

Green Economy Analysis of the North Shore



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Executive Summary

Green jobs are occupying a central role in workforce development planning today and they are likely to remain central for the foreseeable future. The earliest codification of the green economy in policy on the national level was the Green Jobs Act of 2007, co-sponsored by Congressman John Tierney (MA-6). Since then, Massachusetts has implemented a state Green Jobs Act and green jobs training is one of the critical funding priorities for the American Recovery and Reinvestment Act. Based on its skilled workforce, deep bench of entrepreneurial talent, and complementary industries, the North Shore region is poised to capture a significant portion of this growing economic sector.

WHAT ARE THE GREEN JOBS?

The green economy was broadly defined by Van Jones, Special Advisor for Green Jobs, Enterprise and Innovation at the White House Council on Environmental Quality, in his seminal book *The Green Collar Economy: How One Solution Can Fix Our Two Biggest Problems*, as being comprised of firms in the energy, transportation, water, waste, and land management industries. Recently, this definition has been expanded to include components of the construction and manufacturing industries that either use green techniques or manufacture products for the green economy.

In the energy industry, much of the focus has been on alternative and renewable sources of energy, including wind, solar, fuel cells, and biofuels. The energy industry offers green jobs opportunities in research and development, manufacturing, and installation. While the research and development component generally offers jobs that have high education thresholds that are beyond the scope of this report (Masters or Ph.D. degrees are often required), both the manufacturing and installation segments of the sector offer opportunities for workers with less than a Bachelor's degree in formal education. Many of the jobs in the industry pay significantly higher wages than the median hourly wage in the region. Furthermore, the skills and education requirements for these jobs have been identified and foundational training programs are available already for many of them.

Perhaps no industry has been as affected by the increasing importance of the green economy as the construction industry. Requirements for sustainable building practices are being built into bid documents, driving both skills and certification requirements for workers at all levels of the construction industry. Of particular importance for workers at the entry level is LEED Green Associate certification, which demonstrates green building expertise in non-technical fields of practice. The LEED Green Associate credential denotes basic knowledge of green design, construction, and operations. This credential, along with others discussed within the report, can give workers a leg up on the competition in jobs that require LEED certification. The North Shore region has a very robust construction industry sector that can be further enhanced with an increased focus on green construction and LEED certification.

Green jobs and the green economy have affected the manufacturing industry quite differently than the industries previously discussed. In manufacturing, there are few new occupations resulting from the green economy and few jobs that are commonly considered to be green jobs. However, many of the critical occupations in the

manufacturing have changed significantly as a result of the emphasis on green, creating new skills requirements that training programs must take into account. In addition, the manufacturers of renewable energy products such as fuel cells and wind turbines may be attracted to the skilled workforce and demonstrated engineering and manufacturing experience of a wide variety of small and medium sized manufacturing firms on the North Shore.

RECOMMENDATIONS

- Explore strategic opportunities to make concentrated investments that can serve as pilot projects that may serve as models for effective workforce development and training programs serving green economy companies.
- Work closely with firms in the North Shore's critical industries, particularly construction and manufacturing, to identify emerging occupations and create training programs that meet these needs.
- Continue to work with the K-12 school system to enhance the STEM competencies, particularly mathematics, which will be critical for the emerging workforce gaining access to the fastest growing jobs in the green economy.
- Encourage the programs that the WIB funds in the construction industry to add LEED certification and experience to their training programs to ensure that program graduates are ready for changing industry trends toward sustainability and green construction.
- Ensure that construction and manufacturing training programs include internships and on the job experiences in LEED certified jobs to ensure that workers have the skills and experience needed to get on future LEED certified jobs.
- Monitor regional companies and education institutions receiving ARRA green economy funding to ensure that job training and career center efforts are aimed at maximizing the employment opportunities available for North Shore residents.
- Include questions about green jobs in future regional workforce development analyses of all industries to ensure that overarching green jobs that cross industries are taken into account.
- Market the region's workforce strengths to organizations working to develop green industries in Massachusetts such as the Massachusetts Technology Council and the Massachusetts Clean Energy Center.
- Explore the addition of green components into existing training programs where additional skills and certifications, such as LEED certification and experience in construction, can give participants advanced standing in the labor market.
- Partner closely with the region's community college to develop training programs that are responsive to regional industries in the green space and that support career ladders and advancement for workers in green occupations.

Green Economy Analysis of the North Shore

Green jobs occupy a central role in workforce development planning today. From the Center for American Progress to the Department of Labor to the nation's leading universities, there is hardly an organization working on workforce development that is not taking the green economy into account. There are several reasons for the emphasis on green jobs and the green economy. First, there is always an emphasis on the new; and green jobs are certainly new. Second, the confluence of the emergence of the green economy and the economic downturn have convinced some in the policy community that the jobs created in the green economy may help to lead the growth in employment as the economy rebounds. Also, many of the jobs that are part of the green economy utilize the skills, education, and experience of workers in some of the hardest industry sectors such as manufacturing and construction. Finally, the importance of policy entrepreneurs operating in this space cannot be overestimated.

The purpose of this report is to provide information to the North Shore Workforce Investment Board and its partners on the green economy and green jobs that can be considered in their workforce development planning. This information will be useful to career center staff who advise job seekers on the best possible industries in which to seek employment and of course to job seekers themselves. First, we consider the policy history of the green economy and the critical federal and state legislation driving the development of the green economy and supporting a wide variety of training and economic development programs. Second, we examine the green jobs in industries directly associated with the green economy and also those green jobs in the North Shore's critical and emerging industries that may be green themselves even if their firms are not formally part of the green economy. Next, we turn to the workforce and occupational strengths of the North Shore, with an emphasis on how those strengths are congruent with the demands of green jobs and the green economy. We then profile several companies in the green economy on the North Shore and conclude with policy and practice recommendations for the Workforce Investment Board to consider in its engagement with the green economy over the next several years.

When addressing a recent phenomenon such as the green economy, it is important to bear in mind some important caveats. First, most data currently available on the green economy is anecdotal. Traditional data sources have yet to incorporate green jobs as unique categories. Instead, green jobs are part of the total number of jobs for a given occupational category, making it impossible to come up with an accurate count of the number of green jobs in the region. Second, much of the research on green jobs and the green economy attempts to project the future. In this report, we consider current policies and funding programs and report on projections from a variety of sources. However, all of these are subjective, so there is no way to describe with precision the future jobs that will come from the emergence of the green economy. Finally, it is important to recognize that this research is being conducted during a serious economic downturn. During periods of high unemployment and significant policy and funding changes, it becomes even more difficult to predict what the industrial and occupational

structure of the regional economy is likely to be coming out of this downturn. One of the critical recommendations of this report is for the North Shore Workforce Investment Board to continue to monitor the growth of the green economy and green jobs in the region so the Board and its Career Centers can be ready to provide appropriate strategic assistance to businesses and job seekers in the green economy.

In the development of this report, we relied on national data from the U. S. Department of Labor and a number of secondary analyses and research reports which are listed in Appendix A. In addition, we conducted interviews with companies representative of the green economy on the North Shore, as well as several organizations providing training in critical green economy industry sectors. The data provided from these sources has been aggregated and does not represent any single company.

A BRIEF POLICY HISTORY OF GREEN ECONOMY INITIATIVES

The Green Economy is a relatively recent concept and as such is used to cover a wide variety of concepts across different constituencies. The earliest codification of the green economy in policy on the national level was the enactment of the Green Jobs Act of 2007. Congressman John Tierney (MA-6) was a sponsor of the Green Jobs Act. The Green Jobs Act was attached to the Energy Independence and Security Act and was intended to identify the most needed skills in the green economy and provide training for those jobs.

While the Green Jobs Act did not provide funding for any specific programmatic efforts, it did help set the stage for future efforts in two critical ways. First, it set the expectation that significant portions of the government's investment in green jobs would be targeted to low-income workers through the Pathways Out of Poverty Demonstration, which was scheduled to receive 20% of the Green Jobs Act funding. Second, the Green Jobs Act provided the first policy definition of the green economy through the targeting of training programs on the following industry sectors:

- Energy-efficient building, construction, and retrofits industries;
- Renewable electric power industry;
- Energy efficient and advanced drive train vehicle industry;
- The biofuels industry;
- The deconstruction and materials use industries;
- The energy efficiency assessment industry serving the residential, commercial, or industrial sectors; and
- Manufacturers that produce sustainable products using environmentally sustainable processes and materials.¹

While these industries are not what we would consider the totality of the green economy industries today, the fact that they were explicitly listed in the act provides a foundation from which other efforts and other policies were able to build.

The first major piece of state legislation related to green jobs and the green economy was the Massachusetts Green Jobs Act of 2008. This act, signed by Governor Deval Patrick, had three aims:

- to provide grant money to stimulate clean energy companies;
- to create green jobs; and
- to provide job training programs to ensure all people have access to new green jobs.

1. H.R. 2847 Green Jobs Act of 2007.

The act created the Massachusetts Clean Energy Center (www.masscec.com), which will promote research, act as a clearinghouse for information on the clean energy industry in Massachusetts, and support demonstration programs. The Act also created the Alternative and Clean Energy Investment Trust Fund to stimulate increased financing for green energy companies and provide matching grants to state educational institutions to conduct research on and provide training for careers in the clean energy industry. Finally, the act authorized as much as \$1 million in grants for workforce development training initiatives and another \$1 million for a Pathways Out of Poverty initiative for training programs leading to economic self-sufficiency.

Most recently, the American Recovery and Reinvestment Act (ARRA) has provided several opportunities related to green jobs and the green economy generally. The ARRA included \$750 million for a competitive grant program to support worker training in high growth and emerging industries, of which \$500 million is required to be spent on training programs for workers for jobs in the energy efficiency and renewable energy sectors. As part of this effort, a set of Pathways Out of Poverty grants will be awarded to organizations whose programs focus on helping low-income and under-skilled workers, unemployed youth and adults, and other underserved populations to find employment in energy efficiency and clean energy sectors. Other specific grant areas included State Sector Training Grants, Green Capacity Building Grants, and Energy Training Partnership Grants. The Department of Labor issued Solicitations for Grant Proposals using ARRA funds to provide training and capacity building efforts for green jobs in June 2009.

Funding for training for green jobs in the ARRA is widely dispersed. At the federal level, the Department of Energy, Department of Commerce, and the Environmental Protection Agency, as well as the Department of Labor, all have green economy resources that will be provided either directly, through grants, or as pass through funds to state and local governments. Investments in economic development and private sector research and development in green economy sectors are likely to be significant drivers of employment. The North Shore Workforce Investment Board and its partners should track these investments closely and be prepared to provide job training assistance and recruitment assistance to companies affected by ARRA investments in the green economy.

As one can see from this policy overview, the policy concepts of the green economy and green jobs are very recent and are clearly on an upward trajectory. It is likely that the green economy and green jobs will become even more important and more policy relevant over the next three years. The relative newness of the green economy offers an opportunity for interested organizations to get in on the ground floor with regard to current policies such as the Massachusetts Green Jobs Act and the ARRA, as well as policies and legislation that may be enacted in the future.

What are the Green Jobs?

The concept of the green economy is inextricably linked to the increase in the public discourse of climate change and the impact of man on the natural environment. While certain aspects of what we now consider the green economy, such as recycling and the weatherization of existing buildings, predate this discussion, much of what distinguishes the green economy is new. By new, it is important to recognize that we mean new in the public consciousness. There have been individuals and entrepreneurs working on technology developments in many of the industries and strategies that we now consider

green for quite a long period of time. However, only in the past ten to fifteen years have the results of these labors become part of the public discourse, with jobs potentially available for the workforce development system available to consider.

In many ways, the critical question for workforce development is what are the green jobs? Once we know what the green jobs are, we can identify the best possible opportunities for a given region to pursue. Unfortunately, with a new concept such as “the green economy,” it takes time for stakeholders to coalesce around a common definition. To date, there remains a dichotomy between what is commonly considered the green economy and green jobs. Both areas are important for workforce development. To limit one’s efforts to strictly jobs in industries in the green economy would unnecessarily limit the field of potential employment opportunities for current and future workers. In this section, we will build from secondary sources to describe the green jobs-green economy dichotomy as it is currently used by leading practitioners in the industry and then discuss green jobs in specific industries with a particular emphasis on critical and emerging industries in the North Shore economy.

The green economy was broadly defined by Van Jones, formerly Executive Director of Green for All and currently Special Advisor for Green Jobs, Enterprise and Innovation at the White House Council on Environmental Quality (CEQ), in his seminal book *The Green Collar Economy: How One Solution Can Fix Our Two Biggest Problems*,² as being comprised of firms in the following industries:

- Energy
- Transportation
- Water
- Waste
- Land Management.

Of course, any single industry definition of a concept as broad as the green economy is likely to miss some potential sectors. For example, many green economy advocates include green building or green construction as a critical part of the green economy. We have seen this codified in policy in the ARRA, which has a strong emphasis on weatherization and other energy efficiency building retrofits as a critical part of the green jobs component of the act.

Another way to define the green economy is that it is the result of strategic investments, public or private, in key economic strategies. According to the Political Economy Research Institute at the University of Massachusetts, six key strategies for green economy investments are likely to yield jobs that will build the green U.S. economy and fight global warming. The six strategies are building retrofitting, mass transit, energy-efficient automobiles, wind power, solar power, and cellulosic biofuels.³ A key contribution of this study has been to point out that many of the jobs in the green economy are jobs that are already critical in the current economy but that will

2. Van Jones, *The Green Collar Economy: How One Solution Can Fix Our Two Biggest Problems*. New York: Harper Collins, 2008.

3. Robert Pollin and Jeannette Wicks-Lim, *Job Opportunities for the Green Economy: A state-by-state picture of occupations that gain from green investments*. Amherst, MA: Political Economy Research Institute, 2008.

require additional skills to be taken on as the result of the emerging green economy. For example, electricians are currently a critical occupation in most areas of the country and the transition to the green economy will not change that. What will change, however, are the specifics of the work that electricians do. Whereas currently electricians may connect a home or business to an electrical transmission line, in the future a portion of their work may be to tie a home or business into solar panels or wind turbines. If these alternative energy sources become ubiquitous, the job opportunities in this field and many others are likely to expand.

From a workforce development perspective, what is most important to determine is where the green jobs are located. Not every job in a company in a green economy industry is a green job. More importantly, there are many green jobs situated in businesses that are not a part of what is traditionally considered the green economy. To best prepare workers for future job growth opportunities, it is most important to examine these opportunities across definitional boundaries. The remainder of this section considers green job opportunities in three critical industries nationally and concludes with a discussion of several overarching green jobs that cross industry boundaries.

Green jobs in the energy industry

Most of the conversation around green jobs in the energy industry has focused on the renewable energy space, and for good reason. A recent study by The Pew Charitable Trusts,⁴ found that the renewable energy industry added jobs at more than twice the national rate between 1998 and 2007, expanding their workforce 9.1 percent while total national job growth in the same period was 3.1 percent. The renewable or clean energy industry includes the solar, wind, wave, and geothermal energy, fuel cells, and biomass energy sub-sectors. With new investments being supported by both government and private sectors, the job opportunities in this industry are likely to increase.

In the renewable energy space, there are opportunities in three main areas: research and development, manufacturing, and installation. While the research and development component generally offers jobs that have high education thresholds that are beyond the scope of this report (Masters or Ph.D. degrees are often required), both the manufacturing and installation segments of the sector offer opportunities for workers with less than a Bachelor's degree in formal education, as shown in Table 1 below. It is important to note that in the data above the occupational data are aggregated for all occupations in the region in that category, not just those working in the alternative energy industry. Furthermore, since there are currently no alternative energy specific occupations in the OES data categories, it is likely that these data under-reports the total jobs and wages in the sector. We expect that as the sector grows in importance, these data deficiencies will be addressed.

Overall, the alternative energy sector appears to be quite promising for workforce development efforts. Many of the jobs in the industry pay significantly higher wages than the median hourly wage in the region. Furthermore, the skills and education demand for these jobs are well known and many foundational training programs are already available.

4. The Pew Charitable Trusts, The Clean Energy Economy: Repowering Jobs, Businesses, and Investments across America. http://www.pewcenteronthestates.org/uploadedFiles/Clean_Economy_Report_Web.pdf

Table 1. Sample Renewable Energy Occupations and Wages⁵

Industry Sector	Representative Occupations	Median Hourly Wage
Wind Energy	Sheet Metal Workers	\$18.72
	Electricians	\$28.63
	Helpers, Construction Trades, All Other	\$11.63
	Electrical and Electronics Repairers, Commercial and Industrial Equipment	\$28.63
	Structural Metal Fabricators and Fitters	\$20.63
Solar Energy	Electromechanical Equipment Assemblers	\$17.63
	Electrical Power-Line Installers and Repairers	\$28.81
	Electricians	\$28.63
Biomass Energy	Biofuels Processing Technicians	
	Biomass Production Managers	
	Biomass Plant Technicians	

By working closely with firms in the alternative energy industry to ensure that sector- and company-specific skill needs are addressed, it should be possible to prepare workers for these positions with relatively modest modifications to existing training programs and curriculum.

Previously in this section, we have focused on the alternative energy sector. However the traditional energy sector has also been influenced by the green economy movement over the years. Traditional energy companies today often embody some green principles including the minimization of waste, increasing the efficiency of their operations, and reducing emissions that impact their carbon footprint. Many of these companies regularly report to their shareholders and the public at large on their efforts to become more green. These changes, in turn have changed the practices for many jobs in the industry as well creating new professions such as that of sustainability professional (see below). Training programs that prepare students for jobs in the energy industry must work closely with industry to make sure that these changes are reflected in their curriculum and training to maximize students' opportunities for employment in the industry.

Green jobs in the construction industry

Perhaps no industry has been as affected by the increasing importance of the green economy as the construction industry. This impact has been felt in two distinct ways. First, green economy policies, particularly the ARRA, have provided funding for weatherization and other improvements to the energy efficiency of existing dwellings. This development, particularly important in a cold-weather region such as Massachusetts, will likely increase demand for occupations such as energy efficiency auditors, maintenance repairers, and carpenters. The demand for increasingly energy

5. Median wage data are taken from the Occupational Employment and Wage Statistics survey for the North Shore Workforce Investment Board service area for May 2008 (the most recent available at the time of this writing).

6. Emerging professions from O*Net's *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*. www.onetcenter.org/reports/Green.html No wage data is available for emerging occupations.

Table 2. Green Occupations in Construction ⁷

Green Increased Demand Occupations	Green Enhanced Skills Occupations	Green New and Emerging Occupations
Architecture Technicians	Construction Laborers	Energy Auditors
Boilermakers	Roofers	Testing, Adjusting, and Balancing Technicians
Carpenters	Equipment and Controls Operators	Weatherization Installers and Technicians
Carpenters Helpers	Pipe Fitters and Steamfitters	
Cement Masons	Plumbers	
Construction Equipment Operators	Heating and Air Conditioning Mechanics and Installers	
Electricians	Hazardous Materials Removal Workers	

efficient appliances may also provide additional employment opportunities for both manufacturers and installers of these products. Locally, these funds are being channeled through Community Action Program agencies, with training provided by the state. Career centers and workforce investment boards should work to ensure that they have connections to these programs so that they can help their clients access these jobs as they become available.

The second major driver toward green principles in the construction industry is requirements from local governments that building projects incorporate green elements. For example, the City of Boston requires LEED (Leadership in Energy and Environmental Design) Silver certification to obtain a permit for public construction within the city. Bid documents for many larger projects contain requirements that green principles in both design and construction are taken into account. Without being able to meet these requirements, a company will be unsuccessful in winning a bid. This in turn drives increasing skills requirements and new occupations in the construction industry. Table 2, above, provides an analysis from the federal level of occupations in the construction industry that are being impacted by the movement toward green.

In addition to the occupations listed in the table above, new occupations are emerging frequently in the construction industry. For example, Building Information Modeling is an emerging occupation in the construction industry that reflects green principles. Building Information Modeling (BIM) is the process of generating and managing building data to increase productivity in the design and construction process.⁸ Using BIM, construction firms can test designs and production methods on the computer without the cost of putting an unproven design or material into the field on an experimental basis. By using these processes, materials usage can be reduced and buildings can be better designed for energy and resource usage efficiency. Currently, many firms are forced to outsource BIM modeling positions due to lack of skilled workers in this specialty on the North Shore. With the base of technically skilled workers on the North Shore, retraining workers to meet these needs could both support North Shore construction companies using these processes and provide access to a strong career opportunity for workers.

7. From O*Net *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*. <http://www.onetcenter.org/reports/Green.html>

8. http://en.wikipedia.org/wiki/Building_Information_Modeling

Other occupations affected by green are not new, but new skills and certification requirements offer new opportunities. For example, to work on a LEED accredited project, it is beneficial for all workers, from managers and designers to laborers, to be familiar with green principles. However, it is not enough to have green work experience. This experience must be combined with a skilled trade or other critical occupation. Currently, much of the training for these opportunities is conducted informally, primarily on the job. Gaining this experience can have two notable benefits for workers. First, workers with these skills and experience will be hired first and retained the longest on jobs that require LEED or other certifications. Second, workers with the requisite experience and certification are likely to have opportunities as foreman or supervisors, which provide increased pay rates and also increased longevity on each job. These benefits are likely to grow significantly in the construction industry in the future.

It is important to note that the green principles and jobs discussed above are not present in the construction industry based on getting positive public relations or to save the planet. They are based on increasing the profitability of the firm. In one way, adhering to green principles is becoming a requirement of the business as discussed above. Without adhering to green principles, a significant portion of a firm's business could dry up. However, green principles help drive firm profitability in other ways as well. For example, waste is an important cost factor for many if not all construction projects. Firms that practice recycling of waste, a key green principle, have turned waste removal from a major project cost to a profit center. In turn, the development of this new profit center has driven skill requirements for laborers. Waste recycling is not complicated but there is knowledge and skill required to ensure that materials are handled and separated in a way that will maximize their salability. Workers who have these skills and experience will be advantaged in the hiring process and will also be likely to be kept on the job the longest, increasing their employment and wages.

Green jobs in the manufacturing industry

Green jobs and the green economy have affected the manufacturing industry quite differently than the industries previously discussed. In manufacturing, there are few new occupations resulting from the green economy and few jobs that are commonly considered to be green jobs. However, many of the critical occupations in the manufacturing have changed significantly as a result of the emphasis on green, creating new skills requirements that training programs must take into account. As shown in Table 3, below, manufacturing has more Green Increased Demand Occupations than any other industry. Many of these occupations are ones that are already present at high levels in the North Shore region.⁹ This suggests that the North Shore's manufacturing economy is well-positioned to take advantage of market opportunities created by the transition to the green economy.

LEED Green Associate

For: Professionals who want to demonstrate green building expertise in non-technical fields of practice. The LEED Green Associate credential denotes basic knowledge of green design, construction, and operations.

Application Process: Agree to disciplinary policy and credential maintenance guidelines.

Demonstrate or document involvement in support of LEED projects.
Be employed in a sustainable field of work or engaged in an education program in green building principals and LEED.
Pass a computer-based test of knowledge.
Submit to application audit.

Source: Green Building Certification Institute (www.gbci.org)

9. See North Shore Workforce Investment Board Labor Market Blueprint at <http://www.northshorewib.com/resources.htm>.

Table 3. Green Occupations in Manufacturing ¹⁰

Green Increased Demand Occupations	Green Enhanced Skills Occupations	Green New and Emerging Occupations
Chemical Equipment Operators and Tenders	Green Building and Recyclable Materials Distributors	None found to date.
Chemical Plant System Operators	Machinists	
Chemical Technicians	Occupational Health and Safety Technicians	
Cutting, Punching, and Press Machine Operators	Photovoltaic Fabrication and Testing Technicians	
Drilling and Boring Operators	Separating and Filtering Operators	
	Sheet Metal Workers	
Electrical and Electronics Repairers	Solar Hot Water Manufacturing Technicians	
Electrical Equipment Assemblers	Solar Lab Technicians	
Electrical Equipment Technicians		
Engine Assemblers		
First Line Production Supervisors		
Industrial Machinery Mechanics		
Iron and Steel Workers		
Laborers and Freight, Stock and Material Handlers		
Laborers		
Metal Fabricators		
Millwrights		
Mixing and Blending Machine Operators		
Production, Planning, and Expediting Clerks		
Safety Investigators/Cause Analysts		
Team Assemblers		
Welders		
Solderers and Braziers		

10. From O*Net *Greening of the World of Work: Implications for O*NET-SOC and New and Emerging Occupations*. <http://www.onetcenter.org/reports/Green.html>

The manufacturing industry is impacted by the movement towards green principles in the economy in two ways. First, new products relating to the green economy are being manufactured, some by newly formed companies and others by existing companies that have retooled to manufacture new products. For example, creating solar panels or wind turbines requires substantial manufacturing expertise. Occupations that are critical in creating these products include sheet metal workers, machinists, millwrights, and assemblers. Other green product manufacturing occupations rely on what the National Council for Advanced Manufacturing refers to as the greening of existing manufacturing jobs. These jobs may cover a wide variety of efficiency jobs in manufacturing including:

- Energy efficiency and renewable energy
- Resource efficiency
- Waste efficiency
- Water efficiency.¹¹

Currently, many of the green jobs in the manufacturing industry are created and categorized on a firm-by-firm, relatively small scale basis. This is particularly true on the North Shore, whose manufacturing industry has long been characterized by a large number of firms, most employing a relatively modest number of workers and often serving as sub-contractors to one of the larger manufacturing firms in the region. This industrial organization may be a competitive advantage to the region as the ability to quickly adapt and change will be an important characteristic of firms that succeed in manufacturing in the emerging green economy.

Overarching green jobs:

In addition to jobs specific to the industries discussed previously, there are also several occupations that are likely to experience growth from all industry sectors impacted by the growth of the green economy. Three are worthy of specific mention here: truck drivers, sustainability professionals, and recycling coordinators.

The growth of almost any industry is likely to drive employment in the transportation and logistics industry, notably for truck drivers and other ancillary materials moving occupations. It may seem odd to include truck drivers in the green economy. However, the creation and manufacture of new green products is useless to the economy if these products cannot be easily delivered to market. Furthermore, there has been substantial progress in improving the fuel efficiency and reducing the emissions of commercial trucks. The U. S. Department of Labor has included the transportation industry as one of its foundation industries for supporting the green economy in their workforce system framework for action.¹² Truck driving is also a critical occupation because it offers the opportunity to earn good wages with relatively modest training investments (median wage in the North Shore region is \$19.21 per hour). Combining strong current labor market demand and projected future demand from the growth of green economy investments and strategies makes this occupation a likely future occupation of strength in the region.

11. National Council for Advanced Manufacturing. "Green Jobs in Manufacturing": A Roadmap for Progressively Greener Solutions through a Sustainable and Green Workforce. http://nacfam02.dev.web.sba.com/Portals/0/Sustainable%20Manufacturing/NACFAMGreenJobs_12.23.08.pdf

12. U.S. Department of Labor. "Green jobs": a workforce system framework for action. http://www.doleta.gov/pdf/No_Workers_Frame_0306.pdf

Another overarching occupation and one that is specific to green economy is that of sustainability professional. Sustainability professionals are currently located primarily in large businesses. This occupation typically has operating responsibilities that focus on reducing energy costs, minimizing waste through recycling programs, reducing toxic emissions and greenhouse gases, or managing the business' participation in various green initiatives. The specific orientation of the position is generally based on the firm's industry. For example, in banking or other financial services firms, sustainability professionals may focus on increased paper recycling or improving energy savings from reduced printing through the greater use of electronic communications and information storage. In the energy industry, sustainability professionals may be more involved in pursuing and documenting efforts to reduce emissions or generate electricity more efficiently. In addition to the cost savings, many companies are now making significant efforts to reduce their carbon footprints and in other ways demonstrate to employees, customers, and shareholders that they are being good corporate citizens in the protection of the environment. These efforts are likely to create many opportunities for career advancement for sustainability professionals. According to one industry leader, in the future most, if not all, large companies will need a sustainability professional as part of their enterprise.

In its early stages, the skills and experience requirements for sustainability professionals are likely to be quite flexible. Having strong skills in physical plant operation and knowledge of energy use and markets is likely to be quite useful. Strong math and project management skills are required for this occupation as they are for many of the fastest growing occupations in the green economy on the North Shore. Sample job responsibilities for sustainability professionals include:

- Conducting research on best practices for sustainability in their specific industry.
- Developing reduce, reuse, and recycling plans.
- Assessing recycling programs and carbon reduction plans to meet organization goals and regulatory mandates.
- Maintaining regular communications with the organization's key stakeholders regarding progress on the organizational sustainability agenda.
- Designing and implementing effective educational programs for organization staff and vendors on relevant sustainability topics.
- Promoting renewable and distributed energy projects, including photovoltaic and hydrogen fuel cells.¹³

The metrics that companies will use to measure success in this occupation are likely to vary considerably as well. Early experience suggests that energy savings is likely to be the most critical metric for many of these positions. For sustainability professionals in some industries, demonstrating reduced carbon footprint or greenhouse gas emissions may be the most important success metrics. Measures of these metrics may be focused within the employing company alone or the company's entire supply chain may be taken into account. Finally, the impact of sustainability professionals may be measured by their ability to influence employees and other critical constituencies within their company to come up with green solutions to company challenges.

13. Adapted from "A Practical Guide to Hiring a Sustainability Professional for Universities and Colleges." http://www.c2e2.org/sustainability_guide.pdf

Finally, the position of recycling coordinator is one that many companies have adopted across a number of industries. Recycling coordinators will be responsible for ensuring that the firm recycles as much waste as possible, whether it be paper waste in financial services firms, equipment and materials waste in health care, or construction materials and debris in the construction industry. Sample job responsibilities for the recycling coordinator position include:

- Performing an analysis of company-wide waste reduction and recycling opportunities.
- Designing and implementing an in-house Reduce, Reuse and Recycle program.
- Training department managers and staff on the new program.
- Researching and coordinating with local recyclers.
- Contacting suppliers for prices for recycled materials.
- Coordinating in-house awards and incentives for employees who demonstrate creative ideas, initiative and enthusiasm for the program.
- Applying for and researching loans and/or grants available for the company's program.
- Monitoring and publicizing program results.¹⁴

This position is becoming increasingly common even in tough economic times because it has the potential to deliver a positive economic return. Whether by reducing costs or by increasing revenues through the resale of recycled materials, any recycling coordinator that demonstrates a real return for the company is likely to be retained. This position offers companies the opportunity to do well while doing good.

New England, and Massachusetts in particular, have been early adopters of the principles that are key in leading to the green economy. While California is generally considered to have been the first to widely promote the green economy, Massachusetts is well-positioned as a future leader in the expansion of the green economy. The North Shore region already has firms that are either in the green economy or employ people in the green occupations discussed in this section. The next section of this report discusses the workforce and occupational strengths of the North Shore workforce, which are closely aligned with the requirements of the emerging green economy.

The Green Economy on the North Shore

The North Shore region is well positioned to take advantage of growth opportunities presented by the emergence of the green economy as a significant economic driver. The North Shore region has a deep talent pool of workers with the kind of experience needed to support companies working in the fastest growing segments of the green economy. In addition, there are a large number of ancillary companies that can support larger green economy companies, much the same as the large number of smaller manufacturing companies supported the success of larger manufacturing companies in the region such as General Electric for many years. This section will outline the key strengths of the region and identify critical green occupations and industries in the region for the future.

14. Adapted from Highland Estates Coffee Traders Recycling Coordinator Job Description, <http://vend-help.com/dnn/GoingGreen/EnvironmentalStewardship/RecyclingCoordinatorJobDescription/tabid/93/Default.aspx>

Table 4. Critical Industries on the North Shore¹⁵

Industry	Number of Establishments	Number of Employees as of September 2008
Durable Goods Manufacturing	335	14,545
Construction	1,252	7,400
Professional and Technical Services	1,372	8,026

The critical industries on the North Shore that have a close relationship to the green economy include Manufacturing, Construction, and Professional and Technical Services.¹⁶ These industries are beneficial to the green economy in the region in two ways. First, a number of companies in these industries are green economy companies themselves. While it is not possible to separate out green economy manufacturing companies, for example, from traditional manufacturing companies, we know from interviews with companies in the region that there are a significant number of North Shore manufacturing companies with at least partial participation in the green economy. Second, even companies that are not in the green economy themselves may be making products or providing services that facilitate the success of other green economy companies in the region. These companies, particularly the small, specialized manufacturing firms, may make the North Shore region an attractive location for green economy companies in the future. At left is a sample list of North Shore companies with a green focus. It is not fully representative of the entire industry.

Examples of Green-focused Companies on the North Shore

Allain & Son Inc
 Babcock Power Inc
 Berry Construction
 BTUs Unlimited
 Energenix
 Essex Turbine Ltd
 Groom Energy Solutions
 Honeywell
 Lci Energy
 North Shore Solar and
 Windpower Company
 Osram Sylvania
 Rolls Battery Engineering
 Rouleau Consulting
 Skipping Stone Inc
 Solar Edison
 Solar Now
 SunPower Corporation
 Swift River CO

The North Shore region has significant workforce strengths that can contribute to the region's success in the green economy. These strengths include:

- A large, experienced, and well-trained manufacturing trades workforce. Since manufacturing on the North Shore has long been characterized by high value-add firms, its workforce is concentrated in the skilled trades and advanced manufacturing occupations. These occupations, such as machinists, skilled assemblers, and technicians, are the ones most likely to benefit from the increase in green jobs.
- A very educated workforce. The North Shore region has a population with a disproportionate number of residents with a Bachelor's degree or above. An educated workforce is a necessary pre-condition for successful firms in many areas of the green economy.
- A very experienced skilled trades base. Much of the green economy work supported by the ARRA will be in the construction field, including new building construction, renovation of existing buildings, and weatherization and energy efficiency renovation. The North Shore region is well positioned in terms of workforce to participate in this work. Occupations that are large in the region and can benefit from the ARRA and green jobs include electricians, carpenters, and laborers.

15. Source: ES-202 data. Massachusetts Executive Office of Labor and Workforce Development.

16. For comprehensive details on the North Shore labor force, see the North Shore Workforce Investment Board Labor Market Blueprint and other publications available online at <http://www.northshore-wib.com/resources.htm>

Sample Manufacturing Occupations

Occupational Title	Median Wage	Mean Wage	North Shore Employment	Projected Growth
Machinery Manufacturing				
Electrical and Electronic Engineering Technicians	\$24.12	\$24.50	37	2.6%
Electro-mechanical Technicians	\$20.57	\$21.17	27	9.4%
Industrial Engineering Technicians	\$20.52	\$22.14	24	5.9%
First Line Supervisors/Managers of Production and Operating Workers	\$25.82	\$26.86	108	-4.3%
Electrical and Electronic Equipment Assemblers	\$16.20	\$16.85	71	-11.9%
Electromechanical Equipment Assemblers	\$14.74	\$14.75	88	-19.5%
Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	\$13.84	\$13.96	17	-10.4%
Tool and Die Makers	\$25.25	\$24.74	142	-12.5%
Fabricated Metals Manufacturing				
First Line Supervisors/Managers of Production and Operating Workers	\$25.82	\$26.86	71	-4.3%
Structural Metal Fabricators and Fitters	\$19.99	\$20.31	21	-4.7%
Team Assemblers	\$15.04	\$15.82	113	2.1%
Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	\$22.06	\$22.04	36	-18.0%
Plating and Coating Machine Setters, Operators, and Tenders, Metal and Plastic	\$15.48	\$15.62	54	-12.2%

In addition to these workforce strengths, two other characteristics of the North Shore workforce merit special attention. First, entrepreneurship has long been a strength of the North Shore region. With an educated and entrepreneurial workforce, the North Shore is well positioned to take advantage of the market opportunities created by the development of alternative energy industries and transitions in the manufacturing industry to accommodate the green economy. Second, the North Shore has a strong representation in the Creative Economy.¹⁷ Many aspects of the creative economy, including design services and architecture, are complementary to the green economy and are likely to grow on the North Shore with the growth of the green economy.

The green economy on the North Shore is currently focused in the construction and manufacturing industries. The construction industry is in the middle of a transition due

17. For a discussion of the North Shore Creative Economy, see the North Shore Workforce Investment Board Labor Market Blueprint.

William A Berry & Son, Inc. Danvers, MA

William A. Berry & Son, Inc. (Berry) is one of the oldest construction firms in the United States. The company has an extensive portfolio of institutional and corporate construction projects throughout New England. Ranked among Engineering News Record's (ENR) Top 50 Green Contractors, Berry is a member of the USGBC and highly experienced with green building. In fact, more than 40% of the firm's projects are LEED™ rated. Due to Berry's extensive LEED experience they understand that the most successful sustainable projects follow an integrated design process from the very inception of the project. Berry's commitment to sustainability is focused and they have incorporated green building design principles into all aspects of their building and management processes in effort to improve the built environment.

Groom Energy Salem, MA

Groom Energy is a recent addition to the North Shore region, growing out of Groom Construction in 2005. Groom Energy provides consulting to large enterprises on energy efficiency and sustainability and provides turn-key installations of equipment and systems that support energy efficiency and other sustainable processes. Groom Energy participates in the green economy by facilitating green improvements in its clients. These green improvements range widely from increasing energy efficiency to increasing clients' use of renewable energy. Groom Energy also helps clients develop sustainability plans to help them meet their commitments to address climate impacts.

to green economy principles and an increasing emphasis on sustainability. A current focus of a number of firms in the construction industry is obtaining LEED certification. A secondary focus is developing skills in meeting the weatherization, energy, and waste efficiency needs of the area. Developing expertise in these areas has the potential to further strengthen the construction industry in the region.

The manufacturing industry is not specific to the green economy and has been challenged by both the general state of the economy and the trend to offshoring manufacturing. However, green principles have the potential to make existing manufacturing more efficient and the development of solar and wind energy products may drive additional manufacturing employment on the North Shore in the future.

The green energy industry is not particularly well developed on the North Shore, as with most of Massachusetts. However, there are a number of companies that provide consulting services related to clean energy and energy efficiency. The North Shore is very well positioned in these services. In addition, state and federal funding for the development of alternative energy generation products such as fuel cells, geothermal, and wind turbines may spur further development of this sector on the North Shore.

Recommendations

The green economy is a rapidly growing national trend. Massachusetts is one of the key states that has the opportunity to take the lead in seizing these emerging opportunities. Based on its skilled workforce, deep bench of entrepreneurial talent, and complementary industries, the North Shore is poised to capture a significant portion of this growing economic sector. The following recommendations are designed to help the North Shore Workforce Investment Board maximize its investments in the green economy with the aim of increasing employment and economic development opportunities for the region's businesses and residents.

- Explore strategic opportunities to make concentrated investments that can serve as pilot projects that may serve as models for effective workforce development and training programs serving green economy companies.
- Work closely with firms in the North Shore's critical industries, particularly construction and manufacturing, to identify emerging occupations and create training programs that meet these needs.
- Continue to work with the K-12 school system to enhance the STEM competencies, particularly mathematics, which will be critical for the emerging workforce gaining access to the fastest growing jobs in the green economy.
- Encourage the programs that the WIB funds in the construction industry to add LEED certification and experience to their training programs to ensure that program graduates are ready for changing industry trends toward sustainability and green construction.

- Ensure that construction and manufacturing training programs include internships and on the job experiences on LEED certified jobs to ensure that workers have the skills and experience needed to get on future LEED certified jobs.
- Monitor regional companies and education institutions receiving ARRA green economy funding to ensure that job training and career center efforts are aimed at maximizing the employment opportunities available for North Shore residents.
- Include questions about green jobs in future regional workforce development analyses of all industries to ensure that overarching green jobs that cross industries are taken into account.
- Market the region's workforce strengths to organizations working to develop green industries in Massachusetts such as the Massachusetts Technology Council and the Massachusetts Clean Energy Center.
- Explore the addition of green components into existing training programs where additional skills and certifications, such as LEED certification and experience in construction, can give participants advanced standing in the labor market.
- Partner closely with the region's community college to develop training programs that are responsive to regional industries in the green space and that support career ladders and advancement for workers in green occupations. ■

Green Economy Resources

Organizations

Green For All: www.greenforall.org

Green for All is a national nonprofit organization providing advocacy and technical assistance for those seeking to build an inclusive green economy strong enough to lift people out of poverty. Founded by Van Jones, currently the Special Advisor for Green Jobs, Enterprise and Innovation at the White House Council on Environmental Quality.

Apollo Alliance: www.apolloalliance.org

The Apollo Alliance is a coalition of labor, business, environmental, and community leaders working to catalyze a clean energy revolution that will put millions of Americans to work in a new generation of high-quality, green-collar jobs. Inspired by the Apollo space program, we promote investments in energy efficiency, clean power, mass transit, next-generation vehicles, and emerging technology, as well as in education and training. The Boston Green Jobs Alliance is the Massachusetts affiliate of the Apollo Alliance.

The Workforce Alliance: <http://www.workforcealliance.org/site/c.cjJNK1PJJtH/b.1103315/apps/s/content.asp?ct=5156885>

Focuses generally on broader workforce development issues but has recently commissioned several reports on the green economy and middle skilled jobs.

University of Massachusetts Political Economy Research Institute: http://www.peri.umass.edu/green_economics/

Authors of several reports on the green economy with policy recommendations for making growing jobs a critical part of the green economy initiatives.

Green Jobs Network: <http://www.greenjobs.net/>

The mission of Green Jobs Network is to connect people seeking jobs that focus on environmental and social responsibility with available opportunities and resources.

AFL-CIO Center for Green Jobs: http://www.aflcio.org/issues/jobseconomy/thesolutions_goodjobs.cfm

Green Building Certification Institute: <http://www.gbci.org>

Provides LEED professional and project certification.

Legislation

2007 Green Jobs Act: <http://thomas.loc.gov/cgi-bin/query/z?c110:H.R.6>: (need to include the colon in the link)

The Green Jobs Act was authorized as an initial pilot program to identify needed skills, develop training programs, and train workers for jobs in a range of industries – including energy efficient building, construction and retrofits, renewable electric

power, energy efficient vehicles, biofuels, and manufacturing that produces sustainable products and uses sustainable processes and materials. However, funding was not allocated to fund the Act.

Massachusetts Green Jobs Act of 2008: <http://www.mass.gov/legis/laws/seslaw08/sl080307.htm>

The Massachusetts Green Jobs Act provides grant money to stimulate clean energy companies, to create green jobs and to provide job training programs to ensure all people have access to new green jobs. The Act also created the Massachusetts Clean Energy Technology Center, which serves as the state's lead agency on the green economy. The Center works to stimulate job creation in the clean energy sector, promote workforce training, and conduct market research to identify barriers to the clean energy industry and job training needs. The Green Jobs Act also established the Alternative and Clean Energy Investment Trust Fund. Which provides \$1,000,000 in fiscal2009 for each of the following three projects:

- 1) A seed grant program for clean energy companies, institutions or nonprofit organizations;
- 2) A workforce development grant program to award grants to universities and colleges, vocational technical schools or community-based organizations with existing or potential workforce development programs in clean energy;
- 3) A pathways out of poverty initiative to award five competitive grants to clean energy companies, community-based nonprofit organizations, educational institutions or labor organizations for training programs that lead to economic self-sufficiency.

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News and Information Aggregators

American Green Jobs: <http://www.americangreenjobs.net/wiki>

Supported by EPA and the Department of Labor, this web site serves as a hub for information dissemination and collaboration among individuals and organizations interested in all aspects of green job development and support.

Work Wonk: <http://www.workwonk.com>

A general workforce development news aggregator which covers the green economy and green jobs as part of its overall coverage.

Green Economy Digest: <http://www.labormarketinfo.edd.ca.gov/?pageid=1032>

State of California digest of green reports and studies from across the country.

Green Collar Blog: http://www.greencollarblog.org/green_collar_jobs_research_reports/

Ongoing review of research reports and other developments related to the green economy.