technologies among others. We are reluctant to include the recycling industry, although many states and localities have been very successful in promoting recycling programs. Most of the jobs in this sector, however, are low-wage positions with few opportunities for mobility. Recycling markets also appear to be quite sensitive to economic conditions. One of the lessons learned is that green industries will still be market-driven and may experience many swings as they mature. It also shows that not all green industries will produce good jobs for workers. It is difficult to estimate the number of green-collar jobs in this area because the category is so broad. Job types might include air quality specialists, greenhouse gas managers and accountants, and water resource specialists (Lewellyn, Hendrix, and Golden 2008).

By adoption of these broad strategies, communities may be able to achieve multiple goals including environmental quality and green job creation. Many of these strategies are particularly appealing because they are demand driven, meaning locally elected officials can create the demand for green industry by simply shifting their regulatory and purchasing policies to achieve their green job and environmental goals. Communities that can weave together a policy framework with broad-based support will likely be at a significant advantage in terms of creating a business environment that encourages green industry development.

## Challenges and Solutions

There are many challenges to green-collar job creation including workforce development, policy development, technological barriers, geography, environmental issues,

and financial constraints. Many of the solutions to the challenges facing green job growth are policy related. For example the lack of a coherent federal policy has led to a very chaotic growth in the wind industry. Tax credits that make wind financially competitive have only been reauthorized for two years at a time. Thus the industry is in a constant state of flux between rapid project growth and dramatic reductions in investments depending on the biennial whims of federal policy makers. The challenge for local governments is to focus on those areas over which they have control while seeking to minimize the negative impacts of state and federal policies over which they have little control.

Workforce development is a key challenge. Many green-collar jobs do not require major changes in training programs because they can build on programs in the trades and advanced manufacturing industries. These programs still face some of the same obstacles that workforce development efforts have experienced in the past. It is difficult to recruit youth into these programs even though they tend to be good-paying jobs with opportunities for income mobility. In addition, it may be too costly for small communities to develop specialized training programs for emerging green-collar jobs. A more likely strategy is that green-collar jobs will require more intensive use of apprenticeships and school-to-work programs to provide on-the-job training. Another solution may be to develop green entrepreneurship programs for youth.

Many jobs in the renewable energy sector will be tied in the short run to geographical regions that have considerable sources of renewable energy, such as biomass, wind, and even solar. For example, the Midwest has a large concentration of biomass that could be used for biofuels; over 80 percent of biofuel facilities currently are located in the Midwest. Many coastal communities can harness wind energy. The Southwest has a significant potential for solar energy. These regions are likely candidates for renewable energy production and manufacturing. But geography need not be a constraint for communities pursuing renewable energy job creation. A very strong predictor of green-collar job growth is local renewable energy policy. Those states with strong incentives, including New Jersey and California, have leapt to the lead in renewable energy deployment. Not surprisingly, they have also benefited from new green industry creation, especially in sales, servicing, and installation of renewable systems. Communities can enact policies that increase demand for residential, business, and government renewable energy projects.

There are several technical challenges to green-collar job creation. For many reasons, it is likely that the renewable energy sector will be more decentralized and based in smaller units than our current system is. This technical challenge will likely be overcome through development of a

smart-grid system that will create many more opportunities to develop locally distributed renewable energy resources that can feed into the grid. Overcoming this challenge will take considerable public and private investment and will not happen overnight.

Financial constraints are another challenge to green job creation. For example, green buildings include both energy efficiency and renewable energies. There is general agreement that retrofitting existing buildings and improving energy efficiency offer the greatest potential for the environment and jobs, at least in the short run. Yet this may be the most challenging sector with which to grow jobs. The cost of retrofitting will be prohibitive for low-income residents in most countries and will require substantial government subsidies (Jones 2008). Cost is also a major challenge for individuals to install renewable energy at their home including solar PV (photovoltaic), hot water, and solar space heating. Americans are extremely mobile and may be reluctant to pay for these technologies because they are concerned they will not get their investment back before they sell their homes. One solution to this problem is being adopted in communities across the country: Local governments are bonding and then using the funds to lend to homeowners at very low interest rates for installation of renewable energy systems. These systems are then paid off over a ten- to twenty-year period through the property tax bill. If the homeowner moves, the payment stays with the home and the new homeowner continues payment.

Green vehicles continue to draw a great deal of interest among environmentalists. Only a very small percentage of the workforce, however, is now employed in automobile manufacturing that would be considered green. There have been important breakthroughs in automotive technology that may significantly increase the potential for green vehicles. Moving this new technology to mass production, however, could take many years and significant capital investment. A major hurdle to green vehicle growth is battery technology: Without adequate storage, the concept of plug-in vehicles is limited. Efforts are underway to reduce the size of battery storage. With improved batteries, green vehicles may be charged at night to take advantage of lower electricity rates; the batteries' energy then is used during the day for driving or for powering household appliances. When combined with renewable energy sources, such as solar power, green vehicles could have a significant impact on carbon emissions.

Finally, there are a number of environmental issues that may constrain green-collar job growth in areas such as biofuels. Much of the current literature focuses on the dilemmas associated with corn ethanol (i.e., trade-offs between food costs and fuel costs). Research focusing on cellulosic ethanol offers the potential of avoiding the trade-off between food and fuel and overcoming many of the

economic and environmental costs associated with corn ethanol. Other solutions include the development of algae as a biofuel and utilizing other types of nonfood feedstock for biofuel production.

## The Future

Green-collar job growth will be dependent on sustained societal commitment to addressing climate change and other threats to the environment. If commitment is long-lasting, then our current economic system will have to be transformed in a way that puts focus on other metrics (i.e., measurements) beyond just gross domestic product and unbridled growth. Environmental factors will need to be considered as well. This will create a huge opportunity across all sectors of the economy as new and existing businesses look for ways to become greener in terms of product and service delivery. The transition toward a green economy will be difficult for many regions. Promoting green industries will lead to job loss in some traditional industries. It will require more investment in workforce development to help workers make this transition.

In summary, green-collar jobs are expanding, but not rapidly enough. Worldwide, green jobs tend to be concentrated in a few developed countries. The United States has not invested as much in research and development in the green sector as many western European countries. Investments in research will be critical to the growth of green-collar jobs over the next decade. Government support for the public and private sector to adopt new technology will also be an essential factor in the transition to this new economy. Finally, educational programs have been proven to be an important element in increasing the public's awareness of environmental issues and in changing attitudes and behavior.

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See also Education, Business; Education, Higher; Energy Industries—Overview of Renewables; Investment, Clean-Tech; Natural Capitalism; Social Enterprise

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