

White Paper | *May, 2009*

How to Prepare Jobseekers for the Green Economy

Green Jobs, Part 5

GREEN JOBS, PART 5

This paper is meant as a practical guide to help workforce, education, economic development professionals (and any other sort of career counselor) understand green jobs and be able to offer solid advice to young people and jobseekers so they can get on the right track and in the context of the demands of the regional economy. This paper will cover: (1) what a green job exactly is and might be, (2) how people can find green jobs, and (3) what sort of training is needed to prepare for these careers.

This paper also builds on our previous four papers on the subject of green jobs, which you can review online at: www.economicmodeling.com/resources/greenjobs.php

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Introduction: What is a green job?

With so much talk about green jobs, you would expect an abundance of available jobs and training for jobseekers to pursue. However, because the green movement is still young and green jobs lack the well-established economic characteristics and relationships found within traditional industry sectors (retail, manufacturing, finance, etc.) training programs, classifications, and actual job descriptions are either not really in place or are perhaps a bit vague and not connected to a job market that is ready to hire. As a result, there is some confusion about green jobs by planners and jobseekers. In a recent article¹ Pamela Murry, Portland Community College's dean of workforce, economic, and community development, talked about how the job market (green or otherwise) is perhaps not ready for the many jobseekers that need employment now.

“While we are still training people, the job market isn't going to be able to support them necessarily when they come out . . . Manufacturing and renewable energy are other areas in which demand for jobs probably will increase, but that may not help you if you are going to be graduating in June,” she said.”

The article continues:

“There is buzz around green jobs such as wind technician and energy analyst, but for the most part the jobs aren't there yet. . . . Our big concern is, when these people are done with training, will the jobs be there,” she said.”

A lot of this has to do with the recession and the fact that the green movement is, in many ways, currently being propped up by government programs that have been rapidly developed and deployed and haven't really manifested themselves in the real world.

So what can career centers, colleges, or other agencies do to help local jobseekers? In order to provide the best possible advice it is important to understand and communicate what is actually known about green jobs and how this sector is going to (or might) manifest itself in the real world and particularly on a regional level.

The goal of this paper is therefore to provide information that local planners can use to better understand green jobs, how they can think about preparing workers for these jobs, and how this movement might play out in the local economy. We will break the discussion down into two parts. **Chapter one** will focus on the big picture of how to understand and look at green jobs and **Chapter two** serves more as a guidebook to how local practitioners can develop their own analysis. To conclude the paper we have a quick discussion on how and why entrepreneurs are going to be so important to this movement.

1 http://www.oregonlive.com/business/index.ssf/2009/05/oregons_unemployed_pin_hopes_o.html

Table of Contents

Chapter One

I. The Importance of the Occupational Perspective	4
II. Defining the Issue	4
Green Jobs: Policy and Government Intervention	4
Green Jobs: Market and Social Trends	5
So how is a regional developer to approach these issues?	5
III. To Train or Not to Train	6
Green Investments and Jobs	6
IV. Occupational Training	9

Chapter Two

I. Understanding the Green Clusters and Associated Training	11
Engineering	11
Construction	13
Construction competency requirements	13
Understanding Green Jobs and the Construction Sector	14
1. Building Retrofitting	15
2. Mass Transit/Freight Rail Cluster	17
3. Smart Grid Cluster	18
4. Wind Farms	19
5. Solar Power	21
6. Advanced Biofuels	22
II. Summary	23
CONCLUSION: Entrepreneurism and Green Jobs	24

Chapter One

I. The Importance of the Occupational Perspective

A big part of our approach thus far has been to look at green jobs through **occupation data**. Once we match green jobs (a.k.a. job descriptions or projects) to actual occupations we can begin to understand a much broader range of industry characteristics, skills and knowledge, and training programs and providers. Basically, through occupation data we will generally have a more thorough understanding of what green jobs really are.

In our first paper² we stated:

“The US Department of Labor identifies nearly 900 distinct occupations (The Standard Occupation Classification System). Matters would be greatly simplified if we could simply scroll through the Labor Department’s list and identify some occupations as green and others as not. Unfortunately, things are not that simple. The consensus among those economists who address these issues is that the designation ‘green’ turns not on the specific task associated with an occupation, but rather on the specific outcome of an occupational effort.”

Since we do not have an actual classification or solid operating definition for green jobs we can use the occupation data to actually convey (1) where the policy might have the biggest impact, (2) how specific industries, labor markets, and training programs are going to or will need to react, and (3) what occupations are most closely associated with the job descriptions/projects that the green movement will demand.

II. Defining the Issue

Green Jobs: Policy and Government Intervention

So let’s start by getting acquainted with the policy and trends that have shaped the green movement. The green movement is more or less being perpetuated by two somewhat complementary forces: (1) **Government intervention** and (2) **Social**

and market trends.

Let’s first consider government intervention. During his Earth Day speech in Newton, Iowa (where a new wind turbine manufacturer has replaced Maytag’s former headquarters³) the president said, “My administration will be pursuing comprehensive legislation to move towards energy independence and prevent the worst consequences of climate change, while creating the incentives to make clean energy the profitable kind of energy in America.”

The most immediate and urgent push for green jobs is coming from the programs and policies being drafted by the Obama administration. These policies, many of which are contained in the ARRA, are aimed at driving the entire economy (private individuals, industries, and governments) to act in more environmentally-conscious and energy-efficient ways (e.g. reduce pollution, use clean, renewable energy sources, curb carbon emissions, improve air, soil, and water quality, etc.). In this broad effort the Obama administration also says that many jobs will be created and saved (as many as 3.5 million), which will simultaneously help to create a “green economy” and encourage economic development to help our nation emerge from the recession. This includes creating “green jobs,” which are occupations focused on helping our economy operate in cleaner, more energy efficient ways. Green jobs will therefore improve our infrastructure, update our power grids, build new methods of harnessing renewable and clean energy (biofuels, wind, solar, and even tides), improve transportation systems to reduce carbon emissions (mass transit), and provide tax incentives so that people would retrofit their homes to make them more efficient.

This all seems to be strategically aimed at offsetting the large losses incurred by the construction sector over the last year and a half. It’s a bit like the thinking behind the development projects that were used during the Great Depression. There is much debate about this, which we will not enter into now. Our focus in this paper is to understand the thinking and motivation for

2 http://www.economicmodeling.com/resources/811_data-spotlight-a-look-at-green-occupations-part-1/

3 http://www.economicmodeling.com/resources/650_iowa-town-re-shapes-its-economy-with-data-focused-plan-partnerships/

why the government is trying to create green jobs.

As a result, if we want to find a green job that would be tied to this sort of dramatic effort, we need to take a much more in-depth look at the short list of specific green investments that have been outlined so far. These are: Building Retrofitting, Mass Transit, Smart Grid, Wind Power, Solar Power, and Advanced Biofuels (*the list and table below comes from the report entitled, "Green Recovery," ([download the pdf](#)) that was produced by the Center for American Progress⁵ and PERI*).

The key for local planners rests in understanding these opportunities, how to pursue them, and if you get them, applying them in ways that would benefit the region's workers and economy. In addition, if regions really want to make the most of these investments, it would be wise to mesh stimulus spending—which is short-term and not the sort of money that you can use to rebuild your community with (i.e. small amounts of money)—with the broader needs of the local workforce and business community, which is where long-term development is going to occur.

Green Jobs: Market and Social Trends

From another point of view, our nation is in the throes of the green revolution. This is pushing industries and households in a greener direction. There is a distinct, though not separate, trend that permeates popular culture, which is the adoption of the term 'green' to project the image of environmental stewardship. This trend has led companies to alter their brands, messages, and products to improve their public image. For instance, television networks now run green versions of their logos while you watch their programs, companies like GE, Toyota, and Wal-Mart tell you how environmentally friendly they are (what does this actually have to do with their products?), and virtually every other large company and mom-and-pop shop lets you know that they are working on "sustainability," "saving energy," and "reducing their carbon footprint." Moreover, companies like Chevron and BP have created subsidiaries called ESCO's (energy service companies) so they can market themselves as green firms. The whole-

4 http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/peri_report.pdf

5 The Center for American Progress is headed by John Podesta, who leads the Obama administration's transition team.

sale acceptance of the green movement means that (from an economic and labor market perspective) there is going to be quite a bit of room for the more entrepreneurial type to step in with some marketable ideas.

In addition, because the green movement is relatively young and undefined it finds itself in uncharted waters, a veritable economic and social "Wild West" if you will. Whenever we have movements like this ("the Information Age," "the Industrial Revolution") it creates opportunities for entrepreneurial-minded people to step in with new and innovative ideas. One of the results of the recession has been a renewed interest in entrepreneurial ventures. This is where the green movement can get some traction. As our nation struggles through and emerges from the recession, many traditional industry sectors and job descriptions will change and morph according to the needs of the economy. As a result, there could be new space for jobseekers to create products and services and take advantage of available labor pools in order to create products and services that companies, households, and governments interested in the green economy can use.

The big point to keep in mind here is that people interested in working in the green economy cannot necessarily expect a lot of these jobs and the related training to simply fall out of the sky, nor can they expect there to be a lot of new jobs that have never been around before. Initially, most green jobs will likely be created by policy from the federal government. However, the vast majority (and especially the high-paying sort) will come through market forces shaped by public sentiment, which nobody seems to have a solid grasp on yet. Seen this way, finding a green job will not be much different than finding any other job.

So how is a regional developer to approach these issues?

The key is understanding and anticipating how federal policy will affect your region, being familiar with how local companies are changing, and understanding what sort of training will be most appropriate. In addition, once you collect this information you can begin to pass it on to local jobseekers and businesses so they can react appropriately.

Jobseekers can in turn use this information to update them-

selves with the right skills and training. Businesses can anticipate what products and services will be needed, as they understand where where money and regulations are going to go. Training providers can also use this information so they can see what programs or curriculum they might need to offer, and be ready to help those that are interested in working in the green economy.

Some of the actual information that could be helpful in this effort is:

- Industry trends and labor market breakdowns,
- What occupations will be doing the green work,
- What training programs are associated with the most in-demand skills/knowledge,
- How policies and technological developments are going to play out or change regional economies, and
- What sort of products/services would fill needs (recognized or unrecognized) in the context of the regional economy.

From this perspective the green movement can be yet another opportunity that jobseekers, businesses, and training providers can take advantage of.

In the remainder of this paper we will review (1) how we

should think about and approach training for green jobs, (2) demonstrate how you can create industry and occupation analysis for your own area, and (3) how the entrepreneurial perspective is vital in all of this.

III. To Train or Not to Train

Much of the confusion about green jobs relates to trying to quantify and find green jobs “in the data.” This is a good sign, because it points to the fact that decision makers are demanding data as they decide the best course of action.

In previous papers we have learned that many of the occupations associated with “green investments” are essentially going to come out of the construction, manufacturing, and engineering sectors (see the **Green Investments and Jobs** table below). If someone in one of these occupations is working on a green project they will be thought of as having a “green job” because their work activity directly tied to a project resulting in a positive environmental outcome.

This definition/classification of the job should be understood based on the actual work activity. And even though maybe just 5 to 10% of the actual work activity is doing green things, it will still be thought of by some as a green job. At

Green Investments and Jobs

Strategies for Green Economic Investment	Representative Jobs
Building Retrofitting	Electricians, Heating/Air Conditioning Installers, Carpenters, Construction equipment Operators, Roofers, Insulation Workers, Carpenter Helpers, Industrial Truck Drivers, Construction Managers, Building Inspectors
Mass Transit/Freight Rail	Civil Engineers , Rail Track Layers, Electricians, Welders, Metal Fabricators, Engine Assemblers, Bus Drivers, Dispatchers, Locomotive Engineers, Railroad Conductors
Smart Grid	Computer Software Engineers, Electrical Engineers, Electrical Equipment Assemblers, Electrical Equipment Technicians, Machinists, Team Assemblers, Construction Laborers, Operating Engineers, Electrical Power Line Installers and Repairers
Wind Power	Enviromental Engineers, Iron and Steel Workers, Millwrights, Sheet Metal Workers, Machinists, Electrical Equipment Assemblers, Construction Equipment Operators, Industrial Truck Drivers, Industrial Production Managers, First-Line Production Supervisors
Solar Power	Electrical Engineers, Electricians, Industrian Machinery Mechanics, Welders, Metal Fabricators, Elecraical Equipment Assemblers, Construction Equipment Operators, Installation Helpers, Laborers, Construction Managers
Advanced Biofuels	Chemical Engineers, Chemists, Chemical Equipment Operators, Chemical Technicians, Mixing and Blending Machine Operators, Agricultural Workers, Industrial Truck Drivers, Farm Products Purchasers, Agricultural and Forestry Supervisors, Agricultural Inspectors

the local level (in terms of workforce and economic development), it seems less likely that folks will actually be calling these occupations—such as roofers, plumbers, and civil engineers—“green.”

The key first step in understanding the green clusters referenced above is to collect data on the current status of these occupations. A publication⁶ by the National Council for Workforce Education and the Academy for Educational Development emphasizes this point:

“As community colleges seek to identify the strategic opportunities of these green sectors, gathering specific and accurate labor market information about the green jobs in demand is critical . . .”

Accurate labor market data would include the number of people employed in the jobs, growth and decline in employment, earnings, replacement jobs (turnover rates), and education level. In addition, once you have this data you can begin to think about how well each one of these areas complements your regional economy, where you might have workforce gaps, and how you could fill those gaps either through occupational compatibility or training programs. **Armed with this information, it is very easy and straightforward to approach the issue of training and finding workers.**

Before we turn to looking at the actual data, we want to share a few more general observations about green jobs and particularly how this all relates to (1) training, (2) developing the right project, and (3) meeting the needs of employers.

1. First, as has been mentioned, green jobs are going to be dominated by construction and manufacturing jobs that will not require massive retraining efforts, which would defeat the purpose of quickly getting people back to work. In a recent letter to the US House of Representatives, Stephen Sandherr, the CEO of the Association of General Contractors of America stated,

“The US Office of Management and Budget (OMB), in its recent update of the standard occupational classification (SOC) system ‘analyzed over 80 unique suggestions regarding ‘green’ occupations,’ rejecting all but

two - wind turbine service technicians and solar photovoltaic installer. In explaining its final decision in the January 21, 2009 Federal Registerer OMB noted, ‘In many cases, the work performed in the ‘green’ job was identical or similar to work performed in existing SOC occupations.’”

Sandherr continues:

“The recent report: ‘US Metro Economies: Green Jobs in U.S. Metro Areas,’ prepared for the U.S Conference of Mayors and the Mayors Climate Protection Center, noted: ‘We should not expect to see a new industry populated by a new breed of ‘green construction workers.’ As green building technology becomes increasingly popular . . . traditional contractors will develop their skill sets and expand their knowledge bases in ways that will allow them to transform large numbers of ordinary buildings into some of the most energy efficient in the world.’”

The simple point: because the job activity of green jobs is so similar to those of regular jobs, there is no need to develop radical new training programs. It should be fairly easy to get people ready for these jobs since there are already a lot of ways to train and prepare for engineering, construction, manufacturing occupations, etc. The training can stay the same, with maybe a little new curriculum thrown in to make sure people are familiar with green building codes, etc.

Continuing with this theme, in a March 16 interview⁷ in the *Huffington Post*, Van Jones, author of the *Green Collar Economy*⁸ was asked about what sorts of occupations will be affected by green policy. In his response he said,

“Sometimes people think we’re talking about some exotic occupation from Mars that nobody’s ever heard of. That we’re talking about George Jetson or Buck Rogers when we’re thinking about green jobs. We’re not talking about solar ray-guns; we’re talking about caulking guns as one of the major tools we’re going to need to be smarter with energy. Those are jobs our existing work force, with a little training, can start doing right away.”

7 http://www.huffingtonpost.com/2009/03/16/van-jones-obamas-green-jo_n_175197.html

8 http://www.huffingtonpost.com/2008/10/20/van-jones-qa-about-his-ne_n_135928.html

6 http://www.economicmodeling.com/resources/1343_ncwe-addresses-community-colleges-and-green-jobs/

So now we see that the actual job activity in these green projects is not going to be that different from what is and was already being done in manufacturing and construction. In a lot of cases, builders and contractors have already naturally developed many of these standards.

Likewise, the NCWE “Going Green” report states that,

*“Green jobs in clean energy sectors span a variety of skills, educational backgrounds, and occupations. However, many jobs that are currently, or predicted to be in demand are ‘middle-skilled’ jobs that require more than a high school diploma but less than a bachelor’s degree. It is important to note that although there will be a growing number of new green occupations requiring new knowledge, skills, and abilities, it is expected that the majority will be transformed from existing jobs, requiring redefinition of skills sets, methods, and occupation profiles.”*⁹

The report goes on to emphasize the importance of:

A. “Identifying strategic opportunities in these green sectors by gathering up-to-date labor market information about the demand for these occupations.”

B. “Collaborating with workforce and economic developers to review and customize labor market information, survey local employers, and develop industry-specific economic impact models that can reveal the potential impact of green development projects.”

Again, green occupations and industries are not listed by the Bureau of Labor Statistics, so local planners will have to collect data on areas likely to be affected by policy.

2. It’s also important to understand how well a specific project matches up with the needs of your regional economy. To illustrate, if your region doesn’t have the correct wind profile, then installing wind turbines is obviously out of the question. If you are not located near a significant source of biomass (e.g. forest products), then the biofuel projects might be a little far fetched. If the median home price in your town has dropped by 50% (like it has in Phoenix), it might be more unlikely

⁹ Feldbaum and States, National Council for Workforce Education and the Academy for Educational Development, “*Going Green: The Vital Role of Community Colleges in Building a Sustainable Future and Green Workforce*”

that people will be pouring a lot of money into their homes. These are fairly anecdotal examples, however, considerations like these need to be made when looking at green projects. The questions that should be asked are, “*Is this the right project for my region (e.g. will it ‘stick’)?*” and “*What sort of resources do we already have in place that can be used to accomplish this project?*”

Labor market and economic analysis combined with things like employer surveys can both reveal how well a specific development would fit your community, what the relative impact of the project would have (in an economic sense), and if people would be excited, supportive, and behind such a development.

A positive case study for such projects comes from Newton, IA, the former headquarters for Maytag, and the site of the president’s Earth Day speech. The recent loss of Maytag, the town’s largest employer, meant the small town had a huge amount of available space and a qualified and available labor pool that could be transitioned into this expanding wind power industry. But let’s imagine for a moment that Maytag were still operational with no signs of slowing. Let’s also say they offered higher wages than a wind-turbine manufacturer. Attracting such a firm into the region would have been a much different story. But because Newton had all the available skills, facilities, and was ideally situated to be a great location for manufacturing wind turbines, they were able to take stock of their resources in order to wisely develop and grow this new industry.

The primary point is that local planners can do a lot of research and groundwork to bring these investments into the community for positive results, and help the community understand what sort of training and background is needed to successfully pursue each project. Without quantifiable labor market data, we cannot create sustainable jobs, training programs, and markets.

3. Finally, employers are still very much more oriented toward occupational skills and training. The green movement may play a part, but their focus is still on the broader occupational definition and training. At this point, and according to many people who have researched this sector, most of the training can be accomplished by adding some new curriculum into training programs.

The California Centers of Excellence have done a good job illustrating this.¹⁰

In a recent survey they found that:

- *“Just over 60% of employers (in their service territory) identified themselves as green or somewhat green firms, indicating a high level of awareness of the importance of being perceived as green.*
- *Almost two-thirds (63%) of employers state that demand for lower energy costs was very important to the development of the green economy and their business.*
- *Over 70% of employers indicated that they had at least some difficulty (49%) if not great difficulty (22%) recruiting non entry-level employees with adequate skills and work experience.*
- *Employers indicated that an A.A. degree in a green subject area was not a priority for hiring employees. A short-term certificate is more desirable to employers hiring employees in the green economy.”*

IV. Occupational Training

Now, let's move on to understanding the various government-backed development projects and how we can communicate and prepare for them. First let's consider something that was covered in a [previous paper¹¹](#) on green jobs. One of the things

10 Centers of Excellence, “Environmental Scan: Green Economy Workforce Study, Central Valley Region,” December 2008

11 http://www.economicmodeling.com/resources/1082_data-spotlight-

that is very unique about the United States is how much data we collect on industries and occupations. The BLS classifies and tracks nearly 900 distinct occupations. This is important because this information gives regional developers a tremendous advantage when they want to actually understand the status of various types of workers, businesses, and economic activities in data-driven, objective ways. Many nations don't have this sort of information (at least publicly available), which means that they will have to survey or guess if they want to make decisions based on hard numbers and measurable economic trends.

It is important to understand and use this information (especially occupation data) when approaching green jobs. Occupations are well classified and cover a very broad range of activities. And with nearly 900 classified, most new jobs that show up in the economy will often fall into an existing code. This data form the foundation of regional forecasts and analysis, and can be applied to any county, ZIP or custom region in the nation. In addition, one occupation will actually be comprised of multiple job titles (**see Table: Occupations vs Job Titles**), so occupation categories actually capture multiple job titles. In this case we have two job titles (Wind turbine electrical engineer and Wind farm electrical system designer), which are essentially doing the work of an electrical engineer. The resolution might not be as fine, but the data certainly are a lot better, and will allow local practitioners to generate very detailed and objective analysis of local employment characteristics and training needs that are actually grounded in data.

Furthermore, when occupation categories are used we can trace the data back to (1) specific industries through staffing

[green-pathways/](#)

Occupation vs. Job Titles

Occupation Category	Electrical Engineer (SOC 12-2071)	
Job Title	Wind Turbine Electrical Engineer	Wind Farm Electrical System Designer

patterns, (2) other occupations through O*NET data, and (3) to specific training programs through a CIP to SOC cross-walk.

So what is a good way to interact with this information and use it to understand where to find people and what training they might need?

In the graph below we provide a simplified schematic. On the left hand side we start with either a job description or a green project. Let's imagine we open the classified ads and a local construction company is looking for solar panel installers. This currently does not have a recognized SOC (it will

be next year). To better understand this job, we should see how well we can line it up with a current occupation (center circle). The way to do this is through understanding the actual work activity. Maybe the occupation is very similar to the work activities of a roofer or an electrician. Once we have that information we can then crosswalk over to:

- **Industries (based on NAICS, top right circle) to learn more about trends,**
- **Other occupations (based on O*NET, middle right circle) with similar knowledge, skills, and abilities, and**
- **Training programs (based on CIP codes, bottom right circle) so we can see who trains for this sort of thing.**



Example Scenario

Our local construction company is looking to hire someone to work on a green project (left blue or red circles). Let's stick with the solar panel installers. So what we want to do is match the job activity to the nearest occupation.

Currently the occupations that would be closest to this sort of work (based on skills descriptions) are roofers and electricians.

From this we can analyze these specific occupations based on SOC (Standard Occupation Classification) codes (center circle). With this information we can move in a lot of directions through crosswalks. In addition, with occupation data we can look at earnings, new and replacement jobs, and change for any region (county, ZIP, or custom region) for our roofers and electricians. This will tell us things like how much they would expect to be paid, if they are losing work, and what industries typically employ them.

Mapping to Industries: The top industries employing electricians are Nonresidential and Residential general contractors, Single family home general contractors, and Residential remodelers. Electricians also do a lot of work in the Residential/Nonresidential electrical contractor and Plumbing and HVAC contractors industries. Because of the downturn, many of these sectors are going to have pretty high unemployment.

Occupations: Mapping occupations to other compatible occupations using O*NET is a useful way to see where people can be up-skilled or transitioned from in order to fill workforce gaps or find reemployment possibilities. In this case Machinists, which is a declining sector, are pretty compatible to electricians. Therefore, with a little training, people with these jobs could be retrained to work as electricians or perhaps solar panel installers, especially if this sector picks up as a result of the green projects around weatherization and solar installation.

Training programs: With occupation data we can also understand the level of education/training associated with the occupation (e.g. associate's degree, on-the-job training, etc.), and map this information over to regional programs that train for the occupations. If we have the SOC code we can match it to CIP codes (Classification of Instructional Programs) to see what sort of training is in the area. This is done via a SOC-CIP crosswalk that indicates the relationships between program content and occupations, based on the descriptions of each.

Using this sort of labor market analysis will allow us to consider a lot of things, move in multiple directions, and help provide solid regional data and analysis to everyone from local planners to local jobseekers.

Chapter Two

I. Understanding the Green Clusters and Associated Training

First, let's review the status of two primary industry areas that will be affected by the green movement. These two industry sectors are Engineering and Construction (manufacturing will be, but manufacturing taken as a industry sector is too wide and disparate and the green economy will likely not impact a large proportion of these occupations). As a result, we will analyze the manufacturing jobs as they relate to the actual green clusters.

Engineering Training

A common thread in the green occupation clusters are engineering occupations. Whether it's **Computer software**

engineers for smart grid projects or **Chemical engineers** for the advanced biofuels cluster, these high-skill, high-wage jobs could be in great demand. On the next page is a table of trends, earnings, and training requirements for all engineering occupations found in green clusters.

These occupations require either an associate's or bachelor's degree, and programs in engineers are plentiful. The average earnings for these occupations is \$36 per hour (roughly \$68K per year). In general, the job outlook for these occupations is holding a lot more steady as compared to the construction and manufacturing clusters. Computer software engineers and environmental engineers are contributing to the growth. Civil engineers, Chemical engineers, and Electrical engineers are showing slight decline.

Engineering Occupations, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
15-1031	Computer software engineers, applications	544,025	570,210	26,185	5%	42,076	8%	\$39.17	Bachelor's degree
15-1032	Computer software engineers, systems software	425,074	433,517	8,443	2%	20,702	5%	\$41.75	Bachelor's degree
17-2041	Chemical engineers	32,763	32,316	-447	-1%	1,180	4%	\$39.69	Bachelor's degree
17-2051	Civil engineers	311,813	309,399	-2,414	-1%	13,473	4%	\$33.20	Bachelor's degree
17-2071	Electrical engineers	158,707	154,903	-3,804	-2%	3,327	2%	\$39.11	Bachelor's degree
17-2081	Environmental engineers	55,321	56,517	1,196	2%	4,407	8%	\$34.69	Bachelor's degree
17-3022	Civil engineering technicians	89,868	89,809	-59	0%	3,367	4%	\$21.22	Associate's degree
17-3023	Electrical and electronic engineering technicians	164,369	159,116	-5,253	-3%	926	1%	\$25.29	Associate's degree
17-3025	Environmental engineering technicians	23,161	23,481	320	1%	1,207	5%	\$19.79	Associate's degree
		1,805,101	1,829,267	24,166	1%	90,664	5%	\$36.26	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

Related competency requirements for Engineering

In order to better understand the sort of training and background engineers must have, we have provided a list of the primary knowledge and skills areas for engineers. After analyzing the competencies of engineers, certain critical knowledge and skills stick out.

Here are some at the top of the knowledge and skill areas:

Knowledge: design, physics, mathematics, computers and electronics, chemistry

Skills: reading comprehension, complex problem solving, critical thinking, active learning

Computer software engineers, applications

- Knowledge: computers and electronics, mathematics, telecommunications
- Skills: programming, critical thinking, complex problem solving

Computer software engineers, systems software

- Knowledge: computers and electronics, mathematics, English language
- Skills: complex problem solving, technology design, troubleshooting

Chemical engineers

- Knowledge: chemistry, mathematics, physics
- Skills: complex problem solving, reading comprehension, active learning

Civil engineers

- Knowledge: design, building and construction, mathematics
- Skills: reading comprehension, critical thinking, complex problem solving

Civil engineering technicians

- Knowledge: mathematics, design, computers and electronics
- Skills: reading comprehension, active learning, critical thinking

Electrical engineers

- Knowledge: computers and electronics, mathematics, English language
- Skills: active listening, troubleshooting, critical thinking

These knowledge and skill areas also correspond to specific programs, which would be a little too complex and unwieldy

to apply at the national level. We recommend that you map out these training programs for your area to see how much training is being provided and if it is starting to prepare workers specifically for green projects. **If you would like to see programs associated with engineering in your area please contact us.**

Again the work activities for green projects are not going to be very far from the normal scope of these jobs, and just a little new training would be required.

Recommendations for Community Colleges from the CA Centers of Excellence

Some other observations and suggestions offered by the CA Centers of Excellence relative to training engineers for the green economy:

New Skills and Competencies in Engineering:

“Environmental engineers work behind the scenes and are well-versed in biology and chemistry to develop solutions to environmental problems. However, focus is expected to shift from controlling existing problems to preventing problems. Therefore, these engineers will need new knowledge and skills in prevention of environmental problems.”

“Mechanical engineers could be good candidates to transition into energy engineers. Energy engineers assist companies in reducing energy costs and making buildings more efficient. Mechanical engineers would need to acquire a new set of skills associated with energy efficiency and green building principles to be able to perform the job of an energy engineer.”

Recommendations to community colleges

- “Strengthen relationships and agreements with four-year engineering programs at local universities, and strengthen partnerships with high schools and middle schools to develop pipelines
- Offer courses that assist graduates in their preparation for the licensing exams.
- Add courses to engineering technology programs that are more driven toward preparing environmental engineering technicians.”¹

12 Centers of Excellence, “Environmental Scan: Green Economy

Construction Occupations

Likewise, construction-related occupations are purported to be in great demand. Below is a look at trends for construction. These jobs pop up throughout the green clusters and certainly would be affected by “green” projects. With the housing bust, these occupations have taken quite a hit. The training tends to be on-the-job, and the wages average out to about \$18 per hour (\$34K). Carpenters and Electricians are experiencing some of the greatest decline —shedding some 7% of their total workforce.

Construction competency requirements

Construction managers

- Knowledge: building and construction, administration and management, engineering and technology
- Skills: critical thinking, reading comprehension, monitoring

Construction carpenters

- Knowledge: building and construction, mathematics, design
- Skills: mathematics, time management, active listening

Construction laborers

- Knowledge: building and construction, mathematics, mechanical
- Skills: active listening, coordination, speaking

Operating engineers

- Knowledge: building and construction, mechanical, public safety and security
- Skills: active listening, equipment maintenance, equipment selection

Electricians

- Knowledge: mechanical, building and construction,

Construction-related occupations, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
11-9021	Construction managers	764,805	730,973	-33,832	-4%	-12,012	-2%	\$21.90	Bachelor's degree
47-2031	Carpenters	1,630,460	1,540,385	-90,075	-6%	-49,744	-3%	\$18.29	Long-term on-the-job training
47-2061	Construction laborers	1,467,001	1,392,242	-74,759	-5%	-54,460	-4%	\$15.09	Moderate-term on-the-job training
47-2073	Operating engineers and other construction equipment operators	435,875	424,702	-11,173	-3%	4,880	1%	\$20.00	Moderate-term on-the-job training
47-2111	Electricians	762,433	711,853	-50,580	-7%	-14,710	-2%	\$22.28	Long-term on-the-job training
47-2141	Painters, construction and maintenance	554,404	525,376	-29,028	-5%	-10,955	-2%	\$16.13	Moderate-term on-the-job training
47-2181	Roofers	183,975	172,023	-11,952	-6%	-4,330	-2%	\$16.58	Moderate-term on-the-job training
47-3019	Helpers, construction trades, all other	29,579	28,086	-1,493	-5%	-116	0%	\$12.62	Short-term on-the-job training
47-4011	Construction and building inspectors	127,292	128,506	1,214	1%	5,821	5%	\$22.75	Work experience in a related field
		5,955,824	5,654,146	-301,678	-5%	-135,626	-2%	\$18.43	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

mathematics

- Skills: critical thinking, active listening, operation monitoring

Painters, construction and maintenance

- Knowledge: customer and personal service, English language, public safety and security
- Skills: active listening, time management, coordination

Roofers

- Knowledge: building and construction, design, mathematics
- Skills: installation, coordination, speaking

Construction and building inspectors

- Knowledge: building and construction, English language, engineering and technology
- Skills: critical thinking, active listening, speaking

significantly impacted by green construction. A common perception is that green construction facilities are generally estimated to cost more than traditional construction facilities. Cost estimators unfamiliarity with green construction processes and materials may result in overestimating costs, rather than underestimating. Therefore, a well-trained cost estimator is crucial for green building projects."

As has been pointed out, training providers can respond by adding specific certifications to existing programs. A very good example of this comes from Grand Rapids Community College,¹² which added the "Green Advantage - Environmental Certification¹³" to its curriculum. Here is a description of the course:

"Green Advantage® is an environmental certification for building related practitioners - primarily contractors, subcontractors and trades people. Certified individuals have successfully passed the Green Advantage® Certification Exam demonstrating knowledge of current green building principles, materials, and techniques."

Understanding Green Jobs and the Construction Sector

Let's once again use an excerpt from the Centers of Excellence study to better understand the potential for the construction trades in the green economy:

"Green building firms are found in all sectors of construction, including commercial and industrial facilities, residential buildings, and among specialty trade contractors. The workforce impact will not only be felt in the construction industry, but also among those firms that are involved in green design (i.e. architects and planners), as well as firms that develop and produce green building materials. . . Green building ratings, particularly the Leadership in Energy and Environmental Design (LEED) rating system implemented by the U.S. Green Building Council (USGBC), play an important role in both providing a gold standard for builders to aim for, as well as certifying that a building or facility is as 'green' as it says."

Construction skills that will be required:

"In the construction industry, and especially green building, cost estimators must have a comprehensive understanding of how the design process is implemented, including what 'green' building materials will work for a given design and how they should be priced. Because green construction requires different designs and uses different building materials, cost estimators are

Reviewing the Green Clusters

Now we will take a closer look at the skills, education, and training associated with the specific green clusters (Building/Retrofitting, Wind, Solar, Biofuels, Smart Grid, Mass Transit/Freight).

Please note that in this section we will be looking at all the workers across all industries that staff these occupations, not just possible green ones. While we've used ***national county-level data below***, the goal for planners should be to look at trends on a ***local*** or ***regional*** level to get a sense of what occupations (green or otherwise) are thriving or suffering.

Another important reminder is that although much of the data paint a bleak picture for the bulk of the clusters, they also mean there's a multitude of available workers for start-up projects, etc.

13 https://learning.grcc.edu/ec2k/CourseListing.asp?master_id=362&master_version=1&course_area=CECT&course_number=134&course_subtitle=00

14 <http://www.greenadvantage.org/>

1. Building Retrofitting (table on p. 16)

This occupation cluster is more or less tied to increased energy efficiency for homes, offices, and public buildings. First, notice that we have expanded our cluster (from the PERI list) to include a more exhaustive list of occupations. This was done based on the recommendation of the Association of General Contractors¹⁴.

Summary

- From 2008-2010 this cluster is on track to shed 390,000 jobs (a 5% decline). Furthermore, construction-related occupations, which can have a high rate of turnover did not replace very many workers.
- The average earnings for these occupations is less than \$18 per hour (avg. salary between \$30,000-\$34,000 annually).
- Only one occupation requires a bachelor's degree (**Construction managers**), and all others require only short-to long-term on the job training or work experience in a related field.
- All of the occupations except **Construction and building inspectors** experienced decline.
- **Iron workers, Electricians, and Elevator installers and repairs** have the highest associated wages, and **Carpenter helpers** and **Industrial truck and tractor operators** have the lowest.

15 <http://www.agc.org/>

How to Prepare Jobseekers for the Green Economy

Green Jobs, Part5



White Paper
May, 2009

"Building Retrofitting" Occupational Cluster, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
11-9021	Construction managers	764,805	730,973	-33,832	-4%	-12,012	-2%	\$21.90	Bachelor's degree
47-2021	Brickmasons and blockmasons	143,422	134,353	-9,069	-6%	-3,605	-3%	\$21.21	Long-term on-the-job training
47-2031	Carpenters	1,630,460	1,540,385	-90,075	-6%	-49,744	-3%	\$18.29	Long-term on-the-job training
47-2041	Carpet installers	61,595	58,167	-3,428	-6%	-1,649	-3%	\$17.77	Moderate-term on-the-job training
47-2051	Cement masons and concrete finishers	214,821	203,783	-11,038	-5%	391	0%	\$18.12	Moderate-term on-the-job training
47-2053	Terrazzo workers and finishers	14,846	14,056	-790	-5%	-4	0%	\$16.53	Long-term on-the-job training
47-2061	Construction laborers	1,467,001	1,392,242	-74,759	-5%	-54,460	-4%	\$15.09	Moderate-term on-the-job training
47-2073	Operating engineers and other construction equipment operators	435,875	424,702	-11,173	-3%	4,880	1%	\$20.00	Moderate-term on-the-job training
47-2081	Drywall and ceiling tile installers	164,730	153,834	-10,896	-7%	-6,787	-4%	\$18.45	Moderate-term on-the-job training
47-2082	Tapers	67,287	63,000	-4,287	-6%	-2,611	-4%	\$18.95	Moderate-term on-the-job training
47-2111	Electricians	762,433	711,853	-50,580	-7%	-14,710	-2%	\$22.28	Long-term on-the-job training
47-2121	Glaziers	57,855	56,359	-1,496	-3%	350	1%	\$17.68	Long-term on-the-job training
47-2131	Insulation workers, floor, ceiling, and wall	31,353	29,716	-1,637	-5%	-319	-1%	\$15.89	Moderate-term on-the-job training
47-2161	Plasterers and stucco masons	54,393	50,576	-3,817	-7%	-1,531	-3%	\$17.86	Long-term on-the-job training
47-2181	Roofers	183,975	172,023	-11,952	-6%	-4,330	-2%	\$16.58	Moderate-term on-the-job training
47-2221	Structural iron and steel workers	73,913	70,231	-3,682	-5%	780	1%	\$21.93	Long-term on-the-job training
47-3012	Helpers, carpenters	83,916	78,927	-4,989	-6%	-1,112	-1%	\$12.81	Short-term on-the-job training
47-3013	Helpers, electricians	107,796	98,912	-8,884	-8%	-3,979	-4%	\$12.80	Short-term on-the-job training
47-4011	Construction and building inspectors	127,292	128,506	1,214	1%	5,821	5%	\$22.75	Work experience in a related field
47-4021	Elevator installers and repairers	26,886	25,058	-1,828	-7%	-530	-2%	\$30.62	Long-term on-the-job training
47-4091	Segmental pavers	6,808	6,600	-208	-3%	127	2%	\$16.84	Moderate-term on-the-job training
49-9021	Heating, air conditioning, and refrigeration mechanics and installers	339,304	324,558	-14,746	-4%	-3,696	-1%	\$18.50	Long-term on-the-job training
53-7021	Crane and tower operators	46,169	43,804	-2,365	-5%	-823	-2%	\$20.44	Long-term on-the-job training
53-7051	Industrial truck and tractor operators	627,658	594,304	-33,354	-5%	-1,140	0%	\$14.09	Short-term on-the-job training
		7,494,591	7,106,923	-387,668	-5%	-150,692	-2%	\$18.22	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

2. Mass Transit/Freight Rail Cluster

This cluster primarily revolves around the transportation sector and construction related to road and structural projects (e.g. bridges, overpasses, etc.).

Summary

- From 08-10 this cluster is also projected to take a very big hit (-340,000 jobs, 5% decline).
- In this cluster, only three of the occupations require an as-

sociate's degree or higher (**Construction managers, Civil engineers, and Civil engineering assistants**).

- Quite a few of the occupations require high numbers of replacement workers.
- The average earnings for this sector were also roughly \$18 per hour (\$34K per year). The highest wages are associated with **Civil engineering, Locomotive engineering, and Railroad yardmasters**. The lowest—**Industrial truck drivers, Bus drivers, and Welders**.

"Mass Transit/Freight Rail" Occupational Cluster, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
11-9021	Construction managers	764,805	730,973	-33,832	-4%	-12,012	-2%	\$21.90	Bachelor's degree
17-2051	Civil engineers	311,813	309,399	-2,414	-1%	13,473	4%	\$33.20	Bachelor's degree
17-3022	Civil engineering technicians	89,868	89,809	-59	0%	3,367	4%	\$21.22	Associate's degree
43-5032	Dispatchers, except police, fire, and ambulance	197,527	190,925	-6,602	-3%	2,922	1%	\$16.18	Moderate-term on-the-job training
47-2031	Carpenters	1,630,460	1,540,385	-90,075	-6%	-49,744	-3%	\$18.29	Long-term on-the-job training
47-2061	Construction laborers	1,467,001	1,392,242	-74,759	-5%	-54,460	-4%	\$15.09	Moderate-term on-the-job training
47-2073	Operating engineers and other construction equipment operators	435,875	424,702	-11,173	-3%	4,880	1%	\$20.00	Moderate-term on-the-job training
47-2111	Electricians	762,433	711,853	-50,580	-7%	-14,710	-2%	\$22.28	Long-term on-the-job training
47-2221	Structural iron and steel workers	73,913	70,231	-3,682	-5%	780	1%	\$21.93	Long-term on-the-job training
47-4061	Rail-track laying and maintenance equipment operators	15,578	15,529	-49	0%	700	4%	\$17.99	Moderate-term on-the-job training
51-2031	Engine and other machine assemblers	39,497	35,718	-3,779	-10%	-1,447	-4%	\$15.96	Short-term on-the-job training
51-2041	Structural metal fabricators and fitters	113,697	106,503	-7,194	-6%	-3,512	-3%	\$15.97	Moderate-term on-the-job training
51-4121	Welders, cutters, solderers, and brazers	415,266	397,405	-17,861	-4%	-1,335	0%	\$16.10	Long-term on-the-job training
53-3021	Bus drivers, transit and intercity	205,609	203,643	-1,966	-1%	3,271	2%	\$15.33	Moderate-term on-the-job training
53-4019	Locomotive engineers and operators	46,914	46,968	54	0%	3,270	7%	\$21.52	Moderate-term on-the-job training
53-4031	Railroad conductors and yardmasters	30,122	30,383	261	1%	2,600	9%	\$22.10	Moderate-term on-the-job training
53-7021	Crane and tower operators	46,169	43,804	-2,365	-5%	-823	-2%	\$20.44	Long-term on-the-job training
53-7051	Industrial truck and tractor operators	627,658	594,304	-33,354	-5%	-1,140	0%	\$14.09	Short-term on-the-job training
		7,274,204	6,934,777	-339,427	-5%	-103,919	-1%	\$18.65	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

3. Smart Grid Cluster

The smart grid cluster is focused mostly on enhancing power generation technology, both with transmission and distribution grids. The idea is that better technology will lead to energy efficiency and savings, as well as increased reliability. Smart grid, according to an article in the Electronic Engineering Times, is a “broad term indicating a wide array of changes that could make today’s analog and closed electricity network more like the Internet in the way it is remotely and openly monitored and managed.”¹⁵

Summary

- This cluster is set to shed 240K jobs (4%) from 08-10. Of the 13 occupations associated with the smart grid cluster, seven require a bachelor’s or associate’s degree.

16 <http://www.eetimes.com/news/latest/showArticle.jhtml?articleID=216403573>

- The average earnings for this sector are \$21 per hour (roughly \$40K per year).
- The two Computer software engineers occupations are experiencing significant growth. In addition the replacement jobs associated with these occupations were very significant.
- The lowest earners in this sector are Team assemblers, Construction laborers, and Electronic equipment assemblers.
- **Electrical powerline installers** also has a good job outlook and lots of replacement jobs.
- Finally, **Electrical engineers** seems like a promising career. Even though there were not as many new jobs, there seems to be a significant amount of replacement jobs and the earnings (\$38 per hour, \$72K per year) are very good. Many of the sectors within renewable energy and energy efficiency require electrical engineers and/or electrical engineering technicians.

“Smart Grid” Occupational Cluster, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
11-9021	Construction managers	764,805	730,973	-33,832	-4%	-12,012	-2%	\$21.90	Bachelor's degree
15-1031	Computer software engineers, applications	544,025	570,210	26,185	5%	42,076	8%	\$39.17	Bachelor's degree
15-1032	Computer software engineers, systems software	425,074	433,517	8,443	2%	20,702	5%	\$41.75	Bachelor's degree
17-2071	Electrical engineers	158,707	154,903	-3,804	-2%	3,327	2%	\$39.11	Bachelor's degree
17-3022	Civil engineering technicians	89,868	89,809	-59	0%	3,367	4%	\$21.22	Associate's degree
17-3023	Electrical and electronic engineering technicians	164,369	159,116	-5,253	-3%	926	1%	\$25.29	Associate's degree
17-3024	Electro-mechanical technicians	18,779	18,127	-652	-3%	56	0%	\$21.85	Associate's degree
47-2061	Construction laborers	1,467,001	1,392,242	-74,759	-5%	-54,460	-4%	\$15.09	Moderate-term on-the-job training
47-2073	Operating engineers and other construction equipment operators	435,875	424,702	-11,173	-3%	4,880	1%	\$20.00	Moderate-term on-the-job training
49-9051	Electrical power-line installers and repairers	113,440	114,554	1,114	1%	8,238	7%	\$26.00	Long-term on-the-job training
51-2022	Electrical and electronic equipment assemblers	211,163	188,868	-22,295	-11%	-5,143	-2%	\$13.39	Short-term on-the-job training
51-2092	Team assemblers	1,123,052	1,027,971	-95,081	-8%	-52,445	-5%	\$12.73	Moderate-term on-the-job training
51-4041	Machinists	417,774	388,655	-29,119	-7%	-14,715	-4%	\$17.53	Long-term on-the-job training
		5,933,933	5,693,647	-240,286	-4%	-55,204	-1%	\$21.65	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

4. Wind Farms (table on p. 20)

At this point it appears that sometime next year that the BLS will officially add **Wind technician** (or some derivation of that) to the SOC classification system (it will take a little while longer for data to actually start to come in). This will provide regions with the ability to quantify these green occupations. Programs to train wind technicians are popping up all over the nation, at an exponential rate. The concern is that education institutions are creating these programs without a thorough enough understanding of the labor market and potentially through the use of inflated job projections that serve to substantiate program development. Before every college and jobseeker rushes out to train for these jobs, here is a word of caution. With unemployment as high as it is in construction and manufacturing, and with actual demand for new construction and manufacturing at the lowest point they have been in recent memory, it is important to not overtrain in these areas.

After reading the National Council for Workforce Education's paper on the role community colleges play in growing a green workforce, we thought it would be interesting to look at some data and employment trends for the sort of occupations employed at a company that manufactures wind turbines.

The NCWE report includes a typical employee profile for a 250-person wind manufacturing firm. We've taken the national outlook for the selected occupations in the profile and run some analysis to see how they're projected to change from 2008-2010. These are counts for all of the jobs in each 5-digit SOC area and are not necessarily to be considered "green." The purpose is to show the national outlook in job growth/loss, earnings, and the associated training requirements for each of the 27 occupations.

Note: These are selected occupations, based off information from Management Information Services Inc., and the American Solar Energy Society.

Summary

- As the NCWE study suggests, the lion's share of jobs in this profile are traditional manufacturing jobs.
- Many of these occupations are projected to experience significant decline over the past few years. The worst percentage loss comes from:

- **Drilling and boring machine tool setters and operators:** -12%, -5,446 jobs
- **Lathe and turning machine tool setters:** -11%, -6,647 jobs (the biggest overall loss)
- **Tool and die makers:** -11%, -9,486 jobs
- The value of analyzing replacement jobs—those that come about because of retirement, out-migration, etc.—is important to note here. While all but three of these occupations suffered losses, many have much brighter outlooks when you look at replacements. Factoring in new and replacement jobs, the strongest growth comes from **Janitors and cleaners** (4%) and **Accountants and auditors** (4%).
- Quite a few of the occupations in the profile have fairly low median hourly earnings. There are some notable exceptions (like **Engineering managers** at \$54.41), but the majority have limited wage potential. The average is \$17.06.
- Most of the occupations require somewhere between short- and long-term on-the-job training. A bachelor's degree is certainly useful in this area—but not essential.

Typical Profile of 250-employee Wind Manufacturing Farm

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly Earnings	Education Level
11-9041	Engineering managers	187,028	181,777	-5,251	-3%	2,035	1%	\$54.41	Degree plus work experience
13-1023	Purchasing agents, except wholesale, retail, and farm products	301,927	292,990	-8,937	-3%	3,504	1%	\$25.71	Work experience in a related field
13-2011	Accountants and auditors	1,596,624	1,600,842	4,218	0%	59,134	4%	\$23.45	Bachelor's degree
17-2112	Industrial engineers	213,155	207,363	-5,792	-3%	4,009	2%	\$35.20	Bachelor's degree
17-2141	Mechanical engineers	238,177	226,678	-11,499	-5%	-1,734	-1%	\$35.67	Bachelor's degree
17-3027	Mechanical engineering technicians	47,488	45,814	-1,674	-4%	93	0%	\$22.83	Associate's degree
37-2011	Janitors and cleaners, except maids and housekeeping cleaners	2,314,932	2,312,834	-2,098	0%	84,314	4%	\$10.30	Short-term on-the-job training
43-5071	Shipping, receiving, and traffic clerks	763,640	736,668	-26,972	-4%	7,979	1%	\$13.31	Short-term on-the-job training
43-6011	Executive secretaries and administrative assistants	1,697,239	1,703,318	6,079	0%	58,949	3%	\$18.45	Moderate-term on-the-job training
47-2111	Electricians	762,433	711,853	-50,580	-7%	-14,710	-2%	\$22.28	Long-term on-the-job training
49-9041	Industrial machinery mechanics	287,043	280,670	-6,373	-2%	2,871	1%	\$20.86	Long-term on-the-job training
49-9042	Maintenance and repair workers, general	1,408,688	1,390,525	-18,163	-1%	-11,431	-1%	\$15.83	Moderate-term on-the-job training
51-1011	First-line supervisors/managers of production and operating workers	693,358	648,974	-44,384	-6%	-16,259	-2%	\$24.23	Work experience in a related field
51-2031	Engine and other machine assemblers	39,497	35,718	-3,779	-10%	-1,447	-4%	\$15.96	Short-term on-the-job training
51-2092	Team assemblers	1,123,052	1,027,971	-95,081	-8%	-52,445	-5%	\$12.73	Moderate-term on-the-job training
51-4011	Computer-controlled machine tool operators, metal and plastic	140,969	130,742	-10,227	-7%	-6,332	-4%	\$16.16	Moderate-term on-the-job training
51-4032	Drilling and boring machine tool setters, operators, and tenders, metal and plastic	34,635	30,397	-4,238	-12%	-1,607	-5%	\$14.80	Moderate-term on-the-job training
51-4034	Lathe and turning machine tool setters, operators, and tenders, metal and plastic	57,979	51,332	-6,647	-11%	-2,162	-4%	\$15.76	Moderate-term on-the-job training
51-4041	Machinists	417,774	388,655	-29,119	-7%	-14,715	-4%	\$17.53	Long-term on-the-job training
51-4081	Multiple machine tool setters, operators, and tenders, metal and plastic	88,534	81,369	-7,165	-8%	-3,879	-4%	\$14.96	Moderate-term on-the-job training
51-4111	Tool and die makers	86,578	77,092	-9,486	-11%	-5,891	-7%	\$22.37	Long-term on-the-job training
51-4121	Welders, cutters, solderers, and brazers	415,266	397,405	-17,861	-4%	-1,335	0%	\$16.10	Long-term on-the-job training
51-9021	Crushing, grinding, and polishing machine setters, operators, and tenders	42,735	39,784	-2,951	-7%	-683	-2%	\$14.44	Moderate-term on-the-job training
51-9061	Inspectors, testers, sorters, samplers, and weighers	481,711	443,420	-38,291	-8%	-18,788	-4%	\$15.35	Moderate-term on-the-job training
53-7062	Laborers and freight, stock, and material movers, hand	2,427,546	2,294,812	-132,734	-5%	12,262	1%	\$10.96	Short-term on-the-job training
		15,868,008	15,339,003	-529,005	-3%	81,729	1%	\$17.06	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

5. Solar Power

This cluster is focused on the use of solar cells for energy, including photovoltaic modules that produce electricity directly from sunlight.

Summary

- As is the case with wind power, these occupations are all related to construction to some degree. And overall, the numbers point to how hard the construction sector has been hit in the recent economic downturn. Almost 34,000 construction laborer positions are projected to lose their jobs by the end of 2010 (that figures lowers to 12,012 when replacements are factored in).
- The most in-demand “solar” job is **Electrical or elec-**

tronics repairers. From 2008-2010, it's projected to grow by 5% (new plus replacement jobs) and projected to add 3,643 workers.

- Electrical engineers** are in line to need a fairly large supply of replacement workers (3,327). That's a 2% increase from 2008.
- Postsecondary training is not mandatory with most of these occupations. However, solar industry certification is strongly preferred with employers to work in this sector. Also, the wage potential is fairly low. Six of the jobs have median earnings under \$15 per hour.

"Solar Power" Occupational Cluster, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly	Education Level
11-9021	Construction managers	764,805	730,973	-33,832	-4%	-12,012	-2%	\$21.90	Bachelor's degree
17-2071	Electrical engineers	158,707	154,903	-3,804	-2%	3,327	2%	\$39.11	Bachelor's degree
17-3023	Electrical and electronic engineering technicians	164,369	159,116	-5,253	-3%	926	1%	\$25.29	Associate's degree
47-2061	Construction laborers	1,467,001	1,392,242	-74,759	-5%	-54,460	-4%	\$15.09	Moderate-term on-the-job training
47-2073	Operating engineers and other construction equipment operators	435,875	424,702	-11,173	-3%	4,880	1%	\$20.00	Moderate-term on-the-job training
47-2111	Electricians	762,433	711,853	-50,580	-7%	-14,710	-2%	\$22.28	Long-term on-the-job training
47-3013	Helpers, electricians	107,796	98,912	-8,884	-8%	-3,979	-4%	\$12.80	Short-term on-the-job training
47-3019	Helpers, construction trades, all other	29,579	28,086	-1,493	-5%	-116	0%	\$12.62	Short-term on-the-job training
49-2094	Electrical and electronics repairers, commercial and industrial equipment	76,335	74,947	-1,388	-2%	3,643	5%	\$23.47	Postsecondary vocational award
49-9098	Helpers--Installation, maintenance, and repair workers	152,011	148,433	-3,578	-2%	3,238	2%	\$11.59	Short-term on-the-job training
49-9099	Installation, maintenance, and repair workers, all other	166,042	162,751	-3,291	-2%	-1,255	-1%	\$15.25	Moderate-term on-the-job training
51-2022	Electrical and electronic equipment assemblers	211,163	188,868	-22,295	-11%	-5,143	-2%	\$13.39	Short-term on-the-job training
51-2023	Electromechanical equipment assemblers	62,839	59,074	-3,765	-6%	-636	-1%	\$14.07	Short-term on-the-job training
51-2041	Structural metal fabricators and fitters	113,697	106,503	-7,194	-6%	-3,512	-3%	\$15.97	Moderate-term on-the-job training
51-4121	Welders, cutters, solderers, and brazers	415,266	397,405	-17,861	-4%	-1,335	0%	\$16.10	Long-term on-the-job training
		5,087,918	4,838,769	-249,149	-5%	-81,142	-2%	\$18.71	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

6. Advanced Biofuels

This cluster is made up of occupations that staff the chemical, transportation, and agriculture industries.

Summary

- Like the other green occupation clusters, the jobs that make up advanced biofuels are mostly in decline when you look at standard job change only. But the outlook changes when replacement jobs are factored into the equation. When new and replacement jobs are considered, the largest demand is for:
 - Farm and agricultural managers:** 16% growth,
- 84,746 additional jobs.
- Agricultural workers:** 10% growth, 2,411 jobs.
- Agricultural inspectors:** 7% growth, 1,024 jobs.
- The chemical field is very robust in general, and a four-year degree isn't essential to enter into it. From 2008-2010, **Chemical technicians** is projected to experience nice growth and solid wages (\$20.28), with an associate's degree as the requirement.
- Experience in most cases is just as or more important than postsecondary education with quite a few of these jobs. Purchasing agents of farm products, for example, make \$23.22 per hour (equivalent to \$48,000-plus/year) and require no degree per se.

"Advanced Biofuels" Occupational Cluster, 2008-2010

SOC Code	Description	2008 Jobs	2010 Jobs	Change	% Change	New & Rep. Jobs	% New & Rep.	2009 Median Hourly	Education Level
11-9011	Farm, ranch, and other agricultural managers	537,410	613,654	76,244	14%	84,746	16%	\$12.91	Degree plus work experience
13-1021	Purchasing agents and buyers, farm products	19,373	19,027	-346	-2%	470	2%	\$23.89	Work experience in a related field
17-2041	Chemical engineers	32,763	32,316	-447	-1%	1,180	4%	\$39.69	Bachelor's degree
19-2031	Chemists	83,085	82,848	-237	0%	4,095	5%	\$31.99	Bachelor's degree
19-4031	Chemical technicians	65,277	64,223	-1,054	-2%	3,205	5%	\$20.28	Associate's degree
45-1099	Supervisors, farming, fishing, and forestry workers	59,460	58,398	-1,062	-2%	1,164	2%	\$16.92	Work experience in a related field
45-2011	Agricultural inspectors	15,623	15,828	205	1%	1,024	7%	\$18.45	Work experience in a related field
45-2099	Agricultural workers, all other	23,861	25,049	1,188	5%	2,411	10%	\$10.65	Short-term on-the-job training
51-9011	Chemical equipment operators and tenders	54,178	51,751	-2,427	-4%	367	1%	\$21.11	Moderate-term on-the-job training
51-9023	Mixing and blending machine setters, operators, and tenders	138,951	132,369	-6,582	-5%	-865	-1%	\$15.11	Moderate-term on-the-job training
53-7051	Industrial truck and tractor operators	627,658	594,304	-33,354	-5%	-1,140	0%	\$14.09	Short-term on-the-job training
		1,657,639	1,689,766	32,127	2%	96,655	6%	\$15.80	

Source: EMSI Complete Employment - 2nd Quarter 2009 BETA (National County-Level Data)

II. Summary

We recommend that you create such analysis for your own area and have this sort of information on hand so that you can help jobseekers, displaced workers, or others interested in these sectors. In addition, such information is a good place to start when considering which investment or project area is going to be most helpful in your community.

If you have questions or would like to prepare some regional analysis on labor market trends, education/training programs, or economic impacts for your area, please contact us.

Who should provide training?

Because many of the occupations closely associated with the green projects are in areas like manufacturing and construction there is a lot of talk around who should be the primary training provider. On one hand you have apprenticeships, which are more appropriate for jobs that only require “on-the-job training” and on the other you have more workforce oriented institutions like community and technical colleges.

In February of 09 the AFL-CIO announced its Center for Green Jobs:¹⁶

“The mission of the center is not only to engage public policy but to also move beyond that to help our labor unions implement real green jobs initiatives—initiatives that retain and create good union jobs, provide pathways to those jobs and assist with the design and implementation of training programs to prepare incumbent workers as well as job seekers for these family-sustaining careers.”

Community colleges have also launched major initiatives for training. The NCWE’s Going Green publication lists many of the efforts currently underway at the nation’s community colleges to prepare the local workforce for green projects. At this point there does seem to be a little tension between the two entities, which is to be expected. Local trainers should work at the local level to understand where training is taking place and who is providing it.

To understand how training will play out in your area we recommend that you are familiar with what sort of training is already available in your region. We imagine that the actual training will be provided in different ways in different areas. This will have a lot to do with who is most well positioned to actually provide the training.

Here are the key points to keep in mind when it comes to providing training or helping jobseekers understand what sort of green jobs they can pursue.

- Short-term job creation in green jobs will primarily be in engineering, construction, and manufacturing occupations.
- Engineering positions are the only occupations that require more than an associate’s degree.
- Most of the jobs can be filled through traditional training efforts, short-term training programs/curriculum, and through basic occupational compatibility.
- Many of the occupations that will be needed to work on these green projects have experienced dramatic cutbacks and layoffs over the past few years, which means that there is a fairly large labor pool for these occupations. This means that these job markets could be very competitive.
- The implication here is that if supply is higher than demand, the wages and long-term employment opportunities in these areas decreases.

17 <http://blog.aflcio.org/2009/02/05/afl-cio-announces-center-for-green-jobs/>

Conclusion

Entrepreneurism and Green Jobs

In his Earth Day address in Newton, IA, the President said (in reference to the ARRA and tax credits for environmental improvements),

“And these steps will spur job creation and innovation as more Americans make purchases that place a premium on reducing energy consumption. Businesses across the country will join the competition, developing new products and seeking new consumers.”

And further down in his speech . . .

“That young guy in the garage designing a new engine or a new battery, that computer scientist who’s imagining a new way of thinking about energy, we need to fund them now, fund them early, because that’s what America has always been about: technology and innovation.”

As a result, the true manifestation and development of the green economy ultimately rests on the shoulders of the sort of companies and individuals that will create products and services that are in demand, fulfill needs, and solve problems. The ‘green’ economy, (like any other economy) needs entrepreneurs to grow. Again, this all hearkens back to the need for individuals and young people to apply themselves, and it speaks to the fact that there is no clear or defined “career pathway” for carving out a career in the green economy.

As economists familiar with both **government interventionist** and **entrepreneurial** schools of thought and familiar with our present day economic crisis, we see a lot of value in taking the latter approach. We are at a time in our nation’s history where many industry sectors are being shaken up (or down in a more accurate sense). A big result of this is that a lot of regions, especially places like Michigan, Ohio, Illinois and other Rust Belt states, are losing what is referred to as

their economic base¹⁷ (e.g. the industries that are primarily responsible for bringing in the most amount of money, jobs, earnings, and well-being). This means that as one job is lost in one sector perhaps as many as 5, 10, or even 20 jobs are lost via indirect effects. This has to do with the fact that a complex web of industries has grown up to support and sell to manufacturing companies that spend a lot on many sorts of materials.

The job loss in and of itself is a big enough problem. However, with dramatic declines happening across many sectors there are far fewer opportunities for transitioning into new occupations. So what are we to do with many of these new jobseekers? During more stable times we could likely transition them to another manufacturing company that was looking for similar knowledge and skills sets. However, with the wholesale decline of this sector, there are no real places to transition folks to.

So we are left with two choices—leave or do something new. And this is why we think the entrepreneurial angle is vital. A recent special report by *The Economist* ([PDF download](#)¹⁸) on the topic of entrepreneurship does a good job of pointing out that many of the United States’ major companies were in fact born out of recessions, and that recessions free up labor and resources which are then reapplied in new and more effective ways. Thought of this way, recessions are a sort of “cold shower” that wakes you up to the fact that things need to change. Its time to rethink what we are doing, which means seeking out new opportunities, taking risks, and working really hard.

A recent interview with the Professor of Entrepreneurial Studies and Case Western University, Scott Shane,¹⁹ also confirms

18 http://www.economicmodeling.com/resources/1216_io-guidebook-sec-v-using-input-output-for-economic-dev-analysis/

19 http://www.kauffman.org/uploadedFiles/Entrepreneurship/The_Economist_Global_Heroes_Reprint.pdf

20 http://www.mlive.com/business/ann-arbor/index.ssf/2009/01/tough_economy_layoffs_increase.html

this view. Shane says that, “There is this pattern [that normally] occurs when people lose their jobs. As their opportunity cost of starting a business goes down, so their probability of doing it goes up.” The article goes on to point out that in Ann Arbor, MI, there has been a lot more interest in entrepreneurship, and regional meetings on the subject are very well attended. Diana Durance, Executive Director of the Washtenaw Development Council also adds, “One of the positive effects of this horrible downturn that we’re in is you do get a sense of, ‘Well I have nothing to lose now. I can do what I’ve always wanted to do.’ I see people pursuing their dreams.”

The best way to develop and sustain this movement is to allow individuals and corporations to create products and services that impart some value to society. There is a long history of governments trying to create real market demand, and supporters of the green movement have said that the government needs to help drive it. However, successfully carrying out such a venture in a nation with an economy as large and diverse would require levels of regulation and taxing that could easily have more negative repercussions than positive. In addition, much of the job creation and policies that the government is enforcing are not associated with significant, long-term improvements in wages, labor markets, or skills. As industries innovate and create new products and services matched to real labor market demands, this will help to create economies that provide better wages, and longer-term career opportunities.

The industrial revolution had its Rockefellers and Carnegies, and the information age has its Microsofts, Apples, Googles, Facebooks, Ciscos, etc. The key element is that the folks that created or helped to create these companies matched a need to the demands of the current economy. Without such a champion, it is doubtful that the green economy can maintain itself as something more than a short-term trend. This is why jobseekers and young people should be encouraged, trained, and supported in being innovative, thoughtful, and keyed into the sorts of products and services that could be in demand.

In the new, undefined, green “Wild West” scenario the real winners will be those who come up with the best ideas and

work the hardest to create useful products and services. As a result, all sorts of education and training, not just engineering, LEED certification, and perhaps environmental science, will be valuable (and green). Jobseekers and young people should also be told that there is no specific career path that will serve as the yellow-brick road to the green economy. Because it’s an undefined job market, it’s up to students to apply themselves, learn, read, talk to people/business, and offer new and creative solutions.

A helpful step that training providers can take in shortening the distance between a learner and the actual job market (or new invention) is to talk to local employers, learn what their needs are, use data to look at trends, and be familiar with the sorts of things that local companies are spending a lot of time and money on. Such information will help training providers design more meaningful programs, and will help young people know and understand where they can focus their creative talents.

Above all, this seems like the key to the green jobs movement.

Examples

And there are already some outstanding examples of such activities.

- A California-based company called [Aquentium](#) has figured out how to use shipping containers (of which there is a huge overabundance) for housing during disaster relief missions.
- [Rent-A-Green Box](#), based in Costa Mesa, CA, uses hard-to-recycle plastics from local landfills to create the Recopack, which is an environmentally-friendly packing solution that will cut down on the need for cardboard boxes.
- [Green Truck](#) is a company that delivers organic produce (in and around Los Angeles) using only solar power and used vegetable oil.
- [Interface Inc.](#) is the world’s largest manufacturer of modular carpet, which it markets under the InterfaceFLOR, FLOR, and Bentley Prince Street brands. Bentley Prince Street also is a leader in the designer-quality broadloom carpet market. Interface, headquartered in Atlanta, is committed to sustainability and to doing business in ways that minimize the impact on the environment.